KNOWLEDGE OF AND ADHERENCE TO HEALTH ADVICE AMONG ADULTS WITH DIABETES IN LIBYA

WALID M.A ELKHARAM

Liverpool John Moores University

Centre for Public Health

A thesis submitted in partial fulfilment of the requirements of Liverpool John Moores University for the degree of Doctor of Philosophy

September 2013

Abstract

Knowledge about diabetes can heavily impact on adherence level; people with diabetes need to understand instructions before they can follow health recommendations. Assessment of knowledge and understanding of the health regimen are very important to address the potential problem for adherence, particularly in a country such as Libya where the level of health literacy is low. The research set out to examine the current diabetes knowledge among people with diabetes in Libya and explore factors that enhance adherence to treatment and management of the condition.

A mixed method, quantitative and qualitative design was used to collect data from adults with Type 1 or Type 2 diabetes who have been diagnosed for 12 months or more. The design is a two-phase mixed method which is characterized by the collection and analysis of quantitative data in the first phase of research, followed by the collection and analysis of qualitative data in the second phase, based on the results of the initial quantitative results.

The study revealed that many Libyans with diabetes showed a low level of diabetes knowledge and did not generally adhere to their diabetes self-care regimen except for the medication regimen of taking tablets and/or insulin. The thesis concludes that various factors may explain poor adherence and the lower level of HbA_{1c} level in this study. These include: (1) self-efficacy about the management of the condition; (2) duration of illness; (3) type of treatment; (4) cognitive factors; (5) culture and

social support; (6) economic factors; (7) stressful lifestyle; and (8) health care services delivery.

This study points to a need to improve health care services for diabetes, particularly health education, with more focus placed on socio-cultural and psychological aspects. Furthermore, it would be particularly important to develop a way of assessing adherence and the factors that influence adherence in order to better tailor management of diabetes. Further studies of the impact of social support on adherence, particularly in relation to diet and physical activities, are needed in Libya, as well as a greater understanding of the role of culture.

Acknowledgements

This work is marked by the contributions of many people whom I would like to offer my sincere thanks.

Firstly, Dr. Rose Khatri, my Director of Study, for her guidance, support, encouragement and diligent work in the course of the dissertation. Dr. Ivan Gee, my co-supervisor, has given outstanding and exceptional support during the undertaking of this project. Dr. Daz Greenop, my co-supervisor, who made his professional supervision available to me and offered invaluable suggestions. Thanks also go to Dr. Akhtar H. Wallymahmed, Dr. Linda Mason and Dr. Tawfeg Elhisadi, who also provided supervision for this project.

Secondly, a warm thank you to all people with diabetes who volunteered their time to participate in this study and shared their life experiences and hopes, and gave us insights into the challenges they face.

Thirdly, I also would like to thank the staff members at Benghazi Diabetic Centre, for their encouragement and help with recruitment of participants, particularly Dr. Awade, Dr. Jesmeen, Dr. Hajer, Mr. Adel and Mrs. Sabah.

Finally, but most importantly, I give my greatest thanks to my family for their continuous support and encouragement and for having a sense of humour about my studious ways.

Table of Contents

List of Tables

x

List of Figures

List of Abbreviations

ADA, American Diabetes Association

CIA, Central Intelligence Agency

CIDS, Confidence in Diabetes Self-Care Scale

DCCT, Diabetes Control and Complications Trial

DKA, Diabetic ketoacidosis

DKT, Diabetes Knowledge Test diabetes

DM, Diabetes Mellitus

FPGT, Fasting Plasma Glucose Test

GDP, Gross Domestic Product

HbA1c, Glycated Hemoglobin

HBM, Health Belief Model

HDI, UNDP's Human development Indicators

HONK, Hyperosmolar Non-Ketotic state

IDDM, Insulin-Dependent Diabetes Mellitus

IDF, International Diabetes Federation

IMR, Infant Mortality Rate

LD, Libyan Dinar

LDL, Low-density lipoprotein

MENA, Middle East and North Africa Region

MMR, Maternity Mortality Rate

NCD, Non Communicable Disease

NIDDM, non-insulin-dependent

OGTT, Oral Glucose Tolerance Test

OHA, Oral Hypoglycaemic Agents

RCT, Randomized Controlled Trial

RTI, Road Traffic Injuries

SD, Standard Deviation

SPSS, Statistical Package for the Social Sciences

TPB, Theory of Planned Behaviour

TRA, Theory of Reasoned Action

TTM, Trans-theoretical Model

UKPDS, UK Prospective Diabetes Study

UNESCO, United Nations Educational Scientific and Cultural Organization

WHO, World Health Organization

CHAPTER 1- INTRODUCTION TO THE STUDY

1.1.   Introduction

The aim of this chapter is to provide an introduction to the study and a brief overview of its contents. The chapter outlines the background of the study and identifies the nature of the research problem. It also explores the objectives and the research questions of the study, demonstrates its significance, and provides an outline of the research methodology used. A structure of the thesis is also provided.

1.2.   Background of the study

The majority of chronic diseases including diabetes are likely to limit the functional status, productivity, and quality of life of an individual living with the disease. Without appropriate treatment and care the consequences of chronic disease is endless, causing many problems for the individual and community.

As Kofi Annan (2001) said ''when we are sick, working is hard and learning is harder still. Illness blunts our creativity, cuts out opportunities. Unless the consequences of illness are prevented, or at least minimized, illness undermines people, and leads them into suffering, despair and poverty''[1].

We can state that although prevention of a chronic disease like diabetes is the ultimate goal of public health programmes around the world, once people have the illness then it is imperative to prevent and reduce complications and improve quality of life.

---

[1] Kofi Annan, Secretary-General of the United Nations on the occasion of the release of the Report of the Commission on Macroeconomics and Health, in London, 20 December 2001

Diabetes is one of the most common non-communicable (NCD) diseases worldwide and its epidemic percentage has placed it at the top of public health challenges (IDF, 2003). The number of people with diabetes is increasing and the fastest growth is seen in Middle East and North Africa Region (MENA) (Wild 2004; IDF 2011; Whiting et al. 2011). Increasing numbers are the result of socioeconomic and cultural change, which includes an ageing population, increasing urbanization, changes in diet, reduced physical activity, and an increasing sedentary lifestyle (Beshyah, 2010). In short we can link an increase in diabetes to modernization and globalization the dominant modes of socioeconomic change. Also, so-called diseases of affluence like diabetes reflect the health transition that many MENA countries are going through with a move away from communicable to non-communicable disease.

Despite an increasing burden of many chronic diseases for many years, health systems in most MENA countries are still oriented towards an acute illness model (WHO, 2001; Baghbanian and Tol, 2012). The conceptual model of care for chronic disease is different from the acute model; the chronic model of treatment requires ongoing personal and professional involvement (Priester et al., 2005). Acute model does not always produce the desired outcomes for chronic conditions like diabetes. Diabetes treatment requires ongoing collaborative goal setting and continuous self-management support if successful management of this disease is to be attained. (Anderson et al., 2000; Thompson-Reid; Ernst, 2011). This has implications for health system development in middle income countries like Libya.

Libyan health care facilities operate on three levels primary, secondary and tertiary health care. Primary health care provides basic preventive and curative services, including those for people with diabetes. Even though priority has been given to the provision of basic health care services through the creation of many branches of Primary Health Care at all levels, the

emphasis has been more on quantity rather than quality (Benamer, 2012). In regard to current health expenditures, according to Rahim et al. (2014) most investment in Arab countries has focused on tertiary-care services rather than public health services and prevention. According to Elkhammas and Singh (2010) and El Oakley et al. (2013), Libyan health care services in general, and primary care in particular, are commonly considered as poor in terms of quality, and lack of development and modernisation programmes. As stated by Elkhammas and Singh (2010), reform is needed in every level of health care services in Libya. In addition, reorientation towards a chronic model of care and more self-management approaches are essential to improve the effectiveness of the management of chronic disease such as diabetes (WHO, 2001; Baghbanian and Tol, 2012; El Oakley et al., 2013).

Diabetic complications impact considerably on the person's quality of life and the health economy in general (Bagust et al., 2002) and can result in many health related problems such as blindness, leg amputation, and kidney failure. There is also an increased risk of coronary heart disease and stroke (Zimmet, 2009). Diabetes is also costly to manage, the medical expenditure for people with diabetes average 2.3 times higher than for patients without diabetes (ADA, 2008; ADA, 2013). Diabetes is one of the most life-threatening diseases in the 21st century and if not addressed, the mortality and morbidity burden of the disease will continue to increase (Baghbanian and Tol, 2012).

The early detection and effective management of diabetes, however, may result in a relatively normal and reasonable quality of life. The main aim of diabetes management is to maintain blood glucose levels to as near normal as possible which can be achieved when individual and health care providers work together toward this goal. In order to achieve this goal, it is important that people with diabetes adhere to health care advice. The impact of adherence to

health care advice including self-management has been recognized as a critical method of improved glycaemic controls in the long-term of health outcomes (Brownson and Heisler, 2009; Casey et al., 2009).

For many people with diabetes adherence to treatment is very straightforward, once an appropriate level of medication or insulin has been agreed. Unfortunately adherence in diabetes treatment means more than this; it is a complicated process of adoption and maintenance of a range of additional behavioural regimens including diet and exercise.

Adherence to the management of diabetes is also the key to success in preventing or minimizing acute and long-term complications such as hypoglycaemia, retinopathy, neuropathy, nephropathy and cardiovascular disease (Toljamo and Hentinen, 2001). Therefore, a greater understanding of factors that influence adherence is a vital issue for population health in term of both quality of life and health economic perspectives (WHO, 2003).

1.3.   The research questions:

The specific questions that guided this study are as follows:

1. What is the current level of knowledge among adults with diabetes in Libya?

2. To what extent do people with diabetes adhere to medical advice as identified by HbA_{1c} value and patient self-reporting?

3. What are the main factors that facilitate and enhance adherence to health advice?

4. Is there any difference between Type 1 and Type 2 diabetes regarding to level of knowledge, adherence and self-efficacy.

1.4.   The research aim and objectives

The aim of this study is to examine diabetes knowledge among adults living with the disease in Libya and explore key factors including self-efficacy that enhance adherence to treatment and management of the condition. This aim is broken down into the following objectives:

    i.   To examine the levels of diabetes knowledge among adults with diabetes in Libya.

    ii.   To investigate the levels of adherence to health advice (as identified by HbA_{1c}) with regards to diabetes management.

    iii.   To examine the factors which facilitate and enhance adherence to health care advice.

    iv.   To examine the relationship between self-efficacy and diabetes management.

    v.   To identify what knowledge people with diabetes had received about the condition and its management.

    vi.   To identify the main sources of this knowledge.

    vii.   To examine the level of reported adherence to treatment, diet regimen and exercise among the participants.

    viii.   Compare Type1 and Type2 diabetes regarding to the above points.

1.5.   Significance of the study

Despite the existence of diabetes care recommendations and on-going development in the management guidelines of the disease, adherence to health advice remains a critical challenge for most health care services. Sub-optimal adherence to medical advice among people with diabetes is widespread in every community. Many studies have noted that the majority of people with chronic disease in general do not follow health care advice (Clark and Becker, 1998; Dunbar-Jacob and Mortimer-Stephens, 2001; Cramer, 2004).

Ultimately, people living with diabetes are responsible for the day-to-day management of their own condition including adherence to the lifestyle advice as well as medication. Accordingly, an understanding of how to assist those people with poor adherence is necessary to help in reducing the negative impacts that it has for individuals' health, and to help in improving the effectiveness of health care services. Several factors can greatly affect the level of adherence to self-care regimens such as diabetes knowledge, duration and complexity of the treatment and this will be discussed more in the the literature review chapter. However, most of these studies have been carried out in Western countries where the level of education and health care services are at higher level. Also, most of the research in diabetes and particularly in Middle East Countries has focused on adherence to medication treatment alone (WHO, 2003), although adherence consists of many health-related behaviours and care issues. The current study focuses on adherence to health advice particularly in three areas: taking medications as prescribed, following a healthy diet regimen, and practicing exercise. Factors that affect adherence level are also an important research area and this study focuses on a number of these factors including knowledge about diabetes and self-efficacy among people living with diabetes in Libya.

Knowledge about diabetes can heavily impact on self-management of people with diabetes (Rappaport, 1987; Funnell et al., 1991). Also there is a need to fully understand the advice before people can follow health recommendations. Several studies have mentioned that the sub-optimal adherence is high with patients who have difficulty in reading and understanding medical instruction. Therefore literacy and health literacy in particular are important areas to consider in research on adherence. Assessment of patients' knowledge and understanding of the regimen, as well as their belief in it, are very important to address the potential problem for adherence (Martin et al., 2005), particularly in a country such as Libya where the level of health literacy is significantly low.

An adequate level of knowledge about diabetes management is essential for diabetics. According to Brannon and Feist (2000) people who know most about their diseases and its consequences are more compliant than those who do not have enough knowledge. Colleran et al. (2003) found that enhanced diabetes knowledge improves glycaemic control. Coates and Boore (1996) conclude that a reasonable knowledge of the condition is required if people with diabetes are to be able to control their condition. However, many other studies have demonstrated that the knowledge of people with diabetes may be inadequate to enable them to enhance self-care (Coates and Boore, 1996; Simmons, 2001; Heisler et al., 2005).

Another important concept for improving self-management in health and chronic disease is self-efficacy (Sarkar et al., 2006); it is a term used to describe an individual's belief in their own ability to succeed in a particular situation. Williams and Bond (2002) found that self-efficacy is strongly related to the management of diabetes, indicating that participants with higher reported levels of self-efficacy are more confident in the management of the condition.

Griva et al. (2000) found that people with higher level of self-efficacy also reported higher level of adherence to the management of diabetes.

Obviously, many factors including limited knowledge and low level of self-efficacy can greatly affect the level of adherence to self-care particularly in a country which lacks the development of adequate health education programs.

In light of what has been outlined above, the significance of this study can be seen in the following aspects:

i. Assessing diabetes knowledge levels among people living with diabetes in Libya is essential to determine the main gaps in knowledge and to identify the socio-demographic and diabetes-related determinants that predict the level of knowledge of diabetes.

ii. The study also attempts to identify the most important factors that enhance adherence to treatments that may face people living with diabetes in Libya.

iii. Understanding how to assist people in their adherence is necessary to reduce the negative impacts of poor adherence and to improve the effectiveness of diabetes health care services.

iv. It is the first specialized study to provide an examination of the level of diabetes knowledge through a discussion of the issue of adherence to health advice among

people with diabetes in Libya from their perspective. As such, the study helps build a foundation for future research in this area.

v. This is the first study to examine the level of self-efficacy among people with diabetes in Libya. Self-efficacy is important for diabetes management and can be used as a predictor variable of adherence among people with diabetes.

vi. By knowing the reasons why people do or do not adhere to the health care advice, health care authorities can implement strategies to improve the level of adherence and diabetes health care in general.

1.6.   Overview of the research methods

A two phase mixed method design was used to collect data from adults with Type 1 or Type 2 diabetes who have been diagnosed for 12 months or more. Quantitative data was collected and analysed in Phase One and based on these findings qualitative data was collected in Phase Two. In Phase One a total of 1000 participants were asked to fill in two questionnaires: The Michigan Diabetes Knowledge Test and the Confidence in Diabetes Self-Care Score. In phase Two 60 participants from the first phase were randomly selected for a semi-structured interview. The purpose of the second phase is to help understand the initial results qualitatively, and to get more and deeper meaning from the data provided (Creswell et al., 2003; Creswell and Clark, 2007; Plano Clark and Creswell, 2011).   These include; understanding what kind of diabetes knowledge the participants have and why they adhere (or not) to medical and health care advice.

In other words, the purpose of the Phase One study was to examine the current diabetes knowledge and to explore any factors including self-efficacy that enhance adherence to

treatment and management of the condition. This requires a quantitative approach in order to identify the association between variables to establish trends. The purpose of the Phase Two study was to understand what kind of diabetes knowledge the participants have and why they adhere (or not) to the health advice; such questions are best addressed through a qualitative approach. The two phases of the study undertaken, with their sample size, methods of data collection and the main objectives are listed in table (1).

Table (1): Overview of the two phases studies described in the thesis

Chapter	Sample	No.	Design	Methods of data collection	objectives
6	Type1& Type2 diagnosed for 12 months or more	855	Mixed quantitative &qualitative	Questionnaires (DKT & CIDS)	Examine knowledge/ self-efficacy and other factors that enhance adherence to treatment
7	Same patients (different level of knowledge)	50	Mixed quantitative &qualitative	Semi-structured interviews	Understanding what kind of diabetes knowledge the participants have and why they adhere (or not) to the health advice

Since this design used both the quantitative and qualitative approaches, the researcher adopted pragmatic research philosophy. This is focused on what *methods* can be used to answer the research questions of the study rather than using one approach (Tashakkori and Teddlie, 2003; Plano Clark and Creswell, 2011). Therefore, the study adopted the [post] positivist assumptions to analyse the world of facts in Phase One while embracing constructivist assumptions for exploring deeper meanings in Phase Two (Plano Clark and Creswell, 2011).

1.7.   Outline of the thesis:

The thesis is organised into eight chapters. The following is a brief description of each chapter:

Chapter one:

This chapter presents an introduction to the study, the purpose of the study, the problem to be addressed and identifies the nature of the research problem. It also explores the objectives and the research questions of the study, demonstrating the significance of the study, and provides outline of research methodology used in the study.

Chapter two

This chapter provides a short overview of key demographics including health status. It also describes and discusses the Libyan health care delivery system and factors underpinning its development. There are a number of specific socio-cultural factors that are relevant to the health system including some information on Arabic-Islamic culture, Libyan culture and food, as well as the education system is discussed as they have relevance to adherence to health advice.

Chapter three

This chapter provides an overview of diabetes including definitions and classification. It also provides an outline of the global problem of diabetes and particularly in the Middle East and North Africa (MENA) including reasons for the rapid increase in this region. Thirdly, diabetes complications including short-term and long-term complications are described. In addition, the correlation between diabetes control and complications, evidence from the

literature review including the two major clinical studies on diabetes DCCT (1993) and UKPDS (1998) are discussed at the end of the chapter.

Chapter four

This chapter reviews the literature related to the concept of adherence and its role in diabetes management. It includes an overview of the measurements of adherence, factors affecting glycaemic control, the level of adherence among diabetics, and finally theories that attempt to explain adherence to the health advice.

Chapter five

This chapter presents details of the research design, methodology and methods used in the current study. It also provides an explanation and rationale for implementing a mixed methods approach. Furthermore, an overview of the two phase study design will be provided. This chapter also outlines the sampling method, recruitment of participants, data collection methods and data analysis.

Chapter six

This chapter presents and analyses data from 855 participants to explore diabetes knowledge and to identify any factors including self-efficacy that enhance adherence to treatment and management of the condition. Two questionnaires were used to collect data; The DTK questionnaire of the University of Michigan to assess the level of diabetes knowledge and the brief CIDS, to assess self-efficacy. The chapter also describes the correlation between many variables including diabetes knowledge level, self-efficacy, glycaemic control (HbA_{1c}), and demographic factors such as age, gender, and education.

Chapter seven

This chapter presents the findings from the interviews conducted in the Phase Two study. It includes a description and analysis of the information that participants have received about diabetes and its management, followed by a more in-depth examination of the relationship between knowledge level and adherence to recommended medication, diet and physical activities. It also seeks an understanding of why people with diabetes adhere or not to their health advice.

Chapter eight

The thesis ends with the main findings of the two parts of the study in chapter six and seven which is presented and discussed according to the aims of the study. The chapter provides a discussion, conclusion, reflection on limitations and recommendations for further research

CHAPTER 2- BACKGROUND ON LIBYA, DEMOGRAPHICS AND HEALTH CARE SERVICES

2.1. Introduction

This chapter will provide an overview of key demographics including health status in present day Libya. It will then describe and discuss the health care delivery system and key factors underpinning its development. There are a number of specific socio-cultural factors that are relevant to the study of health and disease and the health system, in Libya that will be discussed here. These include general discussion of the Arabic-Islamic culture, the traditions of diet and food and the education and health system .

Libya is located in North Africa on the coast of Mediterranean Sea with 1,970 kilometers of coastline. It is the fourth largest country in Africa with a population of 5.323.991 (Libyan census 2006). Most of the population, however, is concentrated in the main cities on the coastal plains, namely Tripoli and Benghazi (Otman and Karlberg, 2007). Libya is classified as an upper middle income country (WHO, 2011). The main national source income is from oil revenue and the associated petro-chemicals industry. The CIA World Factbook (2012) estimated that 30% of the Libyan population is unemployed with 20% living below the poverty line in 2004. Official statistics are almost non-existent but under-development, a lack of basic infrastructure, and generally low standards of living are evident everywhere. Libya is not a poor country and its wealth of resources could be used to provide Libyans with better pay, services, living and working conditions. However, under the dictatorship of Gadhafi's regime, poor governance led to under-development to such a degree that a revolution became inevitable. This study was undertaken prior to the beginning of the revolution.

2.2. Health status and demographics

According to the Libyan Higher Committee for statistics more than 32% of the population is estimated to be under the age of 15 (cited in Otman and Karlberg, 2007). As only 6 % of Libyans are more than 60 years of age this makes Libya demographically a young country (WHO, 2011). It is estimated that 85.6 % of the population lives in urban areas which is high especially in Tripoli and Benghazi; although this is common throughout the MENA region. For example the urbanization rate in Kuwait is 98 %, in Qatar is 93 % and in Saudi Arabia is 86 % (Otman and Karlberg, 2007). Table (2) shows the important demographic indictors.

Table (2): demographic indictors

Indicator	Value
Population aged 15 years and above %	67.60
Male Population	2 695145
Female Population	2 628846
Ratio of the Sexes	102.5 (Males): 100 (Females)
Urban Population %	85.6
Average number of people per family	5.89

Source Otman and Karlberg (2007)

The basic health indictors for Libya are on par with Middle East and North Africa (MENA) generally and particularly with Tunis and Egypt (WHO, 2007). Overall life expectancy stands at 77.38 years with 75.5 years for males and 80.27 for females (CIA World Factbook, 2012). However, the Libyan HDI is among the highest in the MENA region (UNDP, 2011). Table (3) shows the main health indictors in Libya and other relative counties in the MENA region.

Table (3): Libyan Health Indictors and other relative counties in the MENA region

Country	HDI Value	Life expectancy	Birth Rate	Death Rate	IMR[2]	MMR[3]
Libya	0.760	77.38	23.47	3.41	19.34	64
Tunisia	0.698	75.24	17.28	5.87	24.98	60
Egypt	0.630	72.93	24.22	4,8	24.23	82

CIA World Factbook (2012) and UNDPs Human development Index (2011).

The incidence of major communicable diseases such as malaria, typhoid and tuberculosis which were previously the leading causes of death in Libya have been successfully controlled since the 1990s (WHO, 2007). According to the WHO (date) statistical report, Libya has a marked high rate of routine immunization with coverage of 95% in DPT3, OPV3, measles vaccine and HBV3 reported in 2008.

As in many other countries, Libya has experienced a health transition which has shifted from a high prevalence of infectious disease to non-communicable chronic disease such as diabetes and hypertension. This transition is a combination of development in public health infrastructure, education, immunization coverage and access to medical technology which all contribute to an increase in life expectancy (Omran, 2005).

Economic development, however, not only brings many positive health benefits but also many health risks by increasing choice over lifestyle, diet and physical (in)activity. Consequently the chance of prevalence of non-communicable disease such as cardio-vascular

---

[2] IMR (Infant Mortality Rate)

[3] MMR (Maternity Mortality Rate)

disease, chronic respiratory disease and diabetes has increased. This increase in non-communicable disease is a major challenge to the Libyan health system (El Taguri et al., 2008). According to the Libyan national report the main causes of hospital mortality in Libya are as follows: Cardiovascular diseases 37%, Cancer 13%, Road Traffic Injuries (RTI) 11% and Diabetes 5% (WHO, 2007). The accuracy of health and demographic data needs to be treated with caution and is an area which requires a more systematic approach (WHO, 2007; El Taguri et al., 2008). In addition, it must be remembered that diabetes complications and comorbidity account for many health related problems and increased costs of hospitalisation (Kanavos et al., 2012).

2.3. Health services delivery

Since 2006, Libya has moved towards a more decentralized system and has been divided into 23 administration regions, each of which has a number of districts. The numbers of the districts and the health facilities depend on the size of population in the region, but all the regions have at least one general hospital. Every administration region consists of a number of people's congresses including functional secretaries of health services. The secretary of health is responsible for providing comprehensive health care services to all citizens free of charge through primary health care units, health centres and general hospitals (WHO, 2007). The map of Libya according to the administrative distribution is shown in figure (1).

Figure (1): The map of Libya according to the administrative distribution

The 'Health for all by all' strategy has been established in Libya since 1981 (General Peoples' Secretariat, 1995). The goal of this policy is to create a society in which every citizen can play an active role, both socially and economically, and in which health services are equally distributed among the whole population (Otman and Karlberg, 2007).

According to the Libyan Health Information Centre annual report 100 % of the population has access to public health services free of charge; however the emphasis has been more on the quantity rather than quality (Benamer, 2012).

Health services in Libya are run by both a comprehensive public funded system and a limited private sector system. The private sector has emerged in line with international health strategies which have encouraged competition in health sectors and part of the neo-liberal agenda of choice (WHO, 2007). However, the demand for private health care services in

18

Libya is limited because of lack of resources and the high levels of competition from other providers in the region. Egyptian and Tunisian health service providers, for example, have been quicker to exploit the private sector opportunities of catering for Libyan people, alongside the draw of their well-established tourist destinations (WHO, 2007; El Taguri et al., 2008).

The health care services operate on three levels, namely; primary, secondary and tertiary health care, see Figure (2) below. The first level provides services through Health Units and Polyclinic Units. Primary health care is established for curative and preventive services such as general medical care for adults and the elderly population, minor surgery, family planning, care of children, immunization services, school health, the dispensing of pharmaceutical prescriptions and diabetes clinic services (Asharaf et al., 2010). Health Units serve a population of 5,000 to 10,000. Polyclinic Units serve a population of 50,000 to 60,000. Polyclinic Units play an important role in the cities, and are staffed by specialized physicians and contain laboratory as well as radiological services. The second level is the General Hospital service in rural and urban areas which provides services to those referred from the primary level for inpatient and outpatient health care services. At the tertiary level, are the Central Hospitals in the major cities which provide health care through specialized hospitals such as Benghazi Algala Trauma Hospital and The Burns Hospital Tripoli (WHO, 2007).

Health care services for diabetics are provided through all levels though mainly through primary health care. As a result of the increasing number of people with diabetes, a number of diabetic centres have been established in the main cities, such as Benghazi Diabetic Centre. Diabetic centres have the same objectives of health units in the primary health care.

Levels

1	Primary health Care	Health care units: provide services for 5000-10000 citizens Polyclinics: provide services for 5000- 10000 citizens Diabetic Centres: in the main cities
2	Secondary health care	Rural hospital General hospital — Provide services to those referred from the primary level
3	Tertiary health care	Specialized hospitals — Provide services to those referred from the secondary level

Figure (2): the levels of the health care services

Libya spent about 3.9 % of its Gross Domestic Product (GDP) on health in 2010 which is equivalent to 484 US$ per person per capita and less than Egypt and Tunisia (World Bank, 2012). The government spends about 60 million Libyan dinars (about 48.110.000 US$) annually for medical treatment of Libyan citizens abroad and more is spent out-of-pocket by Libyans travelling for treatment to Arab countries and Europe. Many Libyans are opting to go to the private health care sector for a higher level of service and for more serious procedures such as heart operations and kidney transplantation. Many travel outside of Libya because they perceive the quality of treatment to be better, mostly to Tunisia, Jordan, and Egypt (WHO, 2007). Table (4) below compares the main health expenditure in Libya and other countries.

Table (4): Health expenditure for diabetes in Libya and other countries

countries	Total expenditure as % of GDP	Government expenditure as % of total expenditure on health	Per Capita total expenditure on health
Libya	3.9	68.8	484 (US$)
Egypt	4.7	37.4	123 (US$)
Tunisia	6.2	54.3	238 (US$)
UK	9.6	83.9	3,503 (US$)

(World Bank, 2012)

With regard to diabetic health care, the mean expenditure in Libya is about 362 US$ per person per annum which is in fact more than Egypt and Tunisia but is very small compared with Kuwait (1010 US$) or Qatar (2960 US$) (IDF, 2010).

The level of human resources in the Libyan health services is in the line with the MENA region with approximately 13 physician, 2.5 dentists, 2 pharmacists, 48 nurses and 23 paramedical staff per 10000 populations. However, the distribution of health professional staff is not equal across the country for example from 6.3 physicians per 10000 in Jdbaya city to 28.5 per 10000 in Benghazi city (WHO, 2007).

Another key issue about human resources is the emigration of Libyan doctors. Although there are sufficient numbers of doctors trained in Libya with up to 15000 medical students at any given time, many choose to make their careers outside the country for professional and economic reasons (Benamer et al., 2009). Therefore, Libya is still facing a shortage of doctors in a number of areas. The situation is even more critical in nursing whereby

standards in general training, quality of care and further and specialist training are poor quality. Libya therefore still depends on large number of overseas workers (WHO, 2007).

2.4. Health Education

Health education is an important part of the health system. The WHO has defined health education as "any combination of learning experiences designed to help individuals and communities improve their health, by increasing their knowledge or influencing their attitudes" (WHO, 2013).

The aim of health education in Libya is to help people make decisions about their health and to gain the necessary skills and knowledge to change behaviour towards improving health. The Libyan health system uses a variety of health educating programs such as direct contact between patients and health care provider, use of posters, leaflets and the mass media (TV, radio station and magazine). Additionally, health campaigns are organized with the cooperation with Arab national and international agencies such as such as the Annual Arab Maghrabian Campaign against diarrhoeal disease and World Anti-smoking Day (Elfituri et al., 1999).

Generally, health education in Libya is very poor (Elfituri et al., 2006; Roaeid and Kablan, 2007). Although there has been a general lack of nationally developed formal or planned health education programmes, the Ministry of Health has taken an interest in some international programs, such as tobacco control related activities and Breast Feeding and Baby Friendly Infection Control (WHO, 2007). Currently health promotion activity focuses on a series of health education spots via Libyan TV and Radio programs to promote health

knowledge on the problem of tobacco smoking and diabetes for example. This method is mostly directed to the general population and has little impact on changing behaviour for diabetics (Redman et al., 1990; Cavill and Bauman, 2004).

A study by Elfituri et al. (2006) examined the perceptions of Libyan health professionals and their role in the provision of health education. The study found that the main barriers in improving health education was lack of materials, the low priority held for health education in health services and by policy makers, the lack of communication skills among health professionals and the negative influence of other factors related to culture and traditional beliefs.

In view of the above, there have been many individual attempts to enhance health education at the primary health care level. These include free education sessions provided by health care professionals related to, for example, diabetes, hypertension and breastfeeding. However, these programs usually suffer from many problems such as lack of trained staff, lack of equipment and lack of clarity regarding objectives (WHO, 2007; Elfituri et al., 2006).

2.5. Socio-cultural factors relevant to the health system

2.5.1. Libyan culture

Although the majority of Libyans identify themselves as Arab, the population is composed of several ethnic groups such as Arab, Berbers, Greek, Cretans, Maltese and Armenians. However, intermarriage with each other over the centuries has produced a very mixed population. These mixed Arabic-speaking people with a majority of Arabs make up 90% of the country's population. Berbers, black Africans and other indigenous group make up most of the rest (Library of Congress: Fedral Research Division, 2005). All Libyans speak the

Arabic language, and in some places the local language. Most Libyans follow Islam, at least nominally, which is the most common religion in the MENA region. Nearly all Libyan Muslims adhere to the Sunni branch of Islam which emphasizes Islamic law practice in everyday life (CIA World Factbook, 2012). Because of the widely held belief that all events, including ill-health, is from God, Libyans may be more likely to accept health conditions such as diabetes as God's will. This clearly will have implications for factors related to adherence.

There are many common beliefs about diabetes among different cultures throughout the world (Hjelm et al., 1998; Bartlett, 2000; Tripp-Reimer et al., 2001). Some African people believe that diabetes is a result of supernatural causes, such as evil eyes, evil spirits, witches or disturbance related to other peoples' souls (Hjelm et al., 1998). By way of contrast, many Muslims believe diabetes is a test of faith and a sign of the love of God. As such, people who suffer from any particular problem, including disease, accept it as a sign that God loves them and wants them to examine and intensify their faith. They may also believe that disease will eradicate their sins, a concept known as Kafara. So, it can be seen that certain belief systems can provide a challenge to public health professionals, as diseases, such as diabetes, may be accepted without appropriate medical treatment.

Another key issue about Islam is the fasting month (Ramadan) whereby every adult Muslim is required to fast from dawn to sunset during that month every year except when they have permission to abstain because of sickness or travel. Although this would exempt most diabetics, and particularly those with Type 1 diabetes, many still insist on fasting as it

signifies to others a strong sense of faith. To add to this, as a part of their culture, some have a habit of eating large amounts of food and sweets after breaking their fast (Ahmed, 2003).

Generally speaking, Arabic men value large families and view sexual activity as a sign of virility and strength (Khoury, 2001). Because diabetes is associated with sexual dysfunction, it can be regarded as a threat to perceived masculinity and thus becomes shameful (Robertson, 2006). Also, in Arabic culture it is believed that diabetes can affect fertility in women and thus can be viewed as a barrier to marriage. Consequently, many young adults avoid any behaviour that signals that they may be diabetic, such as taking medication or adopting specific dietary regimes (Khoury, 2001). So, people with diabetes are also faced with the challenge of overcoming the stigma attached to being seen as a recipient of medical treatment. Diabetes-related stigma in the community or at the workplace has a negative impact on the health and feeling of wellness of people with diabetes (Roeloffs et al., 2003; Shiu et al., 2003).

In Arabic-Islamic culture, weight concerns and fitness are not culturally relevant. For example plumpness or overweight is desirable because it is associated with high social status and good health (Goenka et al., 2007), while slimness in people is not good because it is associated with poverty, a serious illness or diabetes for example (Khoury, 2001). Keeping fit or taking physical exercise is not a part of Libyan culture, there are few gyms or fitness clubs as in western countries. The few gyms which exist are predominantly used by young people, and it is unlikely that people with diabetes would include this type of exercise practice. In addition according to Islamic law, Muslim women must wear the hijab, which is a long shirt

and scarf that covers the body (Goenka et al., 2007) which is not ideal for taking physical exercise in public places. A further obstacle preventing women from taking up physical exercise is that they should be under supervision and control of their family at all times, this is especially true for young women (Pfister, 2006).

Hospitality and social etiquette is highly valued in Arabic-Islamic culture. The most important sign of hospitality is serving the guests with a large amount of food (especially meat). People with diabetes often find it very difficult to be on their usual diet regimen because it may be considered ill-mannered to refuse such hospitality (Khoury, 2001).

2.5.2. Libyan traditional food

The Libyan food is a mixture of Arabic and Mediterranean dishes especially Italian food. Couscous is the most common dish in Libya, which is boiled cracked wheat or barley that is used as flour for the meat and many other vegetables such as potatoes, pumpkin and carrot. Bazin is also common especially in south and west of Libya, the dish made of dough (usually barley flour) and sauce (meat with season of vegetable). Libyans love meat dishes particularly those consisting of lamb. Libyans usually end their meals with a glass of green tea and a bowl of fruit. For drink, they consume considerable amounts of local mineral water, soft and fizzy drinks. No alcohol is served in Libya. Milk is also consumed mainly for breakfast with increased consumption in Ramadan. In addition, they consume a lot of tea which is creamy, thick with mint and peanuts sometimes in a small glass. Coffee is also thick and sweet. Libyans usually eat three meals; the breakfast is the smallest meal, it is usually cheese, honey or eggs with bread and a cup of tea with milk. The main meal in Libya is the

lunch time which is served around 2:00 pm to 3:00 pm after the end of working hours (most of Libyan working time is between 8:00 am to 3:00 pm, 6 days a week). It usually rice with meat, cuscuses, or stew with lots of breads. The dinner is about 8:00 pm and usually soup, pizza and macaroni. All meals are eaten out of a common bowl. Most Libyans prefer to eat at home in the weekday except for Friday or regional events when they enjoy going out with their family and friends (Elhisadi, 2009).

Libyan meals are typically high in carbohydrates and protein content which is not recommended as healthy food. However, a meal containing average amount of carbohydrate from whole grain, fruits, vegetables and low fat milk has been recommended (ADA, 2004) this may be found in the Libyan meal, but the way of eating usually out of a common bowl makes counting the portion of carbohydrates very difficult. Counting carbohydrates is very important for diabetic patients especially for those with type 1 diabetes receiving fixed daily insulin doses (ADA, 2004).

2.5.3. Education system

The main aim of the Libyan education system is to prepare the workforce that is needed for growth and development in society through economic, social and culture development along with physical and psychological health (Otman and Karlberg, 2007; World Data on Education, 2007).

The structure of the education system in Libya may be divided into three levels: basic education level (primary school and secondary school), Intermediate education level (tertiary

27

schools and diploma institutes) and Higher education level (university and higher institute). Primary and secondary schools are the basic education and successful pupils are awarded a basic certificate which allows them to go to the second level which is usually for a further 3 to 4 years. Higher education is the third level, which ranges from 3 years in some institutes to 7 years in some faculties depending on what is being studied (Otman and Karlberg, 2007).

Education in Libya is the government's responsibility. It is free of charge and compulsory from age 6 to 15 years for both male and females. The education level in Libya has made significant progress in the last quarter of the twentieth century. Currently the literacy rank for the Libyan population is among the highest in North Africa; it is about 99.8% among the population aged between 15 years and 24 years (Otman and Karlberg, 2007). However, most of such data are estimates that ought to be treated with caution. In addition, many who had previously been literate, though left school to work at an early age, seem to have great difficulty in reading and writing as adults because the nature of their jobs does not usually require them to maintain reading or writing skills, such as farming.

A positive relationship between school qualification levels and knowledge about diabetes has been found in many studies (Bautista-Martinez et al., 1999; Abdullah et al., 2001). However, a good educational level does not always increase health knowledge, and many studies show a high level of ignorance regarding basic health facts, including diabetes (Roaeid and Kablan, 2007; Al-Adsani et al., 2009).

Another important issue in Libya is the lack of health research and, in particular, the lack of evaluation studies of health systems. There is no evidence that the health authority in Libya has used health research systems to improve health policy. Indeed, there is no clear funding plan for health research. The small number of articles published per year are mostly those written by active researchers working in academic institutes and usually these articles are not available to the general public (WHO, 2007; Benamer, 2012).

2.6. Summary

Libya is an Arabic-Islamic country and was considered as an upper middle income economy. As in many other countries in MENA region, Libya has experienced a health transition which has shifted from a high prevalence of infectious disease to non-communicable chronic disease such as diabetes and hypertension. These diseases are the major challenge to the Libyan health system. Although, the basic health indictors for Libya are on par with MENA countries, health care services in Libya are generally regarded as poorer in terms of quality of health care services provided. In addition, a number of specific socio-cultural factors are cumulative and increasing the difficulty of improving the health outcomes for people with chronic disease and particularly diabetes. The next chapter provides an introduction to diabetes as a global problem and more specifically as growing problem in the Middle East and North Africa Region.

CHAPTER 3- OVERVIEW OF DIABETES

3.1. Introduction

This chapter sets the scene for the thesis and begins with the definition and classification of diabetes types including the main differences of Type 1 and Type 2 Diabetes. Secondly, it provides an overview of the global problem of diabetes and more specifically its increase in Middle East and North Africa Region and reasons for this. Thirdly, the main complications including short-term and long-term of diabetes are described. The correlation between diabetes control and complications, with evidence from the two major clinical studies on diabetes DCCT (1993) and UKPDS (1998) are discussed at the end of the chapter.

3.2. Definition and classification of diabetes

Although the full terminology of the diabetes disease is Diabetes Mellitus (DM) for the purpose of this study it will refer to it as diabetes. Diabetes is defined by the American Diabetes Association (2004, p. S5) "as a group of metabolic diseases characterized by hyperglycaemia resulting from defects in insulin secretion, insulin action, or both". The classic symptoms of undiagnosed or untreated diabetes are: frequent urination (polyuria), increased thirst (polydipsia), and unexplained weight loss (Arroyo et al., 2004). The most common diagnostic criteria for diabetes based on WHO (2006) guide are: (1) Fasting Plasma Glucose Test (FPGT); where plasma glucose concentration measured after an overnight fast is above 7.0mmol/l (126mg/dl), and/or (2) Oral Glucose Tolerance Test (OGTT); where plasma glucose concentration measured two hours after a 75g oral glucose load is above 11.0mmol/l (200mg/dl).

Although there are a number of types of diabetes, the majority of cases of diabetes fall into two main types, namely insulin-dependent diabetes (IDDM) and non-insulin-dependent diabetes (NIDDM). In 1997, the ADA and the WHO revised these terms to Type 1 and Type 2 diabetes (Dunning, 2009).

3.2.1. Type 1 diabetes

Type 1 diabetes, is often referred to as juvenile-onset diabetes and accounts for 5-10 % of people with diabetes (ADA, 2004). It can occur at any age although it is commonly found among those under the age of 40 (Dunning, 2009). Type 1 diabetes has two forms: Immune-mediated diabetes mellitus and Idiopathic diabetes mellitus. Immune-mediated diabetes results from a cellular-mediated autoimmune destruction of the beta cells of the pancreas. This leads to absolute insulin deficiency which is particularly common in children and adolescents, although it can appear at any age, where in later life it is known as latent autoimmune diabetes (ADA, 2004; Dunning, 2009). The second form of Type 1 diabetes is Idiopathic diabetes, which covers forms of the disease that have no clear aetiologies (ADA, 2004; Dunning, 2009). This type is less common and is strongly genetically inherited among those of African and Asian ethnicity (ADA, 2004). The symptoms of Type 1 diabetes (often thought of as the classic symptoms) include polyuria, polydipsia, lethargy, weight loss hyperglycaemia, glycosuria and blood and urinary ketones. People with Type 1 diabetes often have to inject themselves with insulin several times a day for survival and to control their condition (Dunning, 2009).

3.2.2. Type 2 diabetes

This most common form of diabetes is also known as adult-onset diabetes. It accounts for approximately 90-95 % of people with diabetes (ADA, 2004). It is characterised by insulin resistance and usually have relative insulin deficiency. People with this form of diabetes normally do not need insulin injections for survival, and ketoacidosis does not regularly happen (ADA, 2004). It is usually managed by oral medication or diet.

Table (5): Similarities and Differences of Type 1 and Type 2 Diabetes

	Type 1 diabetes	Type 2 diabetes
Prevalence	Less common (5-10%)	More common (90-95 %)
Cause	• Immune-mediated diabetes mellitus and Idiopathic diabetes mellitus. • Insulin is not produced • strongly inherited	• Preventable disease • Failing to make use of insulin being produced properly because the body became resistant to the insulin. • Associated with obesity/overweight. • Very common in aging society
Treatment	• Treatment requires insulin. • Diet is very important to keep blood sugar levels under control.	• Diet therapy and weight loss alone can manage the disease. • Does not need insulin for survival, but if not managed adequately some people may require insulin.
Complications	• Poor management can cause many complications such as eye, kidney, heart, and nerve disease. • Experiences of low blood sugar are usually common. • Diabetic ketoacidosis (DKA)	• Poor management can cause many kinds of complication such as eye, kidney, heart, and nerve disease. • low blood sugar is not common unless taking insulin • Hyperosmolar Non-Ketotic state (HONK)

The symptoms of Type 2 diabetes tend to develop gradually, and therefore it is often undiagnosed for years or diagnosis comes late when complications are already present (Dunning, 2009). There are no clear specific aetiologies for this type of diabetes. Genetic predisposition is complex and is not obviously defined, and autoimmune destruction of beta cells does not take place. However Type 2 diabetes is associated with increased age, lack of physical activity and obesity/overweight which is the cause of some degree of insulin resistance (ADA, 2004). Table (5) above provides a comparison of Type 1 and Type 2 diabetes.

3.3. Diabetes: A global problem

In the last twenty years the prevalence of Diabetes has risen dramatically in many parts of the world and the disease is now considered one of the most common non-communicable diseases worldwide (DCCT, 1993; ADA, 2002, IDF, 2011). Diabetes is highly prevalent for all age groups worldwide (IDF, 2003), with an estimated number of people living with diabetes worldwide of 366 million in 2011. This is a disease of ageing and changing lifestyles and is not expected to be reduced any time soon, indeed this current figure is expected to rise to 552 million by 2030 (Whiting et al., 2011).

According to the International Diabetes Federation (IDF, 2011) 80% of that total will be people from low and middle-income countries. In the Middle East and North Africa Region (MENA), in 2011 the number of people living with diabetes was 32.6 million or 9.1% of population and this number is estimated to rise to 59.7 million or 11% by 2030 (IDF, 2011).

As stated by Whiting et al. (2011) MENA had the highest regional prevalence of diabetes in 2011, table (6) show the prevalence of diabetes in the world and in some regions including MENA.

Table (6): the prevalence of diabetes in the world and in some regions including MENA

Region	Prevalence (%) 2011	Prevalence (%) 2030
Africa	5 %	5.9 %
Europe	6 %	7.1 %
MENA	12.5 %	14.3 %
World	8.3 %	9.3 %

Adapted from Whiting et al. (2011)

In addition as many as five of the top ten countries estimated to have the highest prevalence of diabetes in the world are part of the MENA, as listed in table (7) below (IDF, 2009).

Table (7): List of five countries have the highest prevalence of diabetes in the MENA

Country	Prevalence (%) 2010	Prevalence (%) 2030
United Arab Emirates	18.7	21.4
Saudi Arabia	16.8	18.9
Bahrain	15.4	17.3
Kuwait	14.6	16.9
Oman	13.4	14.9

Adapted from IDF Diabetes Atlas, 4th ed. International Diabetes Federation (2009)

In Libya, the prevalence of diabetes is not accurately known, although it has been estimated to be as high as 16.4 % (WHO, 2009). However, given the general trends in increasing prevalence in this region it is likely to be on the increase and currently higher than this. This high incidence of diabetes is attributed to an ageing population, an increase in obesity/overweight and lifestyle behaviours, in particular changes in nutrition/diet and, decreasing physical activity, (IDF, 2003). Libya has gone through the health transition and like many other middle income countries is beginning to suffer from the negative impact of modernization and development.

The increase in the number of people with diabetes results in considerable human suffering and increasing economic costs. The majority of western countries spend between 6% and 12% of their annual health care budget on diabetes and its consequences (Dunning, 2009). Despite the high number of diabetes in MENA region, studies show that the majority of MENA regions spend less than this on diabetes care. For example approximately $ 10.9 billion is spent on diabetes and related costs compared with the USA or Europe who spend $223 billion and $131 billion respectively (IDF, 2011). Also diabetes has become one of the major causes of illness and death in most countries, mainly through the increased risk of cardiovascular disease (Wild et al., 2004). In countries with high diabetes prevalence, such as those in MENA, as many as 25 % of deaths in adults aged between 35 and 64 years are related to diabetes (Boutayeb et al., 2004). In Libya, the annual average incidence of Type 1 diabetes among children from 0-14 years-old is 7.8 per 100 000 and diabetes accounts for more than twenty per cent of all medical admissions to the teaching hospitals in Benghazi (Kadiki and Roaeid, 2001).

3.4. Factors associated with increase diabetes in the MENA region

The high prevalence number of diabetes in the MENA region is mainly due to Type 2 diabetes. The increase in prevalence is largely to do with the outcomes of socio-economic development. On the positive side is the impact of health and demographic transition with the move to an ageing population and decreasing communicable disease. On the negative side is the increase in risk health behaviours such as a sedentary lifestyle and the increasing accessibility of unhealthy fast food and its relationship with obesity/overweight (Beshyah, 2010). Another reason for the current high number of people with diabetes in the MENA countries may be the previous lack of accurate data about prevalence and incidence of diabetes particularly in Libya (Eltobgi, 2009; Roaeid and Kadiki, 2011). For any given year, the estimated prevalence number in most of these countries has generally been an underestimate. Badran and Laher (2012) summarize the four main factors associated with the increase in the number of people with Type 2 diabetes in MENA, these include: Obesity/overweight, socioeconomic and demographic factors, food consumption, and low level of physical activity.

3.4.1. Obesity/overweight

The relationship between obesity and diabetes is well established in the literature (Yach et al., 2006; Balluz et al., 2008). Obesity and overweight represent probably the biggest risk factor for developing insulin resistance in Type 2 diabetes. A meta-analysis found a strong association between abdominal obesity and the development of Type 2 diabetes (Freemantle et al., 2008). In recent times the prevalence of obesity and overweight has increased radically and has almost become an epidemic in many of MENA countries (Beshyah, 2010; Musaiger, 2011). Stepwise survey data in the MENA region show that the prevalence of people

overweight (defined as having a BMI greater than 25 KG/M^2 and with obesity defined as BMI $\geq$ 30 KG/M^2) as a proportion of the population is 75.4% in Kuwait, 68.8% in Saudi Arabia, 66% in Egypt and 63.5% in Libya (WHO, 2009).

3.4.2. Socioeconomic and Demographic Factors

Increasing urbanization is usually associated with higher exposure to modernization and its associated lifestyle risks (Madanat et al., 2008). The percentage of population living in urban areas in in the MENA region is high (Galal, 2003), with rates in Kuwait at 98 %, Qatar at 93 % and Libya at 85.6 % (Otman and Karlberg, 2007). The prevalence of Type 2 diabetes tends to be significantly higher in urban compared with rural areas for example a study in Oman found that the ratio of Type 2 diabetes in the urban area is 235 to 100 (Al-Lawati et al., 2002) and in Egypt is 400 to 100 (Herman et al., 2009).

The level of education is also an important measure as it determines the level of knowledge of the causes and risk factors associated with diabetes. Studies in the MENA region reported that prevalence of Type 2 diabetes was higher among the population with no formal education compared to better educated groups (Saadi et al., 2007; Ajlouni et al., 2008). Many studies have shown that the level of education reached in school is a key determinant of the level of knowledge of diabetes (Bautista-Martinez et al., 1999; Abdullah et al., 2001).

3.4.3. Food Consumption

As a result of economic growth in most countries in the MENA region a change in dietary habits have been noted, from consuming local food such as dates, milk, vegetables, fruits, and fish, to consuming food rich in saturated fat and carbohydrates with low dietary fibre

(Musaiger, 2002). This change has an effect on the increase the prevalence of obesity and chronic disease including diabetes (Madanat et al., 2008). For example, in the stepwise survey the consumption of fresh fruit and vegetables during the week ($\leq$ 5 serving / day) was low in the region (WHO, 2009).

3.4.4. Low level of physical activity

As discussed earlier, economic growth in the MENA countries has an implication for the lifestyle in that it encourages a sedentary lifestyle, with the greater availability of cars, the increased use of machines at home and at work, the use of computers , and watching television and the playing of electronic games (Ramachdran and Snehalatha, 2011; Badran and Laher, 2012). A study in Saudi Arabia found that physical inactivity in the adult population ranged from 43.3% to 99.5% (Al-Hazzaa, 2004). In Libya the stepwise survey found that about 34.0% of the total sample reported regular high levels of physical activity, with the level for women being lower (30.7%) than for men (37.3%) (WHO, 2009). Another study in Egypt also suggested that only 2% of the adult population had any exercise in their daily lives (Musaiger, 2004). As previously discussed in chapter two, increasing physical activity in Libya, particularly amongst women, is a major concern.

3.5. Diabetes complication

Diabetes is a multi-systemic illness associated with a variety of short-term (acute term) and long-term complications (Dunning, 2009; Egede and Soule, 2011). Short-term complications include those day-to-day problems that can attack without warning, such as hypoglycaemia and hyperglycaemia. Of these short-term complications, untreated hyperglycaemia can lead to Diabetic ketoacidosis (DKA) and Hyperosmolar Non-Ketotic state (HONK). It usually

occurs as a result of absolute or relative insulin deficiency that is accompanied by an increase in counter-regulatory hormones such as glucagon, catecholamine, and cortisol. This state should be regarded as an emergency situation that requires immediate care. These serious complications are causes of associated morbidity and mortality among people with diabetes. DKA is normally seen in Type 1 diabetes and HONK in Type 2 diabetes (Dunning, 2009; Egede and Soule, 2011).

The long term complications of diabetes mainly affect the vascular system, and are the major source of morbidity and mortality in both Type 1 and Type 2 diabetes (Fowler, 2008). Generally these complications are divided to micro- and macro- vascular disease. Micro-vascular complications include diabetic retinopathy, nephropathy and neuropathy. Macro-vascular complications are due to accelerated atherosclerosis and include coronary artery disease, peripheral atrial disease and stroke (Mullooly and Hanson, 2003).

3.5.1. Diabetic retinopathy

Diabetic retinopathy may be the most common micro-vascular complication of diabetes (Fowler, 2008), and is the leading cause of visual impairment and blindness in diabetics (Dunning, 2009). There are many factors that increase the risk of developing retinopathy, including the length of duration of the diabetes (Fowler, 2008), poor glycaemic control (DCCT, 1993), high blood pressure, cigarette smoking and age (Kohner et al., 1993). Retinopathy is less common before the age of 13 years in Type 1 diabetes (Klein et al., 1984), however 21% of Type 2 diabetes has retinopathy at diagnosis (Harris et al., 1992).

3.5.2. Diabetic nephropathy

Diabetic nephropathy is a kidney disease that occurs in both Type 1 and Type 2 diabetes. It is the major cause of end stage renal disease worldwide, and is associated with increased risk of cardio vascular disease (Marshall, 2004). It is classically defined by the presence of proteinuria >0.5 g/24 hours (Gross et al., 2005). Proteinuria[4] appears first in the form of micro-albuminuria, which is called the lower degree of proteinuria. Untreated micro-albuminuria usually progresses to proteinuria and nephropathy (Fowler, 2008). People with Type 2 frequently have micro-albuminuria at diagnosis, since many of them have had diabetes for a long time before the first diagnosis is made. There are many factors that increase the risk of developing nephropathy, including smoking, the presence of micro-albuminuria and proteinuria, hypertension, presence of retinopathy, long duration of diabetes, male gender and increasing age (Dunning, 2009).

3.5.3. Diabetic neuropathy

Diabetic neuropathy or nerve damage is defined as "the presence of symptoms and/or signs of peripheral nerve dysfunction in people with diabetes after exclusion of other causes" (Boulton and Malik, 1998, p. 909). It is one of the most frustrating and debilitating complications, because it causes pain as well as tingling and burning sensations, also because treatment is often ineffective (Dunning, 2009). There are three broad types of neuropathy: Peripheral (sensory), focal and multifocal, and autonomic neuropathy (Boulton et al., 2005). Peripheral and autonomic are the most common form of diabetic neuropathy (Dunning, 2009). Peripheral neuropathy can affect the sensory nerves, resulting in pain or numbness which is typically worse at night (ADA, 2006). A loss of sensitivity to pain, cold, heat, and

---

[4] Proteinuria: presence of protein in the urine

touch all of which could lead to trauma or a failure to detect trauma and particularly foot ulceration. Foot ulcers are present in about 25% of people with diabetes and it is the primary sources of hospitalizations and amputation among people with diabetes (Dunning, 2009). People with diabetes are 23 times higher risk of amputation than others, ulceration and amputation are strongly association with reduce quality of life and high mortality rate, it is also costly it was estimated at £639-662 million in 2010-2011 in England which equal to 0.6-0.7% of NHS expenditure (NHS, 2012).

Autonomic neuropathy causes significant morbidity and mortality among patients with diabetes (ADA, 2006). It can involve any system such as the cardiovascular and gastrointestinal (ADA, 2006; Dunning, 2009).

The risk of developing of neuropathy is associated with poor glycaemic control and duration of diabetes (Fowler, 2008). Improved glycaemic control is associated with a reduction of macro-vascular complications in both Type 1 and Type 2 diabetes (Stettler et al., 2006). The relationship between macro-vascular disease and diabetes is enhanced by the increased risk factors such as hypertension and hyperlipidaemia (high fat level in blood) in people with diabetes. Therefore improved glycaemic control aims to prevent and/or reduce diabetic complications, and should the major goal in the management of diabetes.

3.6. The correlation between diabetes control and complications

The Diabetes Control and Complications Trial (DCCT) (1993) and the United Kingdom Prospective Diabetes Study (UKPDS) (1998) were two major clinical studies conducted to test the correlation between diabetes complications and glycaemic control (Franz et al.,

2002). These studies demonstrated that improving glycaemic control significantly reduces the risk of complications in both type of diabetes.

DCCT showed that keeping blood glucose levels as close to normal as possible slows or prevents the development of retinopathy, nephropathy and neuropathy diabetic. The study compared two groups from a sample of 1,441 people with Type 1 diabetes; the study compared the effects of the standard control of blood glucose versus intensive control on the complications of diabetes. The two groups of patients were followed for a period of 6.5 years. The study demonstrated that improving glycaemic control reduced the risk of developing retinopathy by 76% and 54% respectively between the two groups (intensive and standards control). There was also a reduced risk of micro-albuminuria by 39% and of albuminuria by 54% in those with intensive control. The study also found a reduced risk of macro-vascular complication by 14% in those with intensive control. The correlation between the development of micro-vascular disease and such factors as retinopathy, nephropathy and neuropathy diabetic and glycaemic control, is well established in Type 1 diabetes (Jeffcoate, 2004).

However, micro-vascular disease does not stand as a one to one relationship with glycaemic control, there are other factors such as genetics thought to be influential (ADA, 2002). A major longitudinal UK study followed 3867 people with Type 2 diabetes for a period of over 10 years (UKPDS, 1998). The study found that improved glycaemic control in this group reduced the risk of developing retinopathy and nephropathy and probably reduced neuropathy. Those people with diabetes who are receiving intensive therapy treatment in which blood glucose is kept close to normal, i.e. HbA_{1c}, mean: 7%, were 25 % less likely to

develop micro-vascular complications compared with patients receiving conventional therapy (HbA1c, mean: 7.9%). Also, for every percentage point decrease in HbA_{1c} there was about a 35% reduction in developing micro-vascular risk of complication (UKPDS, 1998; Holman et al., 2008).

3.7. Summary

Diabetes is now considered one of the most life-threatening public health challenges worldwide. The increase in the number of people with diabetes results in considerable human suffering and increasing economic costs in almost every country. Diabetes is a multi-systemic illness associated with a variety of complications. The DCCT (1993) and UKPDS, (1998) studies have confirmed that keeping blood glucose levels as close to normal as possible slows or prevents the development of diabetic complication. The risk of diabetic complication can be reduced by good adherence to health advice, which is why adherence problems among people with diabetes continue to frustrate many researchers and health care professionals. The concept of adherence and diabetes control is reviewed in the next chapter.

CHAPTER 4- OVERVIEW OF ADHERENCE AND KEY INFLUENTIAL FACTORS

4.1. Introduction

The aim of this study is to examine the current diabetes knowledge among people with diabetes and explore any factors that enhance adherence to treatment and management of the condition in Libya. This chapter accordingly presents a review of the literature relating to this topic. The chapter is divided into the following sections: the concept of adherence and diabetes; the measuring of methods of adherence; glycaemic haemoglobin; factors affecting glycaemic control including age, duration of diabetes, diet, physical activities, social support psychological aspects of diabetes, and diabetes knowledge and health education; the adherence level and its barriers; Adherence and health behavioural theories including self-efficacy; and lastly, a summary and rationale for the present study.

4.2. The concept of adherence

The terms *compliance*, *adherence*, and *concordance* are the most common terms used in the literature review to describe the discrepancy between health care recommendations and patient behaviour towards those recommendations (Lutfey and Wishner, 1999; Horne et al., 2005; Chatterjee, 2006; Kane and Robinson 2010).

Compliance is defined as ''the extent to which the patient's behaviour matches the prescriber's recommendations'' (Horne et al., 2005, p. 12). However, there is a drawback in using the term compliance as it proposes the way that the individual passively yields to the will of the health care provider and, more critically, indicates a lack of patient involvement

(Lutfey and Wishner, 1999; Horne et al., 2005). As an alternative to compliance, the term adherence has been adopted by many researchers (Lutfey and Wishner, 1999; Horne et al., 2005; Kane and Robinson 2010).

Adherence is defined by WHO (2003), p. 3 as ''the extent to which a person's behaviour in terms of taking medications, following diets or executing lifestyle changes corresponds with agreed recommendations from the health care provider''. Although some researchers use the terms interchangeably, the term adherence is different to compliance in that it implies that both the patient and the health care provider are in collaboration when making a decision regarding the proposed treatment. As such, patients are free to agree whether or not to adhere to the health care advice provided (Chatterjee, 2006; Kane and Robinson 2010).

The term concordance is mainly applied in the United Kingdom and its definition has changed over time from one which focused upon the consultation process between the health care professional and the patient to a broader concept which includes communication with regard to the prescription and mutually agreed treatment plans that incorporate the view of the patient (Horne et al., 2005). Whilst concordance and adherence may seem to encapsulate the same concept, concordance does not in fact relate to the treatment-taking behaviour of the patient; it is more related to the communication process between patients and health care professionals (Bell et al., 2007).

Rather than compliance, adherence is the term that is currently used in health care as it implies that the individual and health care providers work together toward the control of diabetes (Toljamo and Hentinen, 2001; WHO, 2003; Kane and Robinson 2010). Hence, the current paradigm is to use the term adherence, as many studies claim that the use of the term

'adherence' has positively impacted on diabetes care by making the practitioner more aware of patients' responsibility and their greater degree of flexibility in making a decision over their treatment (Lutfey and Wishner, 1999; WHO, 2003).

Adherence is difficult to define, especially in terms of diabetes management, and there has, to date, been little agreement on a single definition for the term (McNabb, 1997; WHO, 2003; Horne et al., 2005). The use of the term *self-management* in place of adherence, for instance, can be noted within the literature. Self-management has been defined as "a set of skilled behaviours engaged in to manage one's own illness" (Goodall and Halford, 1991, p. 1). It is clear from this definition; however, that self-management only refers to self-care behaviours and not to an adherence level to a prescribed regimen and some clearer distinction is needed between the two concepts. For that reason, the concept of adherence may be expanded to include a self-management behavioural regimen, but not vice versa (McNabb, 1997). With the support of a health care provider, a diabetes self-management behavioural regimen may help create improvements in adherence and reduce complications. In this case, adherence might be defined as "the degree to which a patient follows a pre-determined set of behaviours or actions" (McNabb, 1997, p. 217). Researchers need to find an agreed common definition of adherence, however, for the purpose of this study the term adherence is used as defined by WHO (2003).

4.3. The measurement of adherence

Measuring the level of adherence to health care advice is a complex issue for many reasons (McNabb, 1997; Hearnshaw and Lindenmeyer 2005). For example, it is difficult for researchers to know the degree to which a patient adheres. Also, the treatment and health

advice are unique to each patient and there are many tasks to be adhered to such as diet, medication and attendance and, as such, any measurement of adherence is only a general estimate (Brannon and Feist, 2000; Hearnshaw and Lindenmeyer, 2005). In general, adherence has traditionally been measured by self-reporting. Brannon and Feist (2000) explain five basic ways of measuring adherence as follows:

i. Asking health care providers about patient's adherence, which is usually the weakest choice because providers often over estimate their patients' adherence level.

ii. Asking patients themselves, which is much better compared with asking health providers, although self-reporting brings at least two further problems. First, patients may not tell the truth, in order to avoid the disapproval of their health care provider, and second, patients may not only under-report poor adherence but they also sometimes actively over-report their level adherence

iii. Asking health care providers and family members to monitor the patients, although this technique also has at least two problems. First, it is very difficult to observe the patients for a long period, particularly with certain regimens such as diet and alcohol consumption. Second, because of persistent monitoring, patients may change their behaviour to act in a better manner. Although this result is desirable, as a way of assessing adherence, this method is inaccurate because the fact of observation is having an impact on what is being observed.

iv. Another important method is counting the number of pills that have been taken from a bottle or drug dispenser. This technique has also problems, such the fact that absence of pills from a bottle does not necessarily mean that the patient has adhered to the programme. Also, this method may be good for some diseases but not for diabetes, as

this disease requires not just adherence to the prescribed medication but also to diet regimens, and exercise.

v.   Biological markers are another method of measuring adherence. This technique looks at the outcome of adherence behaviour through evidence such as blood or urine samples, which can be used to determine whether the patient has behaved in a particular manner.

In this thesis an assumption has been made about the relationship between adherence to the health advice and health outcome. This relationship includes the achievement of the treatment goal (good HbA_{1c} control) which simply depends upon the individual following professional health advice sufficiently. Good HbA_{1c} control means that an individual has adhered sufficiently to the health advice, with sufficiency having been defined as ''the point below which the desired preventative or therapeutic result is unlikely to be achieved'' (Gordis, 1979, p. 52). However, this relationship is not always true, particularly with people with diabetes. There may be many reasons why adherence to health advice does not necessarily lead to better health outcomes; for example, the prescribed treatment may not be correct, and also HbA_{1c} can be influenced by many factors such as age and complications with the particular type of diabetes experienced.

In summary, an accurate valid method for assessing adherence has not yet been found. Currently, the most commonly accepted means of evaluating adherence is HbA_{1c} level and self-reporting; therefore, a combination of these two methods has been used in the current study for assessing adherence, to identify and understand the factors that enhance adherence to treatment and management of the condition.

4.4. Glycaemic hemoglobin (HbA$_{1c}$)

HbA$_{1c}$ is an essential component of the management of diabetes. It is traditionally used as an objective to control and measure adherence to diabetic regimens. HbA$_{1c}$ is directly related to the average amount of blood glucose concentration in the body. It remains in the body for approximately 100 days. Therefore, it is widely used for monitoring long term glycaemic status and for assessing whether an individual with diabetes has achieved the metabolic control target (Sacks, 2008).

Unfortunately, this method has some disadvantages in regards of measuring adherence, such as the fact that HbA$_{1c}$ alone cannot specify which aspects of the diabetic regimen are poor. HbA$_{1c}$ levels may be influenced by other factors including, but not limited to, age, duration of the illness, and the existence of complications (Lustman et al., 1981; Padgett, 1991; Johnson, 1996) which may have no direct connection with adherence to the health advice.

Comparing HbA$_{1c}$ and self-reporting as valid methods of measuring adherence to a diabetic regimen has been discussed in the literature (Hearnshaw and Lindenmeyer 2005). The result shows a variety of outcomes, ranging from the finding that there is no association between self-reported and glycaemic control (Glasgow et al., 1987; Cox and Gonder-Frederick, 1992), to the opposite finding that there is a strong association (Christensen et al., 1983; Brownlee-Duffeck et al., 1987). Both of these latter studies found a strong correlation between metabolic control and adherence to the diet regimen. Others have argued that the association is only between some variables such as diet, blood glucose monitoring, and insulin adherence and HbA$_{1c}$ (Schafer et al., 1983). The differences in these results may be due to fact that the reliability and validity of self-reporting measuring method are not accurate, or because of the complexity of the factors that can influence HbA$_{1c}$ value.

In the management of diabetes, it is absolutely crucial to understand the factors that can cause fluctuations in glucose control and interference with glycaemic measurements; the next section presents an overview about the main factors that affect glycaemic control.

4.5. Factors affecting HbA$_{1c}$

Glycaemic control in patients with diabetes can be influenced by many factors. The following sections discuss the effect of the main factors relating to glycaemic control and how these can be regulated or managed.

4.5.1. Age

Age is an important factor which should be considered in the management of diabetes. It has been associated with deficiency in glucose metabolism in both healthy older adults and adults with diabetes. For instance, a study conducted in Nigeria by Ewenighi et al. (2012) examines the association between HbA$_{1c}$ reduction and age, gender, level of adiposity and diabetes duration in adult with Type 2 diabetes. The study found significant negative correlations between HbA$_{1c}$ reduction and age. Another study by Pani et al. (2008) investigated the association between age in the non-diabetic population with HbA$_{1c}$ conducted in Framingham in the USA. The study found that HbA$_{1c}$ reduction was noted in individuals aged less than 40 years. In fact, with advanced age the function of kidney and liver usually decline, which may interfere with the capacity of the liver and kidney in drug metabolism (Mangoni and Jackson, 2004; McLean and Le Couteur, 2004). Thus, age factor should be considered when measuring HbA$_{1c}$ for control diabetes or for assessing adherence.

4.5.2. Duration and complication of diabetes

Long duration, including complication of diabetes, has been associated with higher HbA_{1c} value (Kilpatrick et al., 1996; Elhwuegi et al., 2012). A study by Verma et al. (2006) using a sample of 76 people which included both diabetic and non-diabetic adults, found a significant increase in the level of HbA_{1c} with the longer duration of diabetes. More recently, Ewenighi et al. (2012) in their study found significant negative correlation between HbA_{1c} value and diabetes duration, which may be due the fact that long duration and complication is associated with increased chronic liver disease. In addition Meta-analyses of intervention trials in Type 2 diabetes found that those with shorter duration of diabetes have a greater benefit to cardiovascular protection offered by strict glycaemic control, whereas those with longer disease duration the beneficial effect can be neutral, or even reversed (Skyler et al., 2009). Therefore, it is important to consider these factors when measuring HbA_{1c} for control diabetes or for assessing adherence to improve the management of diabetes.

4.5.3. Type of diet

Diet has long been considered an essential part for the effective treatment and management of diabetes. A strictly controlled healthy diet can help people with diabetes to achieve and maintain optimal glycaemic control and to reduce the risk of long-term complications (Bantle et al., 2008; Franz et al., 2010).

Studies show a strong correlation between adherence to controlled diet therapy and good glycaemic control (Morris and Wylie-Rosett, 2010). In the UKPDS (1990) study of Type 2 diabetes, participants who received intensive nutrition therapy found that HbA_{1c} decreased by 1.9% (from 8.9 % to 7%) during the 3 months before study randomization. Another study by Kulkarni et al. (1998) found that for participants with Type 1 diabetes who followed nutrition

practice guideline care for 3 months, the HbA$_{1c}$ decreased by 1.0% (from 9.2 % to 8.2%). It is worth mentioning, sub-optimal reading of HbA$_{1c}$ may be due to poor adherence to the diet regimen. In addition, further improvement can be achieved in the HbA$_{1c}$ results when a diet regimen is followed with other components of diabetes care management such as physical activity (Franz et al., 1995; Nelson et al., 2002; Pastors et al., 2003).

Diet regimen is often difficult to implement (Nelson et al., 2002). According to Tripp-Reimer et al. (2001), p. 17 ''an individual's diet depends on a host of religious, economic, family, psychological, and personal factors''. Gohdes (1988) established that diet therapy has been less-than-successful among ethnic minority groups with diabetes for three main reasons: Firstly, because the dietary goals have not been clearly expressed; Secondly, because there was no relation between diet recommendations and an individual's cultural and economic situation; Finally, because diet recommendations were represented in difficult ways for those with low literacy to understand and implement. Therefore, recommendations should be based on individual culture and customs and the availability of food as well as in a simple way to understand and implement.

In addition, a structured education program including information about diet regimen and management of diabetes such as matching insulin to carbohydrate content is very important for people with diabetes and their family. It is also highly recommended that diet therapy involves an individualized plan, as there is no single dietary prescription for all people with diabetes (ADA, 2011). This means that diet management and meal planning should be individualized to accommodate the person's preferences, age, needs, culture, lifestyle, and economic status (Canadian Diabetes Association Clinical Practice Guidelines Expert Committee, 2008; Franz et al., 2010).

4.5.4. Physical activities

Physical activity in adults with diabetes is considered a cornerstone of the therapeutic management of diabetes, along with diet and medication. It can help to increase cardio-respiratory fitness, to improve general well-being and health, to lower HbA_{1c} value, to decrease insulin resistance, and to assist with weight loss management (Kriska et al., 1991; Schneider et al., 1992; Colberg et al., 2010).

Many studies have identified that physical activity lowers HbA_{1c} value in older adults with Type 2 diabetes (Kriska et al., 1991; Schneider et al., 1992). Furthermore, a study consisting of a systematic review with meta-analysis of randomized controlled clinical trials into the associations of structured physical activity and HbA_{1c} values found that structured physical activity (involving aerobic exercise, resistance training, or combined combination of the two) is associated with lowering HbA_{1c} value in people with Type 2 diabetes (ADA, 2011). The study also found that structured physical activity of more than 150 minutes per week is associated with lowering HbA_{1c} more successfully than those with less than 150 minutes per week.

On the other hand, most clinical trials have failed to show that physical activity can improve glycaemic control in adults with Type 1 diabetes (Schneider et al., 1992; Laaksonen et al., 2000). However Laaksonen et al. (2000) report that regular physical activity is associated with substantial reduction in mortality, together with lower frequency and severity of diabetes complications such as limiting the development of peripheral neuropathy (Balducci et al., 2006). People with both types of diabetes who are practicing a moderate to high level of physical activity and cardio-respiratory fitness are at lower risk of morbidity and mortality (Canadian Diabetes Association Clinical Practice Guidelines Expert Committee, 2008).

It is generally agreed that people with diabetes can follow the physical activity guidelines for the general population. However, they should first undergo a medical evaluation for identifying complications, which may place some participants at risk when increasing physical activity (Canadian Diabetes Association Clinical Practice Guidelines Expert Committee, 2008). Thus all people with diabetes should work with their health-care providers to adapt a level of physical activity that is appropriate for their condition. For example, physical activities might be contradicted with uncontrolled hypertension, severe autonomic or peripheral neuropathy and advanced retinopathy (Snowling and Hopkins, 2006). Therefore, it is important to consider the level of adherence to the recommended physical activities as stopping practicing leads to increase $HbA_{1c.}$

4.5.5. Social Support and Diabetes Mellitus

A diabetes management task requires an individual to incorporate a diet with physical exercise, use of medication, and blood glucose monitoring over time, and therefore the support of family and friends is essential. Social support is defined as "the existence or availability of people on whom we can rely, people who let us know that they care about, value, and love us" (Sarason et al., 1983, p. 127). Social support is a related support given to an individual as part of a social network (Goetz et al., 2012).

According to Langford et al. (1997) and Taylor et al. (2004) there are four main types of social support; these are emotional, instrumental, informational and affirmational. Emotional support refers to support such as the showing of warmth and sympathetic acceptance of the illness by people around the patient. Instrumental support could include the provision of material such as financial aid for a diabetes regimen and actual physical assistance. Informational support could include the provision of information and assistance with problem

solving. Affirmational support refers to provision of feedback and acknowledgement of efforts made to overcome a condition.

Regarding HbA_{1c} value, a number of studies have found that social support is associated with improvements in glycaemic control. Fukunishi et al. (1998) examined the clinical efficacy of social support (perception and utilisation) in diabetes control in a sample of 178 participants with Type 1 and Type 2 diabetes. They found that social support correlates significantly with HbA_{1c}. In a randomized controlled clinical trial of 112 individuals with Type 2 diabetes, the study found that individuals who participated in group consultations were lower in HbA_{1c} and experienced more appropriate health behaviours than the control group (Trento et al., 2001). Another study of 334 adults with Type 2 diabetes aged 40 and over by Huang et al. (2010) found that a low burden of diabetes symptoms and higher levels of coping strategy and social support significantly predicted low HbA_{1c} levels and high levels of health-related quality of life and self-care behaviours. In addition, a study by Barrera et al. (2008) referred to social support in terms of resources, noting that greater social support resources for diet and physical activity such as family, friends, neighbourhoods, and media have been associated with healthful lifestyles among people with Type 2 diabetes.

Social support has been found to be positively related to an adherence to both diet and medication and that higher levels of social support are related to higher level of reported adherence to both. In a cross-sectional study of 200 adults with Type 2 diabetes, Garay-Sevilla et al. (1995) found that higher reported levels of social support were associated with higher adherence to diet and medication. The study also found that some aspects of family structure such as age of spouse and behaviour control within the family were also associated

with adherence. They argue that social support from relatives is required because meals are usually shared by all members of the family; for example in Libyan culture family usually eating out of one common bowl together with no difference between diabetic and non-diabetic members therefore the role of culture and traditional food should be taken into consideration. Garay-Sevilla et al. (1995) also add that the family structure and function is different in various cultures, therefore social support and its relationship with family support should be studied in different societies.

Family relationships have found to be important in diabetes management. Greater levels of social support from spouses and family members are associated with better regimen adherence and diabetes management (Glasgow and Toobert, 1988; Delamater, 2006). In another study in the USA, Wang and Fenske (1996) *examined the relationships among the source of support, universal self-care, and health-deviation self-care behaviours in 51 adults who control their blood glucose with an oral agent. They* report that multiple sources of social support, including family, friends, and diabetes support group are related to better regimen adherence among Type 2 diabetes patients. Another study in Finland by Toljamo and Hentinen (2001) on factors associated with adherence to self-care and glycaemic control in Type 2 diabetes found that those who lived alone rather than with a family member had poorer self-care.

In addition, educating families is very important in term of informational support. A study in USA by Carter-Edwards et al. (2004) which includes 12 African American females found that, from the perspective of the participants, families and friends care for them, but they did not understand their life with diabetes. Therefore they do not receive enough social support; families should be educated about the general understanding of the diabetes and implications

including psychosocial problems and daily management such as diet regimen and care during emergency situations (WHO, 1980).

In a mixed method study of 61 participants by Mayberry and Osborn (2012), it was found that family members' non-supportive behaviours were associated with being less adherent to a medication regimen. They suggest that social support directly affects adults' performance of diabetes self-care behaviours and indirectly affects glycaemic control.

Thus, it appears that a range of social factors influence glycaemic control, however, social support is considered as a significant health-promoting factor that is associated with better adherence to self-care regimens.

The role of social support varies across different cultures and may not always be clear (Markus and Kitayama, 1991; Kim et al., 2008). In general, individualistic cultures might be perceived as ones in which an individual has a personal responsibility to solve problems on their own without relying upon the assistance of others. In contrast, more collectivist cultures may be perceived as being ones in which a person may expect more help and support from their family and social network. However, many studies have revealed patterns that are exactly the opposite (Taylor et al., 2004). People within supposedly individualistic cultures, such as western communities, may get more from social support benefits than others within collectivist cultures, such as Libyan communities. In individualist cultures people may more freely seek social support because they share the cultural assumption that individuals should proactively maintain their well-being and that others have the freedom to offer to help or not. By way of contrast, people within collectivist cultures may find it difficult to seek help in relation to their health issues as they may share the cultural assumption that people ought not

to bother their social networks with their personal problems (Taylor et al., 2004; Kim et al., 2008).

In summary, social support plays an important role in adherence to the diabetes regimen; however, this may be different in various societies with different social organisations, values and culture.

4.5.6. Psychological Aspects of Diabetes

Psychological distress is a common problem in people with diabetes compared with the general population, and has a negative impact on diabetes management. Recent estimates indicate that over 40 % of people with diabetes experience psychological distress (Davies, 2010). For example a study by Shaban et al. (2006) reported significant prevalence rates for moderate to severe depression and anxiety in Type 1 patients living with diabetes. In fact the symptoms of depression and anxiety occur 2–3 times more frequently in people with diabetes than in the general population (Pouwer et al., 2010; Lloyd CE, 2010). The most common type of psychological distress associated with diabetes is depression (Davies, 2010). However, it is estimated that people with a history of depression are 37% more likely to develop Type 2 diabetes and are more likely to suffer from a recurrence of depression than the general population (Ali et al., 2006).

Depression experienced by diabetic patients has implications for their quality of life, their diabetic regimen adherence, and their health care consumption (Goldney et al., 2004; Simon et al., 2007). In fact, a study reported that a high severity of depression is associated with

greater health care costs, poor adherence to dietary regimen and medication, and the overall function of the primary care of diabetic patients (Ciechanowski et al., 2000).

A study in the Emirates by Sulaiman et al. (2010) measured levels of psychological distress and its association with glycaemic levels in people with Type 2 diabetes. The results of this study found a strong correlation between psychological distress and diabetic complications such as retinopathy, peripheral vascular disease and peripheral neuropathy. In particular, patients who are depressed tend to have poorer self-care, more severe physical symptoms and are less likely to adhere to prescribed care regimens.

In addition, an experimental study by Lustman et al. (2000) also shows a significant relationship between depression and poor glycaemic control. They conducted a meta-analytic review of 24 studies which found a strong association between depression and glycaemic control. Other study by Ikeda et al. (2003) found in a sample of 113 Type 2 diabetic patients a significant relationship between anxiety, depression, self-efficacy, and blood glucose levels.

In addition, the findings from controlled studies by Lustman et al. (2000) also indicated that effective treatment for depression is associated with significant improvements in glycaemic control. An association between depression and micro-vascular and macro-vascular complications has been also found in the literature review (Black et al., 2003; Wulsin and Singal, 2003). This association is probably because of poor adherence to medical treatment. In fact, the experimental studies indicate that depressed patients are at three times greater risk of non-adherence with medical treatment regimens compared with people with no symptoms of depression (DiMatteo et al., 2000).

Therefore, on the view of the above mentioned, psychological distress may directly affects individuals' adherence to the health advice and indirectly affects glycaemic control.

4.6. **Knowledge of diabetes and diabetes control**

Diabetes education aims to increase knowledge and experience in order to enable people with the disease to better understand their condition, provide people with the required skills that help to control and manage diabetes more effectively, and reduce the cost of treatment (Clement, 1995; Deakin et al., 2005). Measuring the efficacy of education programs is therefore important and can be done in various ways. Some methods focus on assessing the persons' knowledge of diabetes, since there is no doubt that knowledge about diabetes management is essential for all patients with diabetes. Consequently, much interest has been focused on the relationship between knowledge of diabetes and diabetes control, and whether increased patient knowledge about diabetes positively influences diabetic control. Colleran et al. (2003) in their study of the relationship between diabetes knowledge and glycaemic control, found that enhanced diabetes knowledge improves glycaemic control. Similarly, McPherson et al. (2008) investigated the association between a diabetic person's knowledge of medication and their HbA_{1c}. They found that HbA_{1c} was 1.5 units and 1.6 units lower with each increase in the knowledge score among men and women respectively. Lerman (2005) also reported that high education level and knowledge about diabetes is related to better adherence to a regimen and management of any diabetes treatment.

In contrast, many other studies have demonstrated that the knowledge of people with diabetes may be inadequate to enable them to undertake an active role in their care. Coates and Boore (1996) established that knowledge is simply one of numerous factors which influence metabolic control. Heisler et al. (2005) investigated whether self-knowledge of HbA_{1c} is associated with better understanding, assessment and control of diabetes. This is often referred to as better self-care or self-management behaviours; the terminology used may differ across different countries. They found that people who knew their most recent HbA_{1c}

values reported better understanding and assessment of their glycaemic control than those who did not know this value. The study however, found no association with better diabetes care, self-efficacy and self-management behaviours. Heisler et al. (2005) argued that knowledge of HbA$_{1c}$ value is useful but not adequate to improve a person's diabetes management, other areas of diabetes knowledge and behaviour strategies such as motivation and self-efficacy are also required. Lockington et al. (1988) established that in order to manage diabetes, a reasonable knowledge of the condition is required if people with diabetes are to be able to control their condition for themselves. Many studies (Johnson, 1996; Simmons,2001; knight, Dorhan and bundy 2006) concluded that knowledge of diabetes per se, is not enough however to improve self-care management whilst other barriers, such as inappropriate diabetes health care services, lack of family support and low self-efficacy, exist.

For example in Libya, people with diabetes may have essential knowledge about diabetes, such as diet regimen knowledge, but they may not know how to implement the new diet in reality, through changing shopping and food preparation practices, for example, because of lack of general support from the health educator, their family and community. Therefore the aim of any modern educational program is to equip people not just with adequate knowledge but also with the skills for effective self-management of their own condition. As mentioned in section 2.4, Libyan health education programmes are focusing on a traditional approach by passing information to the target population using various media, which clearly has a limited effect on improving self-car behaviour. Without a formal and well planned health education program in Libya, it is unlikely that other more informal forms of education would provide the desired health outcomes.

61

4.6.1. Diabetes and health education

A health education program aimed at diabetes might include methods to enhance the individuals understanding of the disease and how to better manage blood glucose. Education sessions can also refresh knowledge for individuals who have lived with the disease for a long time. However, in many cases, once people with diabetes are given a basic education about the nature of the disease, they are often left on their own to manage their condition for the rest of their lives (Lorig and González, 2000). In a meta-analysis study conducted by Norris et al. (2002), it was found that education about self-management improves glycaemic control; however, the effect is usually useful for only about three months. Similar findings were identified in a meta-analysis on the effect of self-management intervention health education programmes in Type 2 diabetes, which found that the intervention programmes have improved HbA_{1c} but the effect may decrease over time (Minet et al. 2010).

A study conducted in Italy by Trento et al. (2010) in 13 hospitals involved a total of 815 patients with non–insulin-treated Type 2 diabetes receiving 40–50 minutes of group education every 3–4 months, followed by a brief one-to-one consultation with a physician. Also all patients received a one-to-one consultation at least annually. After 4 years, a follow-up study found that the intervention group showed significant improvements in HbA_{1c}, fasting blood glucose, weight loss, BMI, blood pressure, triglycerides, and total cholesterol. In regards of psychosocial aspects, the participants had improved their quality of life, their knowledge of diabetes and were exhibiting better health behaviours. Similar findings were identified in a meta-analysis study on diabetes, which, reported that education on exercise decreased the level of HbA_{1c} in patients with type 2 diabetes (Nielsen et al., 2006).

Therefore, on-going education and support are essential in day-to-day management to maintain and promote effective self-management techniques for both those with diabetes and also their family members (ADA, 2006; Dunning, 2009). Norris et al. (2002) recommended that consideration be given to health education approaches that are effective in maintenance of long term glycaemic control.

4.6.2.1. Education in self-management

Diabetes is classed as a self-managed or self-care condition, as most of the management of the disease lies with the individual with diabetes (Heinrich et al. 2010). In fact, Toljamo and Hentinen (2001) argue that 98% of diabetes care is self-care. The day-to-day management of diabetes requires an extensive and demanding regimen. This includes, for example, a healthy diet, regular exercise, the taking of medicine as prescribed, self-monitoring of blood glucose and foot care, which must all become daily activities (Anderson et al., 2000; Heinrich et al., 2010). It is a complicated process of adoption and maintenance of a range of treatment aspects including changing lifestyle and behaviour patterns (WHO, 1980; Savoca and Miller, 2001; Dunning, 2009).

Diabetes Self-management Education (DSME) aims to support the individual in the making of informed decisions, in the adoption of appropriate self-care behaviours, in problem solving, and by facilitating their active collaboration with health care providers (ADA, 2012; Funnell et al., 2012). DSME is seen as a critical programme for people with diabetes; individuals who are involved in health education programmes that support self-management behaviour achieve better results in health outcomes and in their adherence to the treatment regimen (ADA, 2012; Funnell et al., 2012). Many systematic reviews have demonstrated that

interventions aimed at improving self-management can lead to improved diabetic condition (Norris et al., 2002; Chodosh et al., 2005; Heinrich et al., 2010). A systematic review on the effectiveness of self-management intervention for Type 2 diabetes shows that self-management interventions are effective in changing dietary behaviour, improving self-monitoring of blood glucose, increasing knowledge of diabetes and in improving quality of life in diabetes sufferers (Heinrich et al., 2010). In another meta-analysis by Chodosh et al. (2005), aimed at assessing the effectiveness and essential components of self-management programmes for diabetes, hypertension, and osteoarthritis, the study found a significant reduction in fasting blood glucose and in the HbA_{1c} test. Also, the study showed that the use of feedback to the individual with diabetes improved health outcomes.

Additionally, health education programmes that have a focus with a patient-centred model have been found to have a significant beneficial effect upon self-care management (Funnell et al., 1991; Dunning, 2009). This type of model is designed to provide patients with the knowledge and skills, and a sense of greater responsibility for controlling the condition; as well as the advice of healthcare providers, people with diabetes have to make a decision to change to a more healthy lifestyle (Skinner and Cradock, 2000; Dunning, 2009).

The literature suggests that effective diabetes education, with a view of improving self-management using a patient-centred model, can lead to reductions in HbA_{1c}. For example, in a Cochrane study on group-based training for self-management strategies in Type 2 diabetes, eleven studies in the USA with 1532 participants of group-based, patient-centred educational programmes were reviewed (Deakin et al., 2005). The study found that patients attending group education programmes had lower levels of HbA_{1c} and fasting blood glucose, and had achieved reductions in body weight. In addition, within this group, it was also found that

there had been a significant improvement in diabetes knowledge and a reduced need for medication. Also, a study by Deakin et al. (2005) aimed to determine the benefits from attending a patient-centred structured group for Type 2 diabetes education. They found that, when compared with a control group, 149 of the participants that attended the programme showed significant improvements in the mean HbA1c, reductions in body weight, the need for diabetes medication, and total cholesterol, and improved levels of self-empowerment, diabetes knowledge, physical activity, foot care, fruit and vegetable intake and enjoyment of food, in addition to increased overall satisfaction with the treatment received. However, although there is evidence from many systematic reviews that self-management training is effective, most reviews called for further research in order to ensure success and cost effectiveness of education programmes (Zabaleta and Forbes, 2007; Loveman et al., 2008; Steinsbekk et al., 2012).

It is worth mentioning that, despite the lack of literature about health education programs in Libya, it is generally noted that Arab countries lack the necessary infrastructure to support patient self-management. Self-management or self-empowerment health education programmes have the potential to improve the health outcome for people with diabetes (Minet et al., 2010; Baghbanian and Tol, 2012). Nonetheless, it is widely acknowledged that health education in Libya is under-developed and urgently needs more attention.

4.7. The adherence level and its barriers among people with diabetes

In most medical cases, health care providers expect their patients to follow the prescribed treatment regimen. However, an individual's failure to follow the treatment plan sometimes interrupts the desired outcome in terms of morbidity, mortality and economic burden (Martin

et al., 2005; Anderson et al., 2011). Poor adherence is a major problem in the treatment of many chronic diseases, and one of the most difficult goals to achieve is a change of lifestyle to fit the new condition (Ruggiero et al., 1997; Whittemore, 2000; Alder, 2011). Poor adherence to health recommendations raises the risk of many diabetic complications, a reduced quality of life and increase health care expenditure (Findings, 2003; DiMatteo, 2004; Anderson et al., 2011).

According to WHO (2003) and Lee et al. (2006), adherence to chronic disease regimens in general is poor. It was identified as low as 50% in developed counties, with a much worse rate in the less developed countries. In fact, non-adherence to treatment among people with chronic diseases averages about 60% (Dunbar-Jacob and Mortimer-Stephens, 2001; WHO, 2003; Cramer. 2004). A meta-analysis of 569 studies on adherence to medical treatment found that compared with other disease such as HIV disease, arthritis and gastrointestinal disorders, adherence was low among people with diabetes (DiMatteo, 2004). Therefore, the concept of self-management and adherence to the health advice among people with diabetes has been extensively investigated using a number of criteria in the literature review. A review of the adherence in the literature suggests that only a few people with diabetes were found to be fully adhering to all aspects of the diabetes regimen (McNabb, 1997; WHO,2003). A cross-sectional study in 13 countries from Asia, Australia, Europe and North America found that patient self-reported adherence rates for medication was in Type 1 (83%) and Type 2 (78%) for self-monitoring blood glucose was in type1 (70%) and Type 2 (64%), and for appointment keeping was in Type 1 (71%) and Type 2 (72%). The rates of observed adherence for diet regimen was in Type 1 (39%) and Type 2 (37 %) and for exercise was in Type 1 (37%) and Type 2 (35%) (Peyrot et al., 2005).

Other studies have looked at adherence in specific components of the diabetes regimen and have reported various results. A systematic literature research was conducted to identify the rate of adherence among patients with Type 2 diabetes with oral hypo-glycaemic agents (OHAs) and insulin treatment. The study found that adherence to OHA therapy ranged from 36% to 93% in patients remaining on treatment for 6–24 months and insulin adherence was 62% to 64% (Cramer, 2004). In addition, the study shows that adherence to dietary recommendations averaged about 65% (Christensen et al., 1983; Glasgow et al., 1987). Many studies (Ruggiero et al., 1997; Whittemore, 2000; Alder, 2011) suggest that individuals with diabetes find diet and exercise the hardest behaviours to modify compared to other treatment aspects such as oral medication and insulin injections. Nevertheless, measurement problems in adherence research make it difficult to interpret the results of these studies.

An international study about obstacles to adherence in Type 2 diabetes conducted in seven European countries found that obstacles to adherence are common across countries, and seem to have no strong correlation with the health-care system, but are more influenced by the patient's knowledge about diabetes, their beliefs and attitudes and the relationship between patient and healthcare professionals (Vermeire et al., 2007). These studies were focused on European countries which have similar levels of access to reasonable quality health services despite the differences in the ways they are funded. Clearly there are implications for many other countries where there is a greater expectation for out of pocket expenditure (El-Shazly et al., 2000).

Many pieces of research focus on adherence to medication specifically in Middle East countries. A study conducted in Libya to assess the standards of care and patients' knowledge and practice among 805 patients with both Type 1 and Type 2 diabetes found that 27.1% of

the participants did not take their medication as prescribed (Roaeid and Kablan, 2007). In another study by El-Shazly et al. (2000) which evaluated the pattern of care for diabetics in Egypt found that 11.4% of participants did not adhere to the medication treatment. The study also found that, not having health insurance was the most significant variable linked to poor adherence. This, however, is not necessarily the case in all MENA countries for example in Libya, people with diabetes are provided with all medical services and medication free of charge (Kadiki and Roaed, 1999). The availability of services and medicine does not always solve the problem of adherence.

Chronic diseases including diabetes need to be managed differently to acute illnesses (WHO, 2001). Acute treatment models are usually based on the concept that health providers know best, and that patients should follow their approach for a curative effect. This model has also been extended to the chronic disease, since this approach is also based on the idea that patients should follow the recommendation or advice of their health providers. Unfortunately, studies have showed that this approach does not always produce the desired outcomes (Baghbanian and Tol, 2012). Collaborative goal setting and continuous self-management support are the key elements of successful management in this disease (Anderson et al., 2000).

A variety of reasons can explain a patient's failure to control their diabetes and explanations for such failure are not always clear. In the literature review (Brannon and Feist, 2000; WHO, 2001; WHO, 2003; Martin et al., 2005), a wide range of reasons were given for poor adherence to the medical advice. These can be summarized into five categories, as follows. Firstly, the reason for failure could be due to patient-related factors, such as cognitive factors

that include knowledge about the disease, psychosocial stress, confidence in the ability to follow the regimen (self-efficacy), perceived benefits, and perceived risk. Secondly, therapy-related factors, such as duration of treatment and complexity of treatment, can have a bearing on adherence. Thirdly, condition-related factors can be significant, such as complications of the disease and psychological matters. Fourthly, social and economic factors, such as low level of education, lack of family or social support, and cultural norms, such as a belief in traditional treatment, can result in a failure to maintain an appropriate treatment regimen. Finally, the interaction between the health care system and the practitioner/patient may not be satisfactory. See figure 3. Many of these factors have been found to correlate with HbA_{1c} control in both direct and indirect ways (see section 4.4 above).
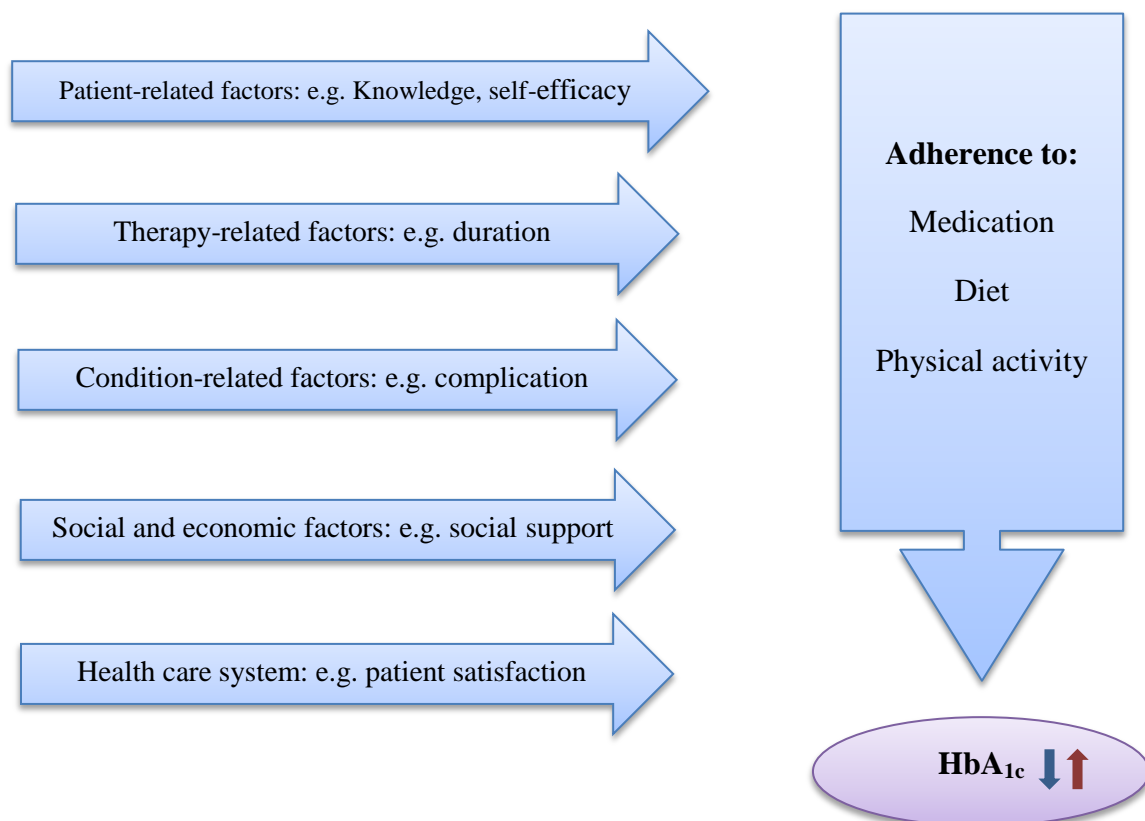
Figure (3): Factors reported to affect adherence

As a result of the complexity of factors that have been found to influence treatment adherence in people with diabetes, up to date, there has been little agreement concerning the most important variables that enhance adherence to the treatment regimen in diabetes.

4.8. Adherence and health behavioral theories

As mentioned above, due to the complexity of factors that have been found to influence adherence to the medical regimen, the concept of self-management and adherence to the health advice among people with diabetes has been extensively investigated using a number of approaches. The following section gives some examples of the theories that attempt to explain adherence.

4.8.1. Theory of Reasoned Action and Planned Behaviour

Theory of Reasoned Action (TRA) is one of the most commonly theories of behaviour which has been developed by Ajzen and Fishbein (1980). This theory assumes that the intention to perform behaviours is a function of both attitudes towards that behaviour and to their subjective norm. Attitudes refer to individual beliefs that a particular behaviour leads positively or negatively to the value outcomes. A subjective norm refers to the evaluation by groups or people who think that one should or should not pursue a particular pattern of behaviour (Brannon and Feist, 2000). According to this, intentional behaviour is considered to be a reflection of people's intentions, which is shaped by attitudes toward their behaviour and the perceived social norm (Rothman, 2000). Therefore, socio-demographic and cultural factors play an essential role in determining behaviour.

The Theory of Reasoned Action is described as volitional and non-volitional behaviour (Clark and Houle, 2008); volitional behaviour relates to an action that an individual chooses, while non-volitional refers to an action that an individual has no or little control over. The theory of planned behaviour (TPB) which is an extension of the Theory of Reasoned Action (Clark and Becker, 1998), proposes that people do not have full volitional control over their own behaviour (Sommer, 2011). Behavioural control includes both personal and external variables such as social support, knowledge and willpower. The theory emphasizes the perceived probability of success and failure, which assumes that people will engage in a particular behaviour when they believe that the benefits of success outweigh the consequence of failure, or when there are expectations from significant others, who believe that they should try to engage in that behaviour(Clark and Houle, 2008).

Both TRA and TPB have been used to predict adherence to many health-related behaviours. Boudreau and Godin (2009) in a study of physical activity adherence among people with Type 2 diabetes in Canada, found that all TPB factors were predictive of intention to engage in physical activity and explained 60% of the variance in intention. Another Canadian study was conducted to understand the utility of TPB and physical activity in people with both Type 1 and Type 2 diabetes (Plotnikoff et al., 2010). The study found that TPB accounts for 23% and 19% of the variance in physical activity respectively.

Fife-Schaw et al. (2007) investigated the efficacy of TPB through a meta-analysis found between 30% to 50% of the variance in intention is accounted for by attitude, subjective norm, and perceived behavioural control. Moreover, the study found that 20% to 30% of the variance in actual behaviour was accounted for by intentions and perceived behavioural control.

TRA and TPB have also a number of limitations in predicting behaviour. For example, attitudes, subjective norms, and perceived behavioural control are not the only factors that influence behaviour (Ajzen, 1991). In addition, some factors within TPB such as perceived behavioural control are difficult to measure (Rutter and Quine, 2002). Another limitation is that there is usually a gap of time between assessment of behavioural intention and the actual behaviour, and the intentions of an individual might change over time (Werner, 2004).

4.8.2. Trans-theoretical Model of Change

The Trans-theoretical Model (TTM) proposed by Prochaska and DiClemente (1983) aims to examine and predict the process of behaviour change. TTM suggests that individuals move through multiple stages in their efforts to change behaviour (Huddleston, 2009). This model may be a useful framework for therapeutic interventions, since TTM assumes that people do not change their behaviours quickly and decisively, but this change is achieved gradually through a series of transitions (Prochaska and DiClemente, 1984).

The TTM identifies five stages, through which individuals progress their various cognitive, affective and behavioural indicators (Prochaska et al., 1992). The following lists the stages of an individual's motivational readiness to change, as summarised by Berg et al. (2009):

(i)   *Pre-contemplation,* when individuals have no intention of changing their behaviour in the near future.

(ii)   *Contemplation,* when individuals are planning to change their problem behaviour and intend to change in the near future.

(iii)   *Pre-action:* in this stage, individuals have a timetable and strong intentions to modify their negative behaviours.

(iv)   *Action,* during this stage, individuals are involved in behaviour change.

(v)   *Maintenance* includes stabilizing the positive behaviour and avoiding relapse.

TTM has been applied to a number of health- related behaviours. For example, it was applied to the treatment of addictive behavioural and to behavioural change for chronic illness (Berg et al., 2009). Natarajan et al. (2002) examined the stages of change for physical activities in African-American people with Type 2 diabetes. The study found that participants who were in the later stages of change had better blood glucose levels. Another study by Bizub (2004) conducted to understand the effects of motivational readiness to change, self-efficacy, disease characteristics, and treatment factors on the outcome of treatment adherence, found a positive association between motivational readiness to change and treatment adherence and self-efficacy.

In contrast, some other studies have found no relationship between stages of change and blood glucose levels in people with diabetes (Holcomb, 2002; Salant, 2003, cited in Claude and Amy 2011).

This model, just as with the other health behavioural theories, has its own limitations. Firstly, TTM places stress on the individual, and ignores the influence of other factors, such as social environmental factors. Secondly, TTM presents the stages of change in a descriptive way rather than explaining the causative relationship between those stages, and consequently this may cause confusion. Finally, each of the stages may not be always appropriate for the characteristics of every population (Adegoke, 2006). These may explain why many studies using the TTM as a basis for interventional behaviour change have not been effective in

facilitating behaviour change. A study review by Bridle et al. (2005) examines the effectiveness of TTM intervention in various health behaviours such as diet and exercise, screening, prevention, and treatment adherence. They found that the majority of these interventions were unsuccessful.

4.8.3. The Health Belief Model

The Health Belief Model (HBM) was first developed by the US Public Health Service to predict and understand the lack of participation in preventative programs for individuals at risk of developing medical illnesses (Rosenstock, 1974). The model was later applied to individual responses to medical symptoms (Kirscht, 1974), and to the study of patients following medical regimens (Becker, 1974). The HBM assumes that decisions regarding health behaviour are based on two main factors: (1) the value placed by individual on a particular goal/condition and (2) the individual's estimate of the likelihood that a given action will achieve that goal (Maiman and Becker, 1974).

The HBM proposes four interactive belief states that influence adherence to health related behaviour as follows: individuals will engage in adherence behaviours if they believe that there will be negative consequences of non-adherence (perceived susceptibility); if they believe the consequences will be dangerous (perceived severity); if they believe that there are cost benefits of performing the regimen (perceived benefits); and/or if they believe that the benefits overshadow the barriers of engaging in the new regimen (perceived barriers) (Brannon and Feist, 2000).

Some studies also have criticized HBM as a prediction of adherence to the health care, while others have found that HBM is useful in predication adherence. For example, in a study by Cerkoney and Hart (1980) HBM was tested to predict patient level of adherence at a community hospital. A total of 30 patients with both Type 1 and Type 2 diabetes mellitus were interviewed in their homes after attending diabetes education classes for 6-12 months. Self-report and direct observation methods were used to collect data about adherence with insulin administration, hypoglycaemia, urine testing, and foot care. Adherence to diet and health beliefs was measured by self-report. The study found that the HBM was able to account for 25% of the variation in the adherence of this sample. In addition, perceived severity was the strongest subscale in predicting adherence, accounting for approximately 16% of the variance.

HBM was also examined in a study focused on Type 2 diabetes, in which a total of 93 middle- and lower class people with diabetes were invited to participate (Harris and Linn, 1985). The study measures HBM, patient understanding and family support, and one general health motivation scale. Patient self-reports, nurses' reports, and biological tests of both short term (i.e. 24-hour urine fasting blood glucose and fasting triglyceride) and long term (HbA_{1c}) adherence were used on this study. The study found that HBM predicts only 11% of the variance in adherence; however, this model was highly influence by perceived severity, which predicted 8% of the variance alone. The other three per cent of model was due to perceived susceptibility (1%), perceived psychological barriers (1%), and perceived benefits to treatment (1%), which did not add much to the overall predictive of adherence. HBM has nevertheless been extensively used in adherence related research, even though its predictability has been found to be inadequate.

The limitations of HBM have been identified as including the following: HBM is a psychological model, and therefore it is not intended or able to account for other factors which are not related to attitude or beliefs, such as environmental or economic factors; Janz and Becker (1984) suggest also that many individuals may initiate behaviours for reasons that are not health-related, such as losing weight to appear more attractive or smoking cessation for social approval. The influence of social norms and peer impacts on individual's decisions regarding their health behaviours is not given much weight in this model (Adegoke, 2006).

Many HBM research studies have suggested that adding self-efficacy to the original HBM will increase the reliability of the model's predictions (Strecher et al., 1986; Rosenstock et al., 1988). The following section explains the importance of self-efficacy in predicted adherence and diabetes control.

4.8.4. Self-efficacy and diabetes

On Bandura's social cognitive theory, self-efficacy is a term used to describe an individual's confidence in their ability to perform health behaviours, and this will influence which behaviours individual will engage in (Bandura, 1977). Bandura (1986), p. 395 defines self-efficacy as "people's judgment of their capabilities to organize and execute courses of action required to attain designated types of performances". Individuals make decisions based on a number of factors. One of these important factors is the patient's capability to carry out medical regimens (Dunbar-Jacob and Mortimer-Stephens, 2001). In other words, self-efficacy is an individual's belief in their capability to succeed in addressing a particular condition.

Bandura (1997) proposes three procedures in changing behaviour. These are implementing new behavioural patterns; generalizing their behaviour to unfamiliar situations; and eventually maintaining the behaviour over time. The author also distinguishes between two concepts of expectancy: efficacy expectancy and outcome expectancy. Efficacy expectancy is a "judgment of one's capability to accomplish a certain level of performance" (Bandura, 1986, p. 391) which represents the belief in themselves to be able to make that behavioural change. Outcome expectancy is "the judgment of the likely consequence behaviour will produce" (Bandura, 1986, p. 391) which represents a belief that certain behaviour will lead to a certain outcome. For instance, individuals may perceive that adapting a diabetes regimen is efficacious, but may not believe in their own capability to carry out the required behaviour successfully. Therefore, including outcome expectancies into diabetes self-care is essential to help patients understand the complexity of diabetes care.

The concept of self-efficacy is an important factor for improving self-management in health and chronic disease (Sarkar et al., 2006; Al-Khawaldeh et al., 2012). High self-efficacy is strongly related to good adherence. A meta-analysis conducted by Padgett et al. (1988) into educational and psychosocial interventions of people with diabetes, using both published and unpublished sources, found that studies utilizing social cognitive theory, including self-efficacy, achieved the most encouraging results. Williams and Bond (2002) examined the relationship between self-efficacy and self-care behaviour in the management of diabetes among 94 participants. They found that individuals with higher reported levels of self-efficacy are more confident in three important areas of the management of diabetes diet, exercise and blood glucose monitoring. The model accounted on average for over 26% of the variance in their self-care behaviours.

Al-Khawaldeh et al. (2012) investigated the relationship between diabetes self-efficacy and the adherence to the diabetic regimen among 223 participants with type 2 diabetes in Jordan. The study found that people with higher self-efficacy reported better self-management behaviours in diet, exercise, blood sugar testing, and taking medication. Aljasem et al. (2001) have studied the role of self-efficacy judgments within the expanded Health Belief Model among 309 diabetic patients. They found that anticipated benefits of treatment, perceived barriers to treatment, and self-efficacy, independently predicted self-care behaviours.

Similarly, Wang and Tak-Ying Shiu (2004) in a study conducted in China found that those who reported high self-efficacy also reported that they were more likely to manage the diabetes self-care. In another study by Kavanagh et al. (1993) investigated the role of self-efficacy in self-care among 63 participants with Type 1 and Type 2 diabetes. The study measured self-efficacy and treatment adherence for glucose testing, dieting and exercise, eight weeks apart. The authors concluded that self-efficacy is a strong predictor of adherence to the diet and exercise regimen indicating that participants with higher levels of self-efficacy are more likely to report higher levels of adherence to the prescribed self-care regimen. Griva et al. (2000) have investigated the relationship between self-efficacy and illness perception in the adherence to diabetes regimen and metabolic control. They also found that people with higher levels of self-efficacy reported higher levels of adherence to the management of diabetes. Studies have also shown that improved self-efficacy can produce improvements in self-management of chronic diseases and health outcomes (Farrell et al., 2004; Sarkar et al., 2006).

In summary, diabetes management requires a series of daily decisions to be made regarding diet regimen, physical exercise, and medication adherence (Anderson et al., 2000). Self-

efficacy impacts people's choices and decision-making and therefore enhancing self-efficacy to the required regimen is essential in successful diabetes outcomes and to achieve the goal of effective diabetes management.

The review of these theories is not exhaustive. This study does not intend to use these theories or to try to overcome their weaknesses. Instead, the goal is to provide a conceptual framework for the problem of adherence. In conclusion, most of the existing behavioural theories have offered a considerable contribution to help explain and predict adherence. These theories have focused on a number of variables such as perceived threat, motivation, and beliefs. Up to date, there has been little agreement concerning the most important variables that enhance adherence to the treatment regimen in diabetes. This study focuses on the general factors that may facilitate or enhance adherence to health care advice.

4.9. A summary and rationale for the present study

The risk of diabetic complication can be reduced by good control to the HbA_{1c} value which can be done through good adherence to health advice. In the literature review a wide range of reasons were given for poor HbA_{1c} and lack of adherence to the health advice as summarised in figure (2). However, due to the complexity of these factors and its relationship with HbA_{1c} value in people with diabetes, up to date, there has been little agreement concerning the most important variables that enhance adherence to the treatment regimen in diabetes.

The present study is concerned with the impact of these factors in general and particularly on diabetes knowledge and self-efficacy on HbA_{1c} value and adherence to the medical advice in the context of Libya. The literature regarding to the knowledge of diabetes management and

adherence to health advice has a number of limitation, namely: (1) Most of studies have been carried out in Western countries (Colleran et al., 2003; Sarkar et al., 2006). There is no study, so far that has examined the level of diabetes knowledge and discussed the issue of adherence to health advice among people with diabetes in Libya; (2) The relationship between knowledge about diabetes and HbA_{1c} is contradictory in the literature (Colleran et al., 2003; Heisler et al., 2005; McPherson et al., 2008; Al-Adsani et al., 2009) which was done mainly among people with higher level of knowledge and education than those in Libya where this current study found that 35.3% of the sample were classified as illiterate; (3) The participants in the studies were mainly from Type 2 diabetes or adolescent with Type 1 diabetes; (4) The studies focused primarily on the relationship between variables (such as HbA_{1c} level of knowledge and Self-efficacy) only a few studies have investigated the difference between Type 1 and Type 2 diabetes with regards of these variables; (5) A literature search suggests that there is no study, so far, that has investigated the self-efficacy level as an important factor to predict adherence among diabetes patients in Libya; (6) A few studies have considered understanding the problem from the patient perception (Zgibor and Songer, 2001), patients need to be given the opportunity to express their experience and problems (Martin et al., 2005).

Additional research is needed from other cultures and settings, such as the Libyan adult population with diabetes.

The present study will therefore address the above limitation by:

   i.   Exploring the levels of diabetes knowledge among adults with diabetes in Libya.

   ii.   Exploring the levels of adherence to health advice (as identified by HbA_{1c} and patients self-reporting) with regards to diabetes management.

iii. Exploring the factors which facilitate and enhance adherence to health care advice including diabetes knowledge and self-efficacy.

iv. Comparing Type 1 and Type 2 diabetes regarding to level of knowledge, adherence and self-efficacy.

CHAPTER 5-DATA COLLECTION AND RESEARCH METHODOLOGY

5.1. Introduction

The main purpose of this chapter is to discuss the methods that have been employed in this study. The aims, context of the study and research questions are presented first. This is followed by an explanation of the research design, including the rationale for implementing a mixed methods approach. Ethical issues and approval will be discussed next. Finally, the chapter will provide an overview of the methods employed in the two phases. Phase One involves information about the recruitment of participants, quantitative data collection methods and analysis. Phase Two includes information on the sample used, the interview methods, along with data management and analysis.

5.2. Health research and design:

According to Creswell et al. (2003) a researcher should choose a research design at an early stage of the research, because research design determines: research methodology, data collection methods, and data analysis methods. Research design is defined as ''the systematic collection, analysis, and interpretation of data to answer a certain question or solve a problem'' (Hardon et al., 2001, p. 145). The methodology is the overall approach to the research process which includes study approach such as quantitative, qualitative or mixed methods and the methods of data collection and analysis. There is a degree of confusion over the relationship between methodology and methods. Methodology and methods are different; methods are techniques and procedures for data collection and analysis under the methodological assumptions (Parahoo, 1997).

Early health related research was dominated by the bio-medical model which focuses on the assumption of scientific reasoning i.e. that disease is caused by an aetiological agent. Social scientists critique this model and argue that this model has too much focus on the function of the body and technology rather than on people's lives in their social context. Their view is that biomedical solutions are only partial therapies, and that ill-health is caused by a combination of determinants which include biological, social and psychological factors; therefore solutions need to have broader scope (Bowling, 2009). It is now widely recognised that many health problems are rooted in their social or cultural contexts (Ulin et al., 2005), these include prevailing norms, ethnic identities, gender norm, and socioeconomic status (Mack et al., 2005). As such one of the main goals of health research is to provide all aspects of knowledge and evidence necessary for improving health and the health care system. Maintaining health and dealing with the complexities of ill health have motivated the researcher to draw from different disciplines such as sociology and anthropology. The methodological approaches in such disciplines have their own validity within specific traditions but usually both focus on human behaviour in the concept of social or cultural context (Green and Thorogood, 2004). For example health care providers increasingly used qualitative social science methods to enhance the understanding of health issues. A range of different approaches is needed to capture the complexities of health and illness.

Research into diabetes addresses both theoretical and practical problems important to clinical practice. Research in this field includes biological, psychological and, indeed, social aspects. A wide range of scientific research methods may be appropriate, therefore, because of the variety of questions that could be raised. Due to the nature of the topic, diabetes studies tend to be heavily connected with biomedical and epidemiological methods of study. However

researchers who are interested in studying human behavioural or social issues related to diabetes have introduced social science methods of surveying and interviewing into diabetes research studies. Therefore, a wide range of methods and approaches within different research disciplines have been employed.

Research design in health and disease related topics has been traditionally dominated by quantitative research methods (O'Cathain et al., 2007) and in particulars Randomised Controlled Trials (RCT). RCT's are seen as the gold standard of medical research whereby the focus is on testing a hypothesis through controlled experiment. It based on the assumption that phenomena can be measured and analysed objectively and falls into a group of methods broadly referred to as positivism. The RCT has much to contribute to clinical research including research on diabetes. RCT methodology has produced an extensive knowledge base for understanding diabetes as a disease process and how to improve treatment and the prevention of secondary complications. However each new finding leads to more questions which may require a different approach to research in this area. For example those concerned with patient behaviour, such as adherence to treatment can use a different approach of data collection and analysis (Pope and Mays, 1995). Whilst quantitative methods are still useful in health and health service based research, qualitative and mixed research methods are increasingly welcomed in health research (O'Cathain et al., 2007; Bowling, 2009).

Although guidelines for diabetes care including self-management support exists (Diabetes UK, 2005; ADA, 2011; ADA, 2012), many studies demonstrate high rates of non-adherence to treatment. This often leads to complications and creates more demands on the health

system (Findings, 2003; DiMatteo, 2004). This means that health systems in many low and middle income countries including Libya face a major challenge in improving the situation. To understand the reasons behind why people with diabetes do not adhere to the medical advice, this study aims to examine the current knowledge of diabetes among people with the disease in Libya and to explore factors including self-efficacy that enhance adherence to treatment and management of the condition. To answer this question and because purpose guides research methods, this study followed a Sequential explanatory mixed methods research design (Tashakkori and Teddlie, 1998; Creswell et al., 2003; Plano Clark and Creswell, 2011).

5.3. The research questions:

The research questions that guided this study are as follows:

1. What is the current level of diabetes knowledge among adults with diabetes in Libya?

2. To what extent do people with diabetes adhere to medical advice as identified by HbA$_{1c}$ value and patient self-reporting?

3. What are the main factors that facilitate and enhance adherence to health advice?

4. Is there any difference between Type 1 and Type 2 diabetes regarding to level of knowledge, adherence and self-efficacy.

5.4. Settings

This study was carried out in Benghazi, Libya's second largest city with population about 750,000 inhabitants. Data was collected from adults with diabetes visiting Benghazi Diabetes Centre, which is one of the oldest and largest diabetes registries in Libya. There are a total of

23,420 diabetic patients on the most recent register in Benghazi Diabetes Centre (Roaeid and Kablan, 2007).

5.5. Research Approach

Traditionally, health research is based on three approaches: quantitative, qualitative and mixed methods. Quantitative and qualitative approaches typically use different tools and procedures. In a quantitative approach, the tools are generally experiments, surveys and questionnaires, and the analysis is usually performed statistically, providing numerical data to measure variables and to test theories (Appleton, 2009). The qualitative approach typically uses observation, interviews and documents; the analysis is usually descriptive and narrative. The main difference between qualitative data and quantitative data is the nature of data collection, analysis and presentation of results (Ary et al., 2009), table (8) illustrate the main differences between the two approaches.

Another major difference between the quantitative and qualitative approaches is the world view of the researcher. Every researcher should clearly state their world view background, the status of their knowledge and how that knowledge can be used to answer the research questions. According to the view of Bryman (1998), Haase and Myers (1988), and How, (1988) (cited in Clarke, 2003), quantitative methods assume that the world is generally stable and therefore predictable, while qualitative methods assume the world is in a dynamic state of flux.

<u>Table (8): Illustrate the difference between Quantitative and Qualitative approaches</u>

The table originally presented here cannot be made freely available via LJMU Digital Collections because of copyright. The table was sourced at Ary, D., et al. (2009). Introduction to research in education. USA, Wadsworth Pub Co

Quantitative approaches are usually associated with a [post] positivism paradigm. As such, the researcher's world view may originate from cause-and-effect thinking, and lead to the measurement and correlation of selected variables and the testing of theories (Slife and Williams, 1995). On the other hand, qualitative approaches are usually associated with a constructivist paradigm. Here, the researcher's world view comes from study of the perceptions of the participants and their subjective view of their social interactions and personal experiences. Mixed method approaches can use more than one world view such as [post] positivism and constructivism, but it is usually associated with pragmatism (Plano Clark and Creswell, 2011).

Pragmatism is focused on what *methods* can be used to answer the research questions rather than the researcher's world view, simply using any methods that are best suited to answering the research questions of the study. (Tashakkori and Teddlie, 2003; Plano Clark and Creswell, 2011). In this approach the researchers are free to use any of the methods, technique and procedures which usually involve quantitative and qualitative research within

the same study. In pragmatism philosophy the research question(s) drive the method(s) used (Onwuegbuzie and Leech, 2005). Table (9) summarizes the main differences between pragmatism and the most common methodological stances in the social sciences as proposed by (Morgan, 2007).

Table (9): comparisons between pragmatism, qualitative and quantitative approach

Approach	Qualitative	Quantitative	Pragmatic
Connection of theory data	Induction	Deduction	Abduction
Relationship to research process	Subjectivity	Objectivity	Inter subjectivity
Inference from data	Context	Generality	Transferability

Source: Morgan (2007)

The table aims to differentiate between induction and deduction and suggests how difficult it is to stick to one approach when the researcher acting in the real word. The deductive approach to research acts as moving from theory or hypothesis to data collection; whereas, the inductive approach research collects data first and then develops theories (Bryman, 2008). Deductive and inductive often do not follow the sequence outlined in its pure form though as for example a deductive research process can involve qualitative approach occasionally. Also the inductive process is expected to involve some deduction, and in the same way that the deductive process is related to a quantitative research approach (Ivankova and Stick, 2006).

A pragmatic approach can allow the researcher to move up and down between induction and deduction. It can rely on a form of abduction which can be explained as an approach primarily involving the conversion of observation into theories and then the evaluation of

those theories through action (Morgan, 2007). For example, a researcher may choose to move from theory down to data, but when it is comes to analysis the data researcher might recognize a need to modify the theory. Also, after moving from data to theory, a researcher may realise that more data are needed to confirm that theory. The pragmatic point of view using abduction is quite common to researchers who use mixed methods in a sequential way. For example, inductive results that are derived from qualitative data can be used to establish deductive goals for subsequent quantitative data collection and vice versa (Ivankova and Stick, 2006; Morgan, 2007).

Table (9) also includes the difference between subjectivity and objectivity and explains the relationship between the researcher and the research process. Generally speaking, subjectivity is associated with qualitative approaches and objectivity is associated with quantitative approaches. From the point of view of pragmatism the inter-subjective process is emphasised. This is usually intended to overcome the duality between subjectivity and objectivity by suggesting a reflexive orientation as social action. It is focused on the process of communication and widely shared meaning between the statuses.

Finally table (9) also explains that the qualitative approach is associated with knowledge that is completely specific to a particular concept and quantitative approach is associated with a generalized set of principles. From a pragmatic approach, Morgan (2007) introduces the concept of transferability which focuses on what an individual can do with the produced knowledge rather than deliberating what can be universal and generalized and what can be specific and context-dependent. The main idea of pragmatism is to work back and forth

between the two extreme approaches to reach an effective approach that has an emphasis upon abductive, intersubjective and transferable aspects.

There are many advantages from being a pragmatic researcher such as allowing the researchers to be flexible, using different techniques to answer the research question of the study (Onwuegbuzie and Leech, 2005). Furthermore, there are more opportunities to promote collaboration among different researchers with different research philosophies, and being able to combine the macro and micro levels of research (Onwuegbuzie and Leech, 2005).

5.5.1. Rationale behind using the Mixed Method Approach

Mixed methods research combines the quantitative and qualitative approaches within a single study. In mixed methods research, the strengths of both quantitative and qualitative approach can be combined and the weaknesses of both research approaches can be effectively avoided (Tashakkori and Teddlie, 1998; Denscombe, 2007; Plano Clark and Creswell, 2011). Quantitative research is usually weak in understanding the context of people's observations or comments, while qualitative research gives opportunity for the researcher to explore thoughts and feelings in greater depth. Qualitative research, on the other hand, has a weakness of its own, related to the personal interpretation of the researcher and the difficulty of generalizing results from the study population because of the limited number of participants. While the quantitative research does not have this weakness because it takes strong evidence using an objective approach to a much larger sample. Therefore a mixed method approach enables the researcher to overcome the weaknesses of using either quantitative research or qualitative research

methods in isolation (Tashakkori and Teddlie, 1998; Denscombe, 2007; Plano Clark and Creswell, 2011).

There are many advantages of using mixed methods research, as mentioned in the literature review (Tashakkori and Teddlie, 1998; Denscombe, 2007; Plano Clark and Creswell, 2011). Plano Clark and Creswell (2011) summarize these advantages in the following points:

i.   Mixed methods research provides stronger evidence for studying a research problem, which can be done by using quantitative and qualitative approaches in one single study.

ii. Different data collection methods can be used. The researcher is not restricted to a single type of data collection in mixed methods research; they would often be restricted when quantitative or qualitative research is used on its own.

iii. Mixed methods can answer research questions which may otherwise have been difficult to answer by quantitative or qualitative research alone.

iv. Mixed methods support the use of more than one worldview because it is not associated with a single type of method.

There are many classifications of mixed method approaches, each using different terminology and features (Tashakkori and Teddlie, 1998; Denscombe, 2007; Plano Clark and Creswell, 2011).

Creswell et al. (2003), p. 212 define the mixed methods approach as ''the collection or analysis of both quantitative and/or qualitative data in a single study in which the data are collected concurrently or sequentially, are given a priority, and involve the integration of data at one or more stages in the process of research''.

The researcher's choices will be determined by the purpose of the study. The six most common mixed methods designs were identified by Creswell et al. (2003). These include three sequential and three concurrent designs. One of the most popular sequential designs used is the mixed-methods sequential explanatory design. This design is well described in the literature (Tashakkori and Teddlie, 1998; Creswell et al., 2003; Plano Clark and Creswell, 2011). This current study followed a sequential explanatory mixed method design as shown in Figure (4).
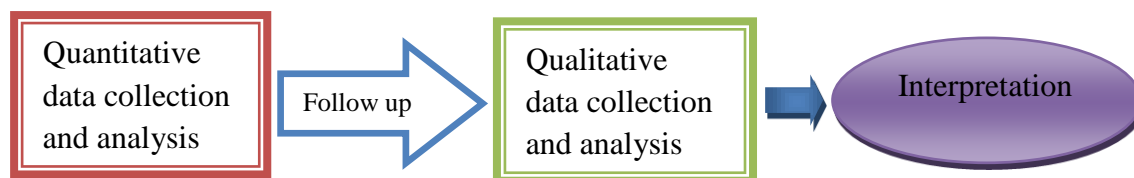
Figure (4): Sequential explanatory mixed method design

5.5.2. Sequential explanatory mixed method design

The explanatory design is a Two-Phase mixed methods design which is characterized by the collection and analysis of quantitative data in the first phase of research, followed by the collection and analysis of qualitative data in the second phase, based on the results of the initial quantitative results. The purpose of the second phase is to help explain the initial results qualitatively, and to get more and deeper information about the study (Creswell et al., 2003; Creswell and Clark, 2007; Plano Clark and Creswell, 2011).

This study design was used to collect data from individuals with diabetes type 1 or type 2 who have been diagnosed for 12 months or more. The purpose of the Phase One study was to examine the current diabetes knowledge and to explore any factors including self-efficacy

that enhance adherence to treatment and management of the condition. This requires a quantitative approach in order to identify the association between variables to establish trends. The purpose of the Phase Two study was to understand what kind of diabetes knowledge the participants have and why they adhere (or not) to the medical advice; such questions are best addressed through a qualitative approach. A visual model of the current mixed methods sequential explanatory design is presented in Figure (4) below.

The strengths and weaknesses of the mixed-methods design including explanatory sequential design have been generally discussed in section 5.5.1. The main advantages of this study design are that:

i. This design is straightforward and has opportunities for explanation of the quantitative finding in detail (Clarke, 2003; Morgan, 2006).

ii. This design can be very useful when unexpected results are occurring from a quantitative study (Morse, 1991).

iii. The design has two phases separately structured; since only one type of data will be collected at a time during each phase, it is easy to implement, and a single researcher can collect data without need for a research team (Plano Clark and Creswell, 2011).

The design of mixed-methods research is limited in that it can be very time consuming and qualitative phases usually take much longer than quantitative phases. Also, it is essential that consideration is given to the resources required and the feasibility of the collection and analysis of the data, as summarized by Plano Clark and Creswell (2011).

Design	Tools	Products

Participant selection

Convenience Sampling, (n= 855)

Type 2: 763 (89.2%) and Type 1: 92 (10.8%)

Quan. Data collection

Questionnaires (n=855): DKT, CIDS.
HbA_{1c}
Socio-demographic information.

Numerical data, L scale score, demographic information

Quan Data analysis

Descriptive statistics and inferential statistical tests

Descriptive stats, level of knowledge, HbA_{1c}

Participant selection

Stratified random Sampling, (n= 50)

50 participants represent the 3 different levels of knowledge from both Type 1 and type 2

Qual Data collection

Semi-structured interview

Text data: Interview transcripts, observation

Qual Data analysis

Content analysis: Coding and thematic analysis

Code and themes

Interpretation

Interpretation and explanation of the Qul and Qul result

Discussion both Quan and Qual results

Figure (5): Visual model for the current mixed methods sequential explanatory design

5.5.3. Justification of using Sequential Explanatory Mixed Methods Design

Several approaches of mixed methods are available for collection of information. The study design chosen will depend upon the study objective, the research strategy adopted, and the time span available for collecting data. The use of Explanatory sequential design is the best choice for this study for the following reasons:

i. As the first aim of this study is to build background and baseline information about the level of diabetes knowledge and other factors related to adherence to the treatment among people with diabetes in Libya, it is therefore important to start with strong evidence using quantitative research. According to Plano, Clark and Creswell (2011) explanatory design is useful when the researcher or the research problem is concerned with quantitative data; this gives the study the advantages and the strengths of the quantitative approach. Focus on quantitative data to look for strong evidence for the study is the most common in Sequential Explanatory design. Examples of this include; a study by Clarke (2003) on understanding well-being following a stroke in later life and, a study on physical activity and mental well-being typologies in corporate employees by (Thøgersen-Ntoumani and Fox, 2005).

ii. As the study aims to understand the adherence problem in the context of Libya, it was important to uses qualitative methods. This design was intended to analyse the results of quantitative phase using qualitative methods for more depth of understanding (Tashakkori and Teddlie, 1998; Plano Clark and Creswell, 2011).

iii. For the purpose of the study the plan was to collect the data by the researcher himself, this design is suitable because it allows collecting one type of data at a time (Plano Clark and Creswell, 2011).

iv.   As any mixed methods usually require plenty of time to complete (Johnson and onwuegbuzie, 2004; Plano Clark and Creswell, 2011), this was a PhD study with, enough time to conduct the study in two phases.

Explanatory sequential design, involves collecting quantitative data first and then explaining the quantitative results with qualitative data, therefore, it can be conducted in different ways. In general, explanatory sequential design is used in two variants or typologies depend on the sequence decision on quantitative phase or qualitative phase.   These are: *Follow-up explanation variant* which is the common design; it focuses on the quantitative phase while relying on the qualitative phase for an explanation of the findings. This design is useful when the researcher wants to investigate the relationship within the quantitative data and the reasons behind this connection. *Participants-selection variant* focuses on a qualitative approach in order to explain a phenomenon in Phase Two; the purpose of the quantitative phase is to identify suitable participants (Plano Clark and Creswell, 2011).

In explanatory sequential design, the researcher should consider many methodological issues which include the priority given to the quantitative and qualitative data collection and analysis, the sequence of the data collection and analysis, and that the stages in the research process are connected and the results are integrated (Morgan, 1998; Creswell et al., 2003). According to Creswell and his colleagues (2003) there are four criteria that help to design the study effectively. These criteria are implementation; priority; integration; and theoretical perspective. Using these criteria the researcher will decide whether quantitative or qualitative data will be collected first, or whether the data will be collected simultaneously. The researcher will also determine the priority given to the quantitative or qualitative data and

decide at what stages to integrate the quantitative and qualitative data, as well as what theoretical framework the study should follow.

The first one is implementation. The current study commences with quantitative research as this study aims to collect data from a large number, in order to examine the general level of knowledge and to explore any other factors including self-efficacy that enhance adherence to treatment. The next criteria is the priority given to the type of research collected, since the second phase was conducted as a follow-up to the quantitative results to help explain the quantitative results, it would appear that more weight is given to the quantitative data. In this exploratory follow up, the plan is to explore the results of Phase One. The third criterion is integration of the research. It was clear from the outset that the data was to be combined in two stages. Firstly, at the analysis stage the results from Phase One were used to help the researcher to choose what topics need to be further explored and who would be involved in the interviews, and secondly in the interpretation stage for merging of the findings. The final criterion is the theoretical framework, since this design used in both the quantitative and qualitative approaches. The researcher drew on a [post] positivist framework to analyse quantitative data such as measuring variables Phase One; and in the second phase drew on constructivist principles for deeper description and analysis (Plano Clark and Creswell, 2011).

5.6. Ethical approval

Ethical considerations are always an important part of academic research (Grinnell and Unrau, 2008), especially when the research study involves directly working with people. Ethical approval is a prerequisite for research study at Liverpool John Moores University. Therefore

formal approval was requested from the University Research Ethics Committee at the beginning of this study. Application for approval involved the following issues:

i. Participant's information sheet, including information about all aspects of the study.

ii. Informed consent, including submission of consent form and clearly informing participants of their right to withdraw from the study at any time.

iii. Confidentiality of the information acquired, including provision of where the information will be stored for safe-keeping.

iv. Description of any potential risks or hazards to the participants, and to the researcher, as appropriate.

Since the current study took place in Libya, the ethics committee requested an agreement approval letter from the Libyan health authorities. The agreed letter was obtained from Libyan health authority in Benghazi Diabetes Centre on 16/02/2010 (see Appendix 1) and later an ethical approval letter from the University of Liverpool John Moores Committee on Research Ethics was issued on 25/02/2010 (see Appendix 1).

5.7. Phase One: Quantitative procedure

This section describes the quantitative procedures utilized to address the purpose of Phase One study.

5.7.1. The objectives of Phase One study

i. To examine the levels of diabetes knowledge among adults with diabetes in Libya.

ii. To investigate the levels of adherence to health advice (as identified by HbA_{1c}) with regards to diabetes management.

iii.   To examine the factors which facilitate and enhance adherence to health care advice?

iv.   To examine the relationship between self-efficacy and diabetes management.

5.7.2.   Participants

Because of ethical considerations, the profile for participants was restricted to Libyan adults (aged 18 years and over) with diabetes (both with Type 1 and Type 2), and with a diagnosis of at least 12 months. The number of diabetic patients visiting Benghazi Diabetic Centre is about 23,420 annually. The clinic is open 6 days a week from 8:30 to 16:30, three days for men (Saturday, Monday, and Wednesday) and three days for women (Sunday, Tuesday and Thursday).

As a list of the population does not exist in the Diabetic centre or in the ministry of health at the time of collection the data, a non-probability convenience sampling technique was used for data collection. Convenience sampling is considered as a weak technique because of the uncertainty and selection bias. Therefore an attempt was made to improve the sample's representativeness by: (1) distributing questionnaires to a different age and gender and at various days and times; (2) using more data, as a general rule for sample size, larger is better (Bowling, 2002); (3) the researcher made an effort to give everyone present an opportunity to fill out a questionnaire. In addition, all people with diabetes have to come to the clinic to receive their medications (oral and insulin) as no other place can offer that, this advantage give everyone an opportunity to present in the study. Also as mentioned earlier the clinic opens three days for men and three days for women due to culture reasons. This may also improve the convenience sample approaches and help to obtain a sample that is close to a probability sample characteristics.

RAOSOFT is an automated online sample calculator which was used for estimate the sample size in this study. It takes into consideration three factors in determining the sample size. These are the margin of error (5% was used for the study), the confidence interval (95% was used for the study), the population and the response distribution (50%). The minimum effective sample size was estimated to be 378 participants (RAOSOFT, 2009). However, a total of 1000 adults with diabetes (500 male and 500 female) were invited to participate in the study for two reasons. First as mentioned before for sample size, larger is better particularly in convenience sampling approach. Second because the study aimed to divide the participants first into two groups according to their Type of diabetes (Type 1 or Type 2), and then each group divided into three sup-groups according to their diabetes knowledge level in Phase Two study (poor knowledge, average knowledge and good knowledge, see section 5.7.3.2). Therefore, the idea is that with a large number the researcher will be able to find enough participants for each group particularly Type 1 diabetes which is less common.

The participants were approached whilst attending the Centre for a routine appointment and they were eligible for inclusion if they met the following criteria:

- Type 1 or Type 2 diabetics who are registered with diabetes in the Centre for at least one year

- Male and female aged 18 and over

- Have given written informed consent to participate

- Living in Benghazi city

- Libyan nationals to ensure the same ethnicity

The purpose of the study and how the findings would be utilised were fully explained to all participants. Written consent (see appendix 5) was then obtained from those who agreed to participate in the study. Confidentiality of the data was assured. All questionnaires were handed out at the Centre by the researcher at three points; the reception desk, in the way to laboratory and at the waiting room. A help to complete the questionnaire was offered for all, as many participants were expected to have a low levels of literacy. The completed questionnaire was collected by the researcher and the nurses on the same day of handing out the questionnaires. Of the 1000 that were approached, 60 declined to participate due to time constraints, 62 participants did not return the questionnaires and 23 returned questionnaires were excluded and they were incomplete. Hence, 855 participants completed the questionnaires and their results are included in this study (85.5% of the total number of questionnaires), see table (10). The study was conducted from the 1st of March to the 10th of April, 2010.

Table (10): Response rate of questionnaire

distributed questionnaires	Refuse	Uncompleted	Not returned	Response Rate
1000	60	23	62	85.5% (855)

5.7.3. Data Collection Methods

For the first phase, a cross-sectional survey design was carried out using questionnaires. Questionnaires are the most common method of data collection in quantitative research but can also be used in qualitative research (Creswell, 2009; Sanders and Wilkins, 2010). They offer an effective way to describe populations, for example count the frequency of some event, assess the distribution of some variables or to study the association between different variables such as age, groups, sex, knowledge, attitude, and other information of similar

nature about the population (Appleton, 2009). The questionnaire method has many advantages as a research instrument, being relatively easy to arrange and economical in terms of both money and time (the costs may simply involve just the printing and postage) compared with other methods such as interviews, particularly when the number of participants are large and distributed over a wide geographical area. Questionnaires also offer a greater degree of anonymity and are less affected by interpersonal factors (Bowling, 2002; Denscombe, 2007; Watson M. & Coombes, 2009).

There are however also a number of disadvantages related to the use of questionnaires which include a relatively low response rate compared with other methods, questions in the questionnaire sometimes are not clear for the participants and the fact that it can be difficult to establish the direction of associations between the variables (Denscombe, 2007). In fact, to overcome these disadvantages, the researcher chooses to physically hand the questionnaires to the participants in the diabetic centre. This increased the opportunity for the researcher to introduce the research topic and motivate the respondents to offer frank answers. The researcher also encouraged the participants to complete the questionnaire while they are in the waiting room which allowed him to clarify any questions when needed.

5.7.3.1. *The rationale behind choosing the survey questionnaire methods in this research*

i.   It is the most common methods of primary data collection (Creswell, 2009),

ii. To achieve the research objectives, a large sample of target population was required, thus survey questionnaire was the best choice in term of both time and money

iii.   It is the best way to describe population and conducting the required test analysis techniques such as ANOVA test and t-Test, to study the relationship between variables

iv.   It is consistent with the research approach adopted in this study (pragmatic paradigm) see section 5.5.1.

Questions in a questionnaire can be closed or open-ended or a combination of both (Black, 1999). Closed questions are usually used in quantitative research (Mitchell and Jolley, 2010). In closed questions the researcher offers a fixed number of answers, and the participants have to choose from them (Oppenheim, 1992), which may involve a simple response (such as yes/no), multiple choice, or may involve ranking scale options (as in a Likert-scale question). Closed questions are useful for basic demographic information and to categorise the respondents, for example, do you have a family history of diabetes (yes/no) or what is your educational level (high school/college graduated etc.). In addition closed questions are easier to analyse, answers can be compared, and take less time for both researcher and participants compared with open-ended questions (Sanders and Wilkins, 2010). In open-ended questions the researcher does not offer any answers to choose from, but instead the participants have to answer and explain their opinion by using their own words. Open-ended questions provide an opportunity to include more information and personal feelings or comments about the topic (Oppenheim, 1992; Sanders and Wilkins 2010). In contrast, closed questions may lead artificially to the suggested answers, even where the participants did not completely agree with the researcher (Sanders and Wilkins, 2010).

For the purpose of Phase One Study two questionnaires using closed questions were used to collect data from all the participants. The rationale for this was because it is a useful approach to build basic background and baseline information about the sample. Also it was deemed to be the best way to measure the level of diabetes knowledge, self-efficacy and other related factors that enhance adherence to the treatment. It is also an ideal method to use in a study with a large number of participants (1000 participants). In addition, as the answers of this type of questionnaire are better suited for computer analysis programs such as Statistical Packages for the Social Sciences (SPSS), this approach is suitable to identify the association between variables to establish trends. Two questionnaires were utilized this study: The Michigan Diabetes Knowledge Test (DKT); and the Confidence in Diabetes Self-Care Score.

5.7.3.2. Michigan Diabetes Knowledge Test (DKT), (Fitzgerald et al., 1998) see Appendix 3
The DTK questionnaire of the University of Michigan Diabetes Research and Training Centre was designed to investigate the level of diabetes knowledge. It comprises of 23 items which include 14 items as a general test of diabetes management and 9 items for insulin use (Fitzgerald et al., 1998). The DKT was chosen because it has been a widely used, valid and reliable tool (Colleran et al., 2003; Murata et al., 2003; Al-Adsani et al., 2009). Furthermore, it has been successfully used with a sample of participants in Kuwait (Al-Adsani et al., 2009) which has a similar culture as Libya. Therefore, the Arabic questionnaire version which was used in the Al-Adsani et al. (2009) study was applied in the current study.

Following measurement of diabetes knowledge, the sample was divided into three groups based on their response to knowledge of diabetes.

Table (11): The ranges of DKT score according to the level of knowledge

Knowledge level	DKT score 23 items	DKT score 14 items general knowledge	DKT score 9 items related to insulin use
Poor knowledge	<11	<7	<5
Average knowledge	11-17	7-11	5-7
Good knowledge	> 17	> 11	> 7

The sample was thus sub- divided into the following three groups; poor knowledge, average knowledge and good knowledge as proposed by Al-Adsani et al. (2009). The knowledge score was calculated by giving one point for each correct response and zero for a wrong or no response. The range of the knowledge score was categorized in three different ways: in all 23 items, as general knowledge 14 items and as 9 for items related to the insulin use, see table (11).

5.7.3.3. *The Confidence in Diabetes Self-Care Scale* adapted from Van Der Ven et al. (2003) (see Appendix 4)

The brief CIDS Scale is a self-report questionnaire designed to assess self-efficacy for people with type-one diabetes (Van Der Ven et al., 2003). It comprises 20 items intended to test the patient's possibilities and capacities of diabetes self-management, including their ability to perform activities such as self-treatment and self-observation, how they control their general health condition and self-regulate to improve their condition. The CIDS scale is regarded as reliable and valid (IDF, 2003; Van Der Ven et al., 2003). However, because the participants in the present study had both Type 1 and Type 2 diabetes, the original questionnaire was modified to 21 items to incorporate questions relating to Type 2. Also the second question on the validated questionnaire was amended for participants with Type 2 by removing 'two times a day', as not all patients are required to check their blood glucose twice a day. Also

one new item was added to the questionnaire, since some participants with Type 2 diabetes are on an oral tablet treatment.

In addition, the CIDS scale was validated using Cronbach's Alpha reliability test; the result of the test was acceptable (0.787) as explained in section 5.7.4. The CIDS was translated into Arabic by the Department of English at the University of Omer Al-Mukhtar to ensure that the essential meaning of the items was preserved. The questionnaire was translated into Arabic by two English language professors individually. The two Arabic versions were then examined and agreed that they were accurate.

Because the questionnaire presents some questions that relate to different types of treatment and may be not relevant to some groups, the scores for the scale were obtained by adding the items from the scale according to what type of treatment each participant was currently receiving at the time of data collection. For example, when the participants are on diet regimen treatment only, it is logical they cannot be expected to give scores to the questions that relate to other types of treatment, and therefore their scores should be divided by the number of questions they are in a position to answer. These were as follows (see table: 12). The higher the score, the higher the reported levels of self-efficacy.

Table (12): Score for Self-efficacy Scale

Treatment that participant was currently receiving	Number of items used from scale	Score divided by
Diet only Treatment	17	17
Oral Hypoglycaemic agents	18	18
Insulin	20	20
Oral Hypoglycaemic agents & Insulin	21	21

A subheading containing Socio-demographic information was designed and appended to the two questionnaires (see Appendix 2). Socio-demographic data including age, gender, education level, family history of diabetes, duration of diabetes in years, type of treatment and income were included The subheading also included self-reported diabetes complication.

In addition data on the most recent HbA_{1c} value (within the last three months prior to data collection) were extracted from the case- notes. HbA_{1c} or Haemoglobin A_{1C} is a test that measures a person's average blood glucose level over the past 2 to 3 months. It is essential component of the management of diabetes and is widely used for monitoring long term glyceamic status and assessing whether an individual with diabetes has achieved metabolic control targets (Sacks, 2008); see section 4.4 for more information.

The two amended questionnaires were pre-tested on a sample of 15 patients from the Diabetes Centre in Derna (Derna is a small city located 300 KM from the east of Benghazi city) to discover any difficulties in understanding the meaning of the questions. After the pilot sample a few items were modified to improve the patient's understanding. This included: In item 2 in the DKT questionnaire peanut butter was named differently between Libyan language and Kuwait local Language, thus the right word was replaced in the new questionnaire. Calculating the duration of diabetes by months was not easy, especially for older people or people who had been diabetic for long time, therefore another option using an annual calculation was added. In addition some people had difficulty understanding Likert-scale question in the CIDS. Therefore, further explanation was added to the questionnaire.

5.7.4.   Data analysis of the questionnaires

As noted earlier, the purpose of conducting a cross-sectional survey were to examine the current knowledge of diabetes amongst people with the disease in Libya, and to explore factors including self-efficacy that enhance adherence to treatment and management of the condition. For achieving this purpose SPSS version 17, was used to analyze the questionnaires data.

For a large sample the data has more power to detect very minor deviations from normality, and a result will generally give a significant result. However, visual analysis of Q-Q plot indicates that these data sets are approximately normally distributed. The Q-Q plot or normality probability plot draws a theoretical line through the data points and evaluates how the actual data points adhere to the theoretical normal distribution. The current study found that the data points were close to a straight line suggesting that the data are close to normal distribution see appendix (6). In addition, Kim (2013) recommended using skewness and kurtosis value to assess the non-normality of a distribution. The author suggested that with a large sample an absolute skew value larger than 2 or an absolute kurtosis (proper) larger than 4 can be used as reference values for determining substantial non-normality. Table (13) shows that, the main variables in the current study were below this figure. In addition, common tests such as t-Test and ANOVA are more robust at large sample sizes (Jordan et al., 1998). For all of these reasons parametric methods in analyzing the data have been applied.

Table (13): Using Skewness and Kurtosis value to assess the non-normality distributed

variables	Skewness	Kurtosis
Duration of DM	0.996	0.583
HbA1c Test result	0.613	1.695
DKT-23	-0.320	-0.035
DKT-14	-0.336	-0.630
Total score of self-efficacy	0.489	-0.531

Descriptive statistics and inferential statistical tests were conducted to study the relationship between variables and to compare the statistically significant differences between two or more groups. In fact, six techniques were used to analyse the information obtained by study questionnaires including: Descriptive statistics, One-way ANOVA, Post hoc tests, T-test, and Multiple regression. Furthermore, the two questionnaires were validated using Cronbach's Alpha test.

i. Descriptive Statistics:

Descriptive statistics provide simple pictures about the study sample which include frequency distributions, percentages distributions, along with mean, median, and standard deviation. For the purpose of this research, descriptive statistics were used to describe the characteristics of the sample such as education level, gender of participants, types of diabetes, complication kind, level of diabetes knowledge, level of self-efficacy and level of $HbA_{1c.}$

ii. One-way ANOVA

One-way ANOVA test is used when there are two or more groups that need to be compared. Therefore, it was used in the current study to examine the differences

between educational level and knowledge about diabetes (comparing four groups of educational levels), the differences between educational level and self-efficacy, the differences between types of treatment and diabetes knowledge (comparing three types of treatment), the differences between type of treatment and self-efficacy, and the difference between types of treatment and $HbA_{1c.}$

iii. Post Hoc Test

This test is usually used after conducting an ANOVA test, when the researcher finds significant differences among means with a factor that consists of three or more means. In this situation a Post Hoc Test is needed to provide additional information on which means are significantly different from each other (Field, 2009). The main purpose of using this test in the current study was to show which groups of educational level and which types of treatments are significantly differ from other in respect of the mean.

iv. Independent t-Test

The independent t-Test is a parametric test which is used when there are two experimental conditions and different participants were assigned to each condition (Field, 2009). The test involves examination of the significant difference on dependent variables between means of two independent groups. In the current study t-the Test was utilised to examine the differences between: males and females, participants with Type1 diabetes and participants with Type 2 diabetes, and participants with family history of diabetes and those with no family history of diabetes, regarding their duration of diabetes, HbA1c, levels of knowledge and self-efficacy.

v.   Multiple regression

The connections between variables and prediction from one variable to another are closely linked. Regression analysis is used to predict an outcome variable from a predictor variable (simple regression) or several variables (multiple regression) (Punch, 2003; Field, 2009). For the purpose of this study Multiple regression tests were utilized to examine the predictors of HbA_{1c}. HbA_{1c} was used as the dependent variable and knowledge score (DKT 23), self-efficacy duration of diabetes, family history, complication problem and educated or not educated were entered simultaneously as predictor (independent) variables.

vi.   Cronbach's Alpha Test:

It is the most common measure of test reliability; which is a measure of the internal consistency of questionnaires. This test calculates the variance within the item and the covariance between particular item and other item on the test. The accepted value for Cronbach's Alpha is between 0.7 and 0.8. This value indicates the estimated error in a test or scale (Tavakol and Dennick, 2011; Field, 2009). In the current study, Cronbach's Alpha tests were utilised to examine the consistency with which individuals responded to the survey questionnaires. For the Michigan Diabetes Knowledge Test (DKT), the Cronbach's Alpha was 0.736 and for The Confidence in Diabetes Self-Care (CIDS) was 0.787 which are both acceptable (see table: 14).

Table (14): Cronbach's Alpha Test Result

Questionnaires	No. of Items/ Scale	Total No. of participants	Cronbach's Alpha
DKT	23	855	0.736
CIDS	20	855	0.787

111

    i.   Demographic information which included: Age, gender, education, family history of diabetes, duration of diabetes in years, type of diabetes and type of treatment and income.

    ii.   Diabetes Knowledge

    iii.   Self-efficacy

    iv. HbA_{1c}

    v.   Presences of any diabetes complications.

5.8. Phase Two: Qualitative Procedure

This section describes the qualitative methods utilized to address the objectives of the second phase of the study (Phase Two).

5.8.1. The objectives of Phase Two

    i.   To identify what knowledge or information people with diabetes have received about the condition and its management.

    ii.   To identify the main sources of this knowledge.

    iii.   To examine the level of reported adherence to treatment, diet regimen and exercises among the participants.

    iv.   Compare Type 1 and Type 2 with regard to the above points.

5.8.2.　Participants

Phase Two of the research study aimed to explain further the initial quantitative results, and as such draws the sample of participants from the Phase One Study. Plano Clark and Creswell (2011) recommend that the qualitative data sample in explanatory design is much smaller than in the quantitative sample, as this design does not aim to compare the data, and so equal sizes are not required. Thus, in the current study 60 participants from the Phase One study were randomly selected and invited to take part in a semi- structured interview. Using stratified random sampling, the sub-sample was selected from the three groups based on diabetes knowledge as described in the Phase One study (good, average, and poor; see table 11). Arrangements were made for an interview with each participant, the participants were initially contacted to arrange for a suitable time and date for the interview, followed by a phone call reminder the day before the scheduled event. In case the selected participant made an excuse for not being able to participate, the next participant from the SPSS list was chosen instead. For Type 2 diabetes, 10 participants from each group were selected. A total of 30 participants were interviewed, with 10 selected from each group. However, due to the small number of participants with Type 1 diabetes, the target number was reduced to 5 out of 6 participants from the good knowledge group, 10 out of 36 participants from the average group, and 15 out of 51 participants from the poor knowledge group. After arrangements were made with each participant, 20 out of 30 were interviewed as 10 failed to attend the interview, as illustrated in Table (15) below. Further written consent (see appendix 7) was obtained from those who agreed to participate in the interview after the purpose of the interview and the use of the findings were explained in detail. Interviews were tape recorded and confidentiality of the data was assured at all times.

Table (15): Stratified random sample from the level of knowledge groups

Groups / Types of DM	Poor Knowledge	Average knowledge	Good knowledge	Total
Type 1 Diabetes	9	6	5	20
Type 2 Diabetes	10	10	10	30
Total	19	16	15	50

5.8.3. The Interview method

The main idea of qualitative research is to provide detailed views, opinions or experiences of participants (Creswell and Clark, 2007). It helps the researchers to gain a deeper understanding of the perceptions of participants, and to know how people structure their world in the context of their daily lives (Berg, 2007). Interviewing is the most common method of data collection in qualitative research and may be described as ''a conversation that is directed more or less towards the researcher's particular needs for data'' (Green and Thorogood, 2004, p. 79). Interviewing is both practical and flexible (Coombes, 2009) and particularly suitable for situations where the researcher aims to obtain information in detail, such as people's opinions, feelings or experiences (Denscombe, 2007). In an interview, the researcher can observe any change in voice, facial expression or other indication of feeling on the part of the participants, and such a level of detail can be very important when analysing the data.

Interviews can be highly structured, totally open or semi-structured. The structured interview resembles a questionnaire but is conducted face to face with a participant. It aims to gather information from participants through an interview schedule which is conducted in a specific

order. Unstructured or in-depth interviews aim to understand the interviewees' point of view of a particular topic in depth (Dawson, 2009). The third type of interview is the semi-structured interview which aims to search for specific knowledge or information about a subject that may be compared or contrasted with other views either within a particular study or across studies. The type of interview to be conducted depends very much on the purposes in the research. For example some studies have used unstructured interviews because they need to explore how people think and feel about the topic of concern to the research.

This study used semi-structured interviews because the need to collect specific information regarding diabetes knowledge and self-management which couldn't be obtained from the initial result in Phase One study, and to check for misunderstanding and misinterpretation with the questionnaire. In the current study a set of questions and prompts are used in each interview (see appendix 8). This aims to ensure some order and control of the interview and prevent the interviewee moving away from the specific focus or topic. Flexibility was also ensured in term of the questions' order and their subject matter including what information the participants wanted to produces (Green and Thorogood, 2004; Denscombe, 2007; Dawson, 2009).

Interviews also have a number of disadvantages, such as being relatively time-consuming and expensive when the participants are distributed over a wide geographical area (Denscombe, 2007). The quality of interviewing also depends largely on the interviewer's skill (Bowling, 2009). In addition, transcribing and analysing the data from interviews is usually considered as time consuming and requires more input from the researcher in terms of listening, thinking and analysis and is more complicated, compared with collating the information from questionnaires. Bryman (2001) suggests that one hour of tape recording typically requires about 5-6 hours to transcribe.

5.8.4. Data management and analysis

There are a number of methods which can be used to analyse qualitative data, including ethnography, grounded theory and phenomenology (Hsieh and Shannon, 2005; Elo and Kyngas, 2008). In health related research studies content analysis is probably the most widely used method of analysis (Green and Thorogood, 2004; Hsieh and Shannon, 2005; Elo and Kyngas, 2008). Berg (2001), p. 238 defines content analysis as "a research technique for making replicable and valid inferences from data according to their context". It is not just counting words or extracting objective from texts, the researcher should also analyse the meanings and relationships of such words and concepts. Content analysis is a flexible method in terms of research design and analysing text data. Hsieh and Shannon (2005), p. 1278 define it as "a research method for the subjective interpretation of the content of text data through the systematic classification process of coding and identifying themes or patterns". Content analysis therefore allows the researcher to enrich understanding.

Both inductive and deductive analysis can be used depending on the purpose of the study, For example, inductive approaches are usually used if there are no studies dealing with phenomenon or the knowledge is unclear, while deductive analysis is more useful when testing a theory or to comparing existent categories (Elo and Kyngas, 2008). Due to the lack of relevant data in Libya, this current study utilised inductive methods with the additional aim of enriching the initial findings of Phase One.

Generally, content analysis involves three main processes: data collection, coding and analysis (Elo and Kyngas, 2008; Bowling, 2009). In the current study transcribed data was broken down to smaller units (Denscombe, 2007). Open coding was then used to create categories which involved writing headings or notes on the transcripts, then creating categories and grouping them under higher heading to reduce the number (Elo and Kyngas, 2008). Finally, the texts were analysed in terms of frequency with which these categories occurred and

relationship with other categories for understanding and gathering knowledge (Denscombe, 2007).The following paragraphs explain the research process and methods used in the Phase Two qualitative study. This includes procedures used in the interviews and transcribing; and steps used in the analysis of data.

5.8.4.1. *Interview procedure*

i. Selected participants were initially contacted to arrange for a suitable time and date for the interview by the researcher.

ii. The interview was confirmed by telephone by the researcher the day before the scheduled event. Before each interview the researcher explained the purpose of the interview and reminded the participants about how the intended findings would be used.

iii. All the participants were asked to sign a consent form.

iv. Permission to tape the interview was agreed and anonymity and confidentiality of the data was assured.

v. The length of interviews ranged from 15 to 35 minutes. Also as not all participants (mostly females) wanted to be recorded, the outline of the interviews was written by hand firstly and transcribed in full later.

vi. All interviews were conducted face-to-face with the researcher in Diabetic Benghazi Centre between 10/12/2010 and 10/02/11.

vii. The recording was transcribed and some transcripts were translated into English language by the researcher. These transcripts were discussed with the supervision team to ensure auditing on all research procedure and data analysis. The other

transcripts, in the original Arabic, were directly analysed by the researcher. According to Van Nes et al. (2010) it is important to analysis the transcripts in the original language to reduce the limitation of losing the meaning of the transcripts. Afterward the results and quotations were carefully reported in English Language.

5.8.4.2. *Interview analysis*

Data was analysed and classified manually, using cut and paste techniques. Although considered as low technology, this method is effective as it needs the researcher to actively compare, contrast, and extract themes and sub-themes. Microsoft Word also helps make this technique much easier, using cut and paste transcriptions into new pages on the computer screen for each new theme, with different colours and fonts, in order to compare and contrast findings (Green and Thorogood, 2004). Since all participants were classified to Type 1 and Type 2 diabetes, each participant was coded as participant number, followed by type of diabetes. The code also used three different colours according to their level of knowledge (red for poor knowledge, blue for average knowledge and green for good knowledge).

The transcripts were re-read many times to provide a close understanding of the particular interest of each interview. These were highlighted on the transcripts and copied onto a separate Word file. This re-reading process sometimes helped to add a new item to the highlighted issues. After completion of the above procedures eight master themes and codes emerged from the transcripts (see appendix 9) which shows themes, codes that constituted each theme.

Using a long table and scissors, all the sections relevant to these themes or codes were categorized together. Each section was headed by the participants' code. These will help to find out the common answers and to determine whether there is any difference between

the participants according to their groups (types and knowledge levels) (see analysis sheet appendix 10).

In addition, two methods of checking validity of analysing the interview data have been used in the current study see (Burnard, 1991; Creswell, 1998). The first one is using member checking, for example a colleague who is familiar with the process of analysing qualitative data but he/she is not involve in any aspects of the research. I asked a Libyan PhD student colleague at Liverpool John Mores University to identify categories in three Arabic transcripts. The idea is to then discuss any key differences between these findings and analysis with that of the researcher.

The second method is getting feedback from participants; I asked three participants to discuss the important issues in their own transcripts and then comparing with the existing concept. These two methods help to adjust the categories list that used in analysing the interview data.

5.9. Summary of the chapter

This chapter has described the methodology used in both phase one and two of the research, see figure (6) which summarizes the research method of the study. Furthermore it has outlined the rational for the methodological choice in data collection methods, approach and analysis. The study uses explanatory sequential mixed methods design, consisting of two phases. The first involves quantitative methods in the form of a questionnaire (Michigan Diabetes Knowledge Test and The Confidence in Diabetes Self-Care Scale). This phase intends to describe population, examine the current diabetes knowledge and to explore any factors that enhance adherence to the management of diabetes condition. A convenience sample of 855 participants took part in the study, recruited from the Diabetes Centre in

Benghazi whilst waiting for a routine appointment. Descriptive statistics and inferential statistical tests were used to analyse the quantitative data.

The second phase was conducted as a follow-up study after the analysis of the quantitative results. In this phase, semi-structured interviews conducted with fifty participants. The aim was to explore in depth the main results of Phase One study which include; understanding what kind of diabetes knowledge the participants have and why they adhere (or not) to the medical advice. Thematic analysis was used to analyse the result of qualitative data. Therefore the qualitative phase helped to provide additional detail that would support the quantitative result and enable reliable conclusions to be drawn.
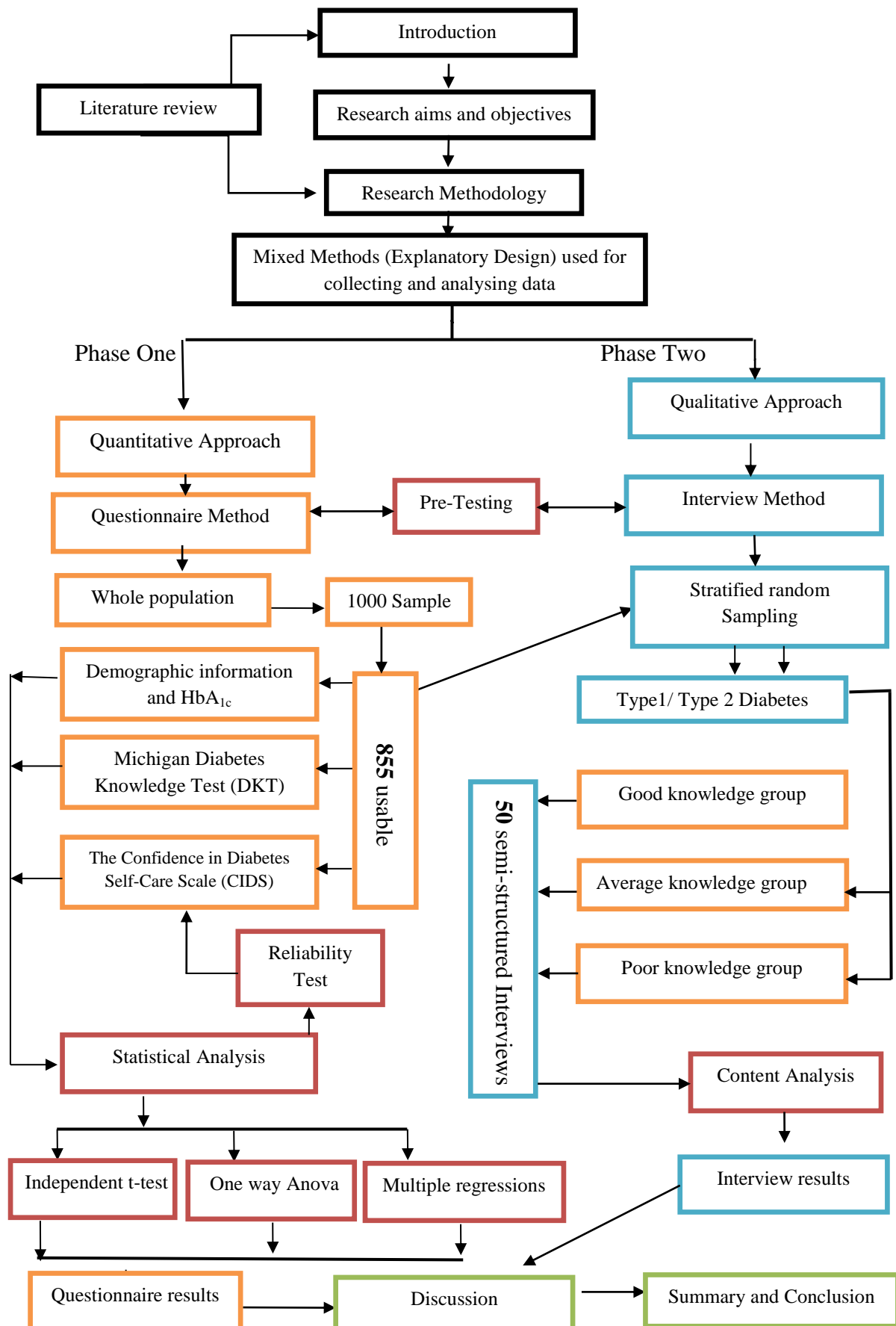
Figure (6): Summary of research method   121

CHAPTER 6- PHASE ONE RESULTS

6.1. Introduction

The purpose of this chapter is to present and analyse data which was collected from all the participants in the Diabetes Centre in Benghazi. The aim of this study was to examine the current diabetes knowledge and to explore any factors including self-efficacy that enhance adherence to treatment and management of the condition. Two questionnaires were used to collect data; The DTK questionnaire of the University of Michigan to assess the level of diabetes knowledge and the brief CIDS, to assess self-efficacy. In addition data on the most recent HbA_{1c} value were extracted from the case-notes to assess adherence level to the treatment recommendation as well as demographic information such as Age, gender, education, family history of diabetes.

6.2. Demographic Characteristics of the sample

A total of 1000 adults with diabetes (500 male and 500 female) were approached by the researcher to take part in this study whilst at the Diabetes Centre for a routine clinic appointment. Of the 1000 that were approached, 60 declined to participate due to time constraints. 23 of the returned questionnaires were not included in the study as they were not completed correctly, and 62 participants did not return the questionnaires. Hence, 855 participants completed the questionnaires and are included in this study.

The characteristics of the 855 participants who completed the questionnaires including the frequency distribution of the participants' socioeconomic and diabetes related data are discussed below.

6.2.1. Gender of participants

Of the 855 participants 446 (52.2 %) were female and 409 (47.8 %) were male, which is very similar to the distribution of gender in Libya. In 2007 the distribution in Libya was 50.62 % male and 49.38 % female (Otman and Karlberg, 2007).

6.2.2. Type of diabetes

A total of 763 (89.2%) participants had Type 2 diabetes while just 92 (10.8%) had Type 1 diabetes.

6.2.3. Education level

Whilst 120 participants (14%) had obtained a university degree, over a third of the sample 307 (35.9%) were classified as having no formal education (for the purpose of this study, this means cannot read or write). Table 16 shows the education levels of the participants.

Table (16): Level of education

Education	No formal ed.	Primary/Intermediate	Secondary/Diploma	Uni. Degree
No. (%)	307 (35.9%)	219 (25.6 %)	207 (24.2 %)	120 (14 %)

6.2.4. Family history of diabetes

The data shows that just over half of participants 451 (52.7%) had a positive family history of diabetes in a first-degree relative (e.g. father, mother, sister etc.), and 403 (47.1%) had no family history.

6.2.5. Age of participants

The age of participants, range from 18 to 96 years old. The mean age and standard deviation of participants was 51.91 years (SD =13.17).

6.2.6. Duration of diabetes

The duration of diabetes since diagnosis ranges from 12 to 500 months (1 year to 41.5 years). The mean and standard deviation of diabetes duration was 128.29 months (10.7 years) (SD = 92.10).

6.2.7. Annual income

The range of annual income was between 0 and 16800 Libyan Dinar (£8400). The mean and the standard deviation of family annual income was 3327.34 Dinar (SD = 2583.61)

6.3. Self-efficacy

The participants reported moderate level of self-efficacy, with the mean and standard deviation of the total sample 3.23 (SD = 1.05) in the diabetes self-efficacy scale.

6.4. Diabetes knowledge level among the participant

The diabetes knowledge test questionnaire (DKT) designed by the University of Michigan comprises 23 items. The first 14 items are based around general knowledge of diabetes (DKT-14) and the second part tests knowledge of insulin-use; 9 items (DKT-9).

6.4.1. Diabetes knowledge test (DKT-23)

The DKT-23 has 23 items which are scored as 0 for incorrect response and 1 for a correct response. Hence, the minimum score possible is 0 and the maximum is 23. The range of scores for the sample were 0 to 21 and the mean and standards deviation of the total sample score was 11.18 (SD = 4.21), which indicate less than fifty per cent of the participants (48.63, SD = 18.30) correctly answered the DKT 23 (see table: 16)

Table (17): Diabetes knowledge test (DKT) 23 items (Mean, SD, n = 855)

Knowledge Test	Score range	Mean (SD)	Mean (SD) of the total score
DKT-23	0-21	11.18 (4.21)	48.63 (18.30)

The DKT-23 data were further analysed as proposed by Al-Adsani et al. (2009). This resulted in the sample being divided into three different groups based on their measured knowledge of diabetes. The three groups are: (a) those with ''poor knowledge'' (score < 11), (b) those with ''average knowledge'' (score of between 11-17), and (c) those with ''good knowledge'' (score of > 17).

The data in table (18) shows that nearly 50 % of the participants have average knowledge and 43.7% as having poor knowledge. Only 6.2 % of the participants, however, have good knowledge.

Table (18): Diabetes knowledge test (DKT-23)

Poor knowledge	Average knowledge	Good knowledge
374 (43.7 %)	428 (50.1 %)	53 (6.2 %)

125

6.4.2. Diabetes knowledge test (DKT-14)

The 23 items DKT consists of two components. The first 14 items are related to General diabetes knowledge (see section 5.7.3.2 for more detail). The minimum possible score for the general diabetes Knowledge is 0 and the maximum possible score is 14. The mean and the standard deviation of the total sample of the general diabetes knowledge was 7.35 (SD = 3.05) which indicates that more than fifty per cent of the participants (52.53, SD = 21.83) correctly answered the DKT-14, see table (19).

Table (19): Diabetes knowledge test (DKT) 14 items (n = 855)

Knowledge Test	Score range	Mean (SD)	Mean (SD) of the total 14 score
DKT-14	0-14	7.35 (3.05)	52.53 (21.83)

As proposed by AL Adasani et al. (2009), the result for DKT-14 was further subdivided into three groups (a) those with ''poor knowledge'' (score < 7). (b) those with ''average knowledge'' (score of between 7-11), and (c) those with ''good knowledge'' (score of > 11). Table (20) shows that, over half (56.1%) of the participants scored as average knowledge and over a third of the sample (37.8%) have poor knowledge. Only 6.1% had good knowledge.

Table (20): Diabetes knowledge test (DKT-14)

Poor knowledge	Average knowledge	Good knowledge
323 (37.8 %)	480 (56.1%)	52 (6.1%)

6.4.3. Diabetes knowledge test (DKT-9)

The DKT-9 Insulin Use Related Knowledge includes items 15 to 23 in the DKT (see appendix 3) which is related to knowledge of using insulin. The data in table (21) suggested that many of the participants reported poor knowledge of insulin use. (Mean = 3.83, SD = 1.88), which indicates that 42.57 % of the participant correctly answered these questions (9 items).

Table (21): Diabetes knowledge test (DKT) 9 items (n = 855)

Knowledge Test	Score range	Mean (SD)	Mean (SD) of the total 9 score
DKT-9	0-9	3.83 (1.88)	42.57 (20.94) %

As proposed by AL Adasani et al. (2009), the result for DKT-9 Insulin Use Related Knowledge was further subdivided into three groups: (a) those with ''poor knowledge'' (score < 5). (b) those with ''average knowledge'' (score of between 5-7), and (c) those with ''good knowledge'' (score of > 7).

Table (22) shows that, more than 60 % of participant reported poor knowledge of DKT Insulin Use Related Knowledge and only 1.6% of participants have good knowledge.

Table (22): Insulin use related knowledge test (DKT-9)

Poor knowledge	Average knowledge	Good knowledge
527 (61.6%)	314 (36.7%)	14 (1.6%)

127

6.5. HbA$_{1c}$ of the total sample

The mean and standard deviation for HbA$_{1c}$ are shown in table (23).

Table (23): HbA1c (n = 718)

The level of HbA$_{1c}$ (%)	Mean	SD
	9.39	2.35

The data were further analysed, and the sample was divided into three groups based on HbA$_{1c}$. Group 1 classified a HbA$_{1c}$ of less than 7%, as 'good' control. Group 2 classified HbA$_{1c}$ between 7% & 8 %, 'acceptable' whilst group 3 for classified a HbA$_{1c}$ of more than 8 %, 'poor' control (DCCT, 1993; ADA, 2002). Figure (7) shows that 64% of participants have poor glycaemic control and just above 14% of the participants have good level of HbA$_{1c.}$
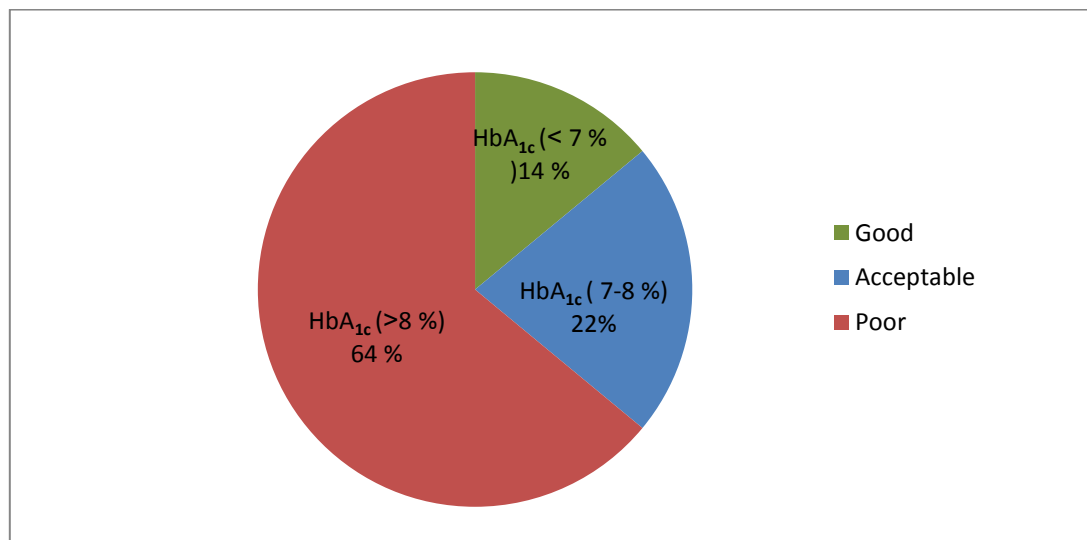
Figure (7): Distribution of degrees of glycaemic control as good (HbA1c <7%), acceptable (7-8%) and poor (>8%) n=827.

128

6.6. Type of treatment

The majority of participants (n=588, 68.8%) were using insulin as a form of treatment. Other forms of treatment in use were combined oral anti-hypoglycemic agents and insulin (n=149, 17.4%), and 12 (1.4%) of participants were using a diet plan program, (see figure: 8).
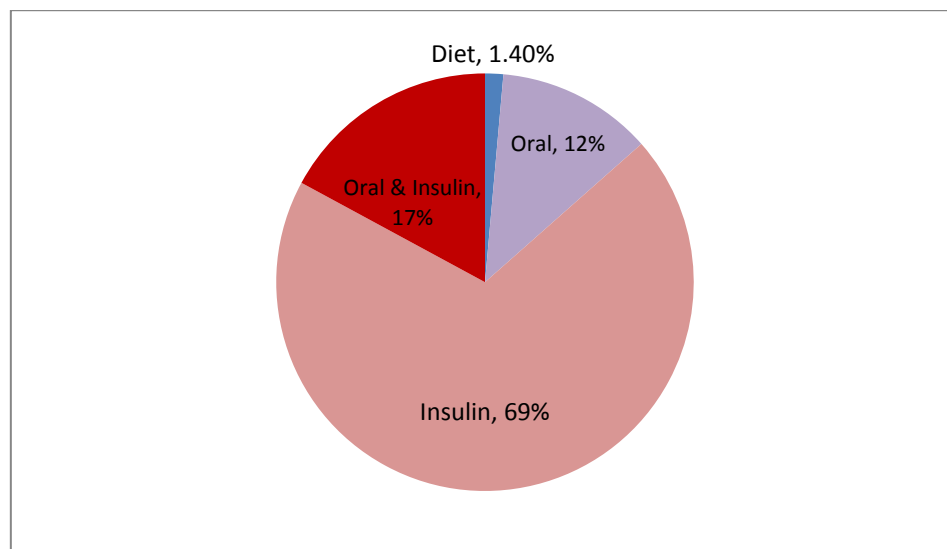
Figure (8): Figure Type of treatment (%) n=855.

6.7. Complication of diabetes

The number of participants who reported having any Diabetes-related complications is shown in figure (9). 74 % of the participants reported one or more diabetes complications, the most common complication was related to vision with more than 40% of total participants experiencing this. Some participants experienced more than one complication (21.01%), whilst only 26% of participants had no complications.

129
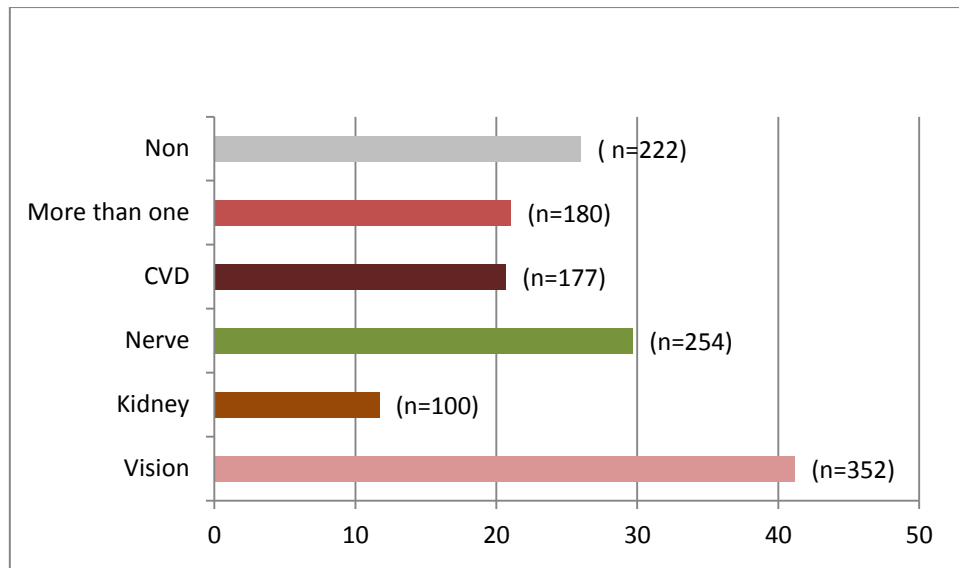
Figure (9): Percentage of diabetes complication among the participants n=855.

6.8. Difference between Type1 and Type2 diabetes

Independent t-Tests were conducted to examine the differences between participants with Type1 diabetes and participants with Type 2 diabetes for duration of diabetes, HbA$_{1c}$, Levels of knowledge (DKT-23, DKT-14 & Insulin-use DKT-9) and self-efficacy. The result suggests that there is no significant difference in duration of diabetes, HbA$_{1c}$ test result, level of diabetes knowledge, and self-efficacy scales between Type1 and Type2 diabetes see table (24).

Table (24): Difference between Type 1 and Type 2 diabetes

	Type 1: Mean (SD)	Type 2: Mean (SD)	t	P
Duration of DM (Months)	130 (95.18)	128.08 (.91.78)	0.183	0.855
HbA1c result (%)	9.43 (2.47)	9.38 (2.30)	0.136	0.892
DKT-23 (Score)	10.86 (4.04)	11.22 (4.23)	-0.815	0.417
DKT-14 (Score)	7.05 (2.87)	7.39 (3.07)	-1.051	0.295
DKT -9 (Score)	3.80 (1.88)	3.83 (1.88)	-0.146	0.884
Self-efficacy (Mean)	3.17 (0.95)	3.23 (1.06)	-0.607	0.545

6.9. Difference for gender

Independent t-Tests were conducted to examine the differences between males and females on: duration of diabetes, HbA_{1c}, DKT-23, DKT-14, DKT-9 Insulin-use and self-efficacy. The data suggested that there is a statistically significant difference for gender on the DKT-23 test, but the effect size is small. The results indicate that females were less knowledgeable about diabetes (Mean = 10.88, SD = 4.47) compared with males (Mean = 11.52, SD = 3.78). A similar difference was found on DKT-14, but again very small differences were observed in the means, so although differences were statistically significant they may not be important for health. The results indicate that females were less knowledgeable (Mean = 7.07, SD = 3.29) compared with males (Mean = 7.66, SD = 2.47), see Table (25).

Table (25): Difference between Males and females

	Male: Mean (SD)	Female: Mean (SD)	t	P
Duration of Diabetes (Months)	134.40 (94.46)	122.69 (89.62)	1.855	0.064
HbA1c result (%)	9.44 (2.49)	9.34 (2.22)	0.653	0.514
DKT-23 (Score)	11.52 (3.87)	10.88 (4.47)	2.224	0.026*
DKT-14 (Score)	7.66 (2.47)	7.07 (3.29)	2.835	0.005**
DKT-9 (Score)	3.86 (1.85)	3.81 (1.91)	0.396	0.692
Self-efficacy (Mean)	3.17 (1.04)	3.28 (1.05)	-1.537	0.125

(* $p<0.05$, **$p<0.01$)

6.10. Difference for family history

Independent t-Tests were conducted to examine the differences for family history on duration of diabetes, HbA_{1c}, DKT-23, DKT-14, DKT-9 Insulin-use and self-efficacy. The data suggested that there are statistically significant differences between those with family history of diabetes and those with no family history of diabetes, and this is important in term of effect size. Participants with a family history had longer duration of diabetes (Mean = 143.23, SD = 94.19) when compared with those without family history of diabetes (Mean = 115.06, SD = 88.25).

A statistically significant difference was also found for HbA_{1c}; the difference is small but clinically may be important. The results indicate that those with family history have higher HbA_{1c} (Mean = 9.61, SD = 2.27) when compared with those without family history of diabetes (Mean = 9.10, SD = 5.40).

A statistically significant but very small difference was also found for DKT-14 and this is likely to be less important regarding the effect size. The result indicates that those with a prior family history have a slightly higher knowledge on DKT-14 test (Mean = 7.80, SD = 2.90) when compared with those without family history (Mean =7.61, SD = 3.17).

A statistically significant difference was also found for self-efficacy, but this is likely to be less important due to the small effect size of the difference. The results indicate that those with no family history of diabetes (Mean = 3.08, SD = 0.97) have lower level of self-efficacy when compared with those with family history of diabetes (Mean = 3.37, SD = 1.09) see Table (26).

Table (26): Difference in family history

	Yes: Mean (SD)	No: Mean (SD)	t	P
Duration of Diabetes (Months)	143.23 (94.19)	115.06 (88.25)	4.510	0.001**
HbA$_{1c}$ result (%)	9.61 (2.27)	9.14 (5.40)	-2.883	0.004**
DKT-23 (Score)	11.43 (4.14)	10.91 (3.96)	-1.892	0.070
DKT-14 (Score)	7.61 (3.17)	7.08 (2.90)	-2.529	0.012*
DKT-9 (Score)	3.83 (1.94)	3.84 (1.81)	0,090	0.92
Self-efficacy (Mean)	3.37 (1.09)	3.08 (0.97)	-4.048	0.001**

(* $p<0.05$, ** $p< 0.01$)

6.11. Difference for education level

6.11.1. Difference between educational level and knowledge about diabetes

Table (27) shows the result of one way Anova comparing four groups for educational level (as previously mentioned in section 6.2.3) on diabetes knowledge DKT-23 test. Statistically significant differences were found (F = 17.14, p 0.001). Further analysis using the Tukey test (with $p < 0.05$) suggests that those who were classified as have no formal education were slightly different from the other 3 groups; in that those who are classified as having no formal education also had lower levels of knowledge about diabetes. Although the differences were statistically significant they are small and may be too small to be considered important.

Table (27): The relationship between DKT 23 and education level

Groups	Knowledge 23, Mean (SD)	F	P
No formal education	9.95 (4.37)	17.14	0.001
Primary/Intermediate	11.61 (4.04)		
Secondary/Diploma	12.50 (3.69)		
Uni. Degree	11.32 (4.13)		

Table (28) shows a statistically significant difference (F = 25.11, p = 0.001) between DKT-14 and the four educational groups. The Tukey test (with $p < 0.05$) suggests that those who were classified as having no formal education were different from the other 3 groups having lower levels of knowledge about diabetes. In term of effect size a reasonable reduction in knowledge score for this group was observed.

Table (28): The relationship between DKT 14 and education level

Groups	Knowledge 14, Mean (SD)	F	P
No formal education	6.29 (3.17)		
Primary/Intermediate	8.04 (2.80)	25.11	0.001
Secondary/Diploma	8.33 (2.61)		
Uni. Degree	7.18 (3.06)		

Table (29) shows a statistically significant difference (F = 5.47, p = 0.001) between DKT-9 insulin-use related test and the four educational groups. The Tukey test (with p< 0.05) suggests that those who were classified as having no formal education were different from the other 3 groups in that they also had lower levels of knowledge about diabetes. However the difference is small and likely to be less important.

Table (29): The relationship between Insulin- use test and education level

Groups	Insulin-use 9 knowledge, Mean (SD)	F	P
No formal education	3.66 (1.89)		
Primary/Intermediate	3.58 (1.95)	5.47	0.001
Secondary/Diploma	4.17 (1.77)		
Uni. Degree	4.14 (1.58)		

6.11.2. Difference between educational level and self-efficacy scale

One way Anova was conducted to examine for any difference between education level and self-efficacy. Table (30) shows a statistically significance different (F = 3.46, p = 0.016) were found between self-efficacy and the 4 educational levels. The Tukey test (with p< 0.05) suggests that those with Primary/Intermediate level (Mean = 67.44, SD = 20.67) have higher level of self-efficacy than those with Secondary/Diploma level (Mean = 62.46, 19.94). However in the term of effect size the difference seems quite modest.

Table (30): The relationship between self-efficacy and education level

Groups	Self-efficacy, Mean (SD)	F	P
No formal education	63.12 (19.52)		
Primary/Intermediate	67.44 (20.67)	3.46	0.016
Secondary/Diploma	62.46 (19.94)		
Uni. Degree	62.96 (19.97)		

6.12. Difference for Treatment Types

6.12.1. Difference between type of treatment and diabetes knowledge

One way Anova was also conducted to examine for any difference between the type of treatment and knowledge of diabetes. A sizable and statistically significant difference was found (F= 18.71, p = 0.001) in DKT-9 insulin-use related knowledge. Further analysis using the Tukey test (with p< 0.05) suggests that those with oral hypoglycaemic plan have

considerably lower levels of insulin-use related knowledge than those are in insulin plan treatment or in those of combination plan of treatment (oral and insulin plan), see Table (31).

Table (31): The relationship between DKT-9 Insulin- use test and type of treatment

Treatment type	DKT-9, Mean (SD)	F	P
Oral	2.59 (1.97)		
Insulin	3.99 (1.73)	18.71	0.001
Oral & Insulin	4.11 (1.98)		

6.12.2. Difference between type of treatment and self-efficacy scale

One way Anova was conducted to examine for any difference between the type of treatment and self-efficacy. A substantial and statistically significant difference was found (F= 34, p = 0.001). Further analysis using the Tukey test (with p< 0.05) suggests that those with oral hypoglycaemic have a higher level of self-efficacy than those with insulin treatment plan and oral and insulin treatment plan, see table (32).

Table (32): The relationship between self-efficacy and type of treatment

Treatment type	Self-efficacy, Mean (SD)	F	P
Oral	72. 87 (21.04)		
Insulin	61.71 (19.13)	34	0.001
Oral & Insulin	66.02 (20.08)		

6.12.3. Difference between type of treatment and HbA$_{1c}$

One way Anova was also conducted to examine for any difference between type of treatment and HbA$_{1c}$ level. A significant difference was found (F= 19.15, p = 0.001). Further analysis using the Tukey test (with p< 0.05) suggest that those with oral hypoglycaemic treatment plan have a lower HbA$_{1c}$ reading than those with insulin treatment plan and oral and insulin treatment plan, see table (33).

Table (33): The relationship between HbA1c and type of treatment

Treatment type	HbA$_{1c}$, Mean (SD)	F	P
Oral	8.01 (1.64)		
Insulin	9.50 (2.31)	19.15	0.001
Oral & Insulin	10.02 (2.55)		

6.13. Relationship between HbA$_{1c}$ and duration of diabetes, knowledge about diabetes and self-efficacy

Another aim of the study was to examine the factors which facilitate adherence to health care advice. For this purpose correlation between HbA$_{1c}$ and other factors such as duration of diabetes was conducted. The correlation coefficient (*r*) is a measure of the correlation between the observed value and the predicted; generally the tests suggested that statistically there were several significant but weak correlations. Table (34) shows that there is a correlation between HbA$_{1c}$ and duration of diabetes (r = 0.11, p <0.001) suggesting that the longer the participants have been diagnosed with diabetes the higher the HbA$_{1c}$. Another positive correlation (r = 0.12, p <0.001) was found between total knowledge of diabetes and HbA$_{1c}$ indicating that those with higher knowledge also had higher HbA$_{1c}$. A negative correlation (r = - 0.22, p <0.001) was however found between self-efficacy and HbA$_{1c}$. Those

who reported higher levels of self-efficacy had lower HbA_{1c}. A negative correlation (r = - 0.12, p <0.001) was also found between duration of diabetes and self-efficacy. Those who have had diabetes for a longer time reported lower level of self-efficacy. A negative correlation (r = - 0.09, p <0.001) was however found between self-efficacy and total knowledge of diabetes indicating that those with higher knowledge also had lower level of self-efficacy.

Table (34): Relationship between HbA1c and duration of diabetes, knowledge about diabetes and self-efficacy

Factors	HbA_{1c}	Duration of DM	Total knowledge	Self-efficacy
HbA_{1c}	_	_	_	_
Duration of D.	r = 0.109**	_	_	_
Total knowledge	r = 0.116**	r = 0.24	_	_
Self-efficacy	r = -0.223**	r = - 0.097**	r = - 0.091**	_
Onset of D.	r = -0..69*	r = -0.142**	r = -0.114**	r = 0.016

(*p <0.005, ** p <0.001)

Another negative correlation (r = - 0.69, p < 0.005) was found between onset of diabetes and $HbA_{1c.}$ Those with early onset of diabetes reported higher HbA_{1c} levels. Also, a negative correlation was observed between onset of diabetes and duration of diabetes (r = - 0.14, p < 0.001). Those who had diabetes for a long time also had early onset of diabetes. Again a negative correlation was found between onset of diabetes and total knowledge of diabetes (r = - 0.11, p <0.001), suggesting that those with higher knowledge also had early onset of diabetes. As a result of the majority of people with Type 1 diabetes having been diagnosed at an early stage of their lives, another correlation test was conducted for Type 1 diabetes and for Type 2 diabetes, separately. The results showed that there were no remarkable differences

between Type 1 and Type 2 diabetes in regard to the onset of diabetes and the other factors in the correlation test.

6.14. Predictors for HbA$_{1c}$ levels

Multiple regression was conducted to examine the predictors of HbA$_{1c}$. HbA$_{1c}$ was used as the dependent variable and knowledge score (DKT 23), self-efficacy duration of diabetes, family history, complication problem and educated or not educated were entered simultaneous as predictor variables. The results indicate that model accounted for 9.5% of the variance (Adjusted R^2 = 0.095) (F = 15.34, p < 0.01). In addition the Beta (standardized regression coefficients) value which is a measure of how strongly each predictor variable influences dependent variable (HbA$_{1c}$), indicated that these factors are important but have a small impact on the predictor variable, with the strongest self-efficacy, accounting for only -0.214. Table (35) shows that 5 variables namely: DKT-23, self-efficacy, duration of DM, Family history and complication significantly predicted levels of HbA$_{1c}$.

Table (35): Factors are predicted HbA1c levels

Predictor variables	Standardized Coefficients	t	P
	Beta		
DKT 23	0.085	2.474	.014
Self-efficacy	-0.214	-6.336	.000
Duration of DM	0.078	2.206	.028
Family history	0.151	4.401	.000
Complication	0.111	3.241	.001
Educated or not	-0.059	-1.676	.094

6.15. Summary

This chapter presented the characteristics of the 855 participants, level of diabetes knowledge, level of glycaemic control, frequency of diabetic complications and relationship between variables including age of participants, income, education level, duration of diabetes and self-efficacy. Descriptive statistics and inferential statistical tests including correlations, t-Test, One-Way ANOVA and multiple regressions were performed to explore the relationship between variables and to compare the statistical significant difference between two or more groups. The results of this study are based on quite large samples which may affect the statistical significance of differences or relations between variables, despite the effect sizes frequently being small. Therefore, in this study consideration of observed effect sizes are very important to understand the degree of practical significance (Lantz, 2012).

In the following chapter, the findings of the interview elements of the study will be presented.

CHAPTER 7-PHASE TWO RESULTS INTERVIEW STUDY

7.1. Introduction

The purpose of phase two through an exploratory qualitative study was to find out more information about diabetes knowledge and adherence to health advice among people with diabetes visiting Benghazi Diabetes Centre. The participants were randomly selected from the larger sample in Phase One study. The sample has been divided into three groups according to their knowledge level (see section 5.7.3.2). The semi structured interviews were undertaken with the following objectives:

(a)   Identify what knowledge the three groups have received about diabetes and its management.

(b)   Identify the main sources of this knowledge in the three groups.

(c)   Examine the level of reported adherence to treatment, diet regimen and physical activity among the three groups.

(d)   Compare Type 1 and Type 2 regarding to the above points (a, b, c) in the three groups.

7.2. Interview results

The following section outlines the themes that have emerged from the interviews using thematic content analysis (see section 5.8.4). The initial results from the first study have also been taken into account as well when identifying the themes.

A description of the participants has been summarized in the table (36) below which assists in setting the context.

Table (36): demographic information of the sample (n = 50)

Age	Between 19 and 81 years, (Mean:43.22)
Gender	28 Male and 22 Female
Type of diabetes	20 type 1 and 30 type 2
Education level	7 classified as having no formal education, 14 educated to primary school level, 16 educated to secondary school level, and 13 having a university degree.
Treatment type	1 using a diet plan as treatment, 7 using oral treatment, 40 insulin treatment and 2 using combined oral, and insulin treatment.
HbA$_{1c}$	9 have good glycaemic control, 9 have acceptable glycaemic control, 31 have poor glycaemic control, and 1 missing information.

The semi structured interview yielded data on many topics, 8 major themes are reported on here:

1. Ideas about diabetes (What is diabetes?)

2. Awareness about the management of diabetes

3. Divergent beliefs and practices regarding diabetes

4. Consequences of not controlling blood glucose level

5. Knowledge about the last reading and the normal range of sugar level

6. Source of the knowledge received

7. Level of adherence to diet regimen, regular exercise, and medication

8. Experience of clinic services

The first 5 themes are related to participants' knowledge of diabetes with a focus on basic knowledge about treatment, diet regimen and physical activity. Theme 6 is related to the source of their knowledge and theme 7 is related to the level of adherence to medical advice regarding to treatment (oral or insulin injection), diet regimen and physical activity. Theme 8 is related to their experience with clinic services. In the following sections, quotes from participants have been used to represent the results. Each example was coded as (P) for participant number, (T1) and (T2) for types of diabetes, and (G, A & P) for the level of knowledge (Good, Average & Poor).

7.2.1. Ideas about diabetes (What is diabetes?)

As a general lead-in question, each interview began with *what is diabetes?* Although several types of response were given, a minority of participants (9/50) paused or required clarification before answering. Typical responses included: *'what do you mean?', 'oh you mean the causes of diabetes', 'I don't know…', or 'I know one thing about diabetes'.* This did not obviously reflect lack of knowledge as even those with 'good' knowledge often required prompting. It is more likely therefore to reflect the 'strangeness' of the question to people who do not commonly talk about diabetes despite its high prevalence. The most common definitions were categorised as follows:

- Defined diabetes in terms of pancreatic deficiencies and lack of insulin (21/50).

- Defined diabetes in terms of signs and symptoms (13/50).

- Defined diabetes in terms of its relationship with the participant (11/50).

The first and most common answer (21/50) was reductive and based on medical information drawn from health professionals and wider literature. This definition was high among those interviewees classified as possessing good and average knowledge groups (18/21) in Phase One. Words such as 'pancreas' and 'insulin' were frequently used by educated participants (16/21) as in exemplar 1 (below).

Exemplar 1
Diabetes happened because the pancreas doesn't work as usual so there is not enough insulin in the body (P: 813/T2/Gk)

School educational achievements have been found as key factors in improving diabetic knowledge in many studies (Bautista-Martinez et al., 1999; Abdullah et al., 2001). This definition seems to reflect what patients read or hear from medical personnel about the disease and has no clear connection with his/her own experience of the disease as in the exemplar 2 the '*doctor tells me*'.

Exemplar 2
The doctor tells me that ... the cells of the pancreas excrete insulin, when these cells died, people with diabetes need exterior insulin (P: 671/T2/Gk).

The second most common type of definition (13/50) views diabetes primarily in terms of consequences or the signs and symptoms that participants had experienced as illustrated in the example below. Interestingly, all of the participants giving this definition were from Type 2 diabetes, which may indicate that late on-set diabetes is experienced differently. People with type 1 diabetes by way of contrast have lived with the condition for a long time

(Childhood) and so are more likely to come to terms with the signs and symptoms of diabetes and feel 'normal'.

Exemplar

Diabetes is a disease that makes you feel pain in the bones, problems with vision and feeling tired and fatigued as well as going to the toilet constantly (P: 367/T2/Pk).

The other interviewees (11/50) did not define diabetes as a problem in their body or as a signs or symptoms but as a *relationship*. Within this category, diabetes is typically perceived as a companion who may act either as a 'good' friend or a 'bad' one. In the exemplar 1 below the participants felt that diabetes could be a *good* friend that is dependent on patient's self-management. Whereas exemplar 2 sees diabetes as a *bad* friend or 'traitor' that must be always be treated with caution because of the complications that may result.

However, in general there was no clear relationship between these definitions of diabetes and the level of knowledge or adherence to the medical advice.

Exemplar 1
If people with diabetes take care of their food and treatment diabetes will be a good friend (P: 304/T1/Pk).

Exemplar 2
Diabetes could be likened to a traitor that we must always treat cautiously. If you are cautious you will always be in good condition (P: 197/T2/Gk).

7.2.2. Awareness about the management of diabetes

Knowing what keeps blood sugar levels in good condition is critical in order to manage diabetes. According to standard advice the day-to-day management of diabetes requires at least three important basic elements of regimens, which include adjustment of diet intake, taking medication or injection of insulin on time and at least one kind of exercise (Coates and Boore, 1996; WHO, 2003). All participants were therefore not only questioned about what diabetic patients *should* do to manage their condition but also what they *actually* do.

The response to these questions reflected their level of knowledge and their behaviour toward this knowledge; as mention before knowledge does not always match behaviour (McCaul et al., 1987; Goodall and Halford, 1991; Johnson, 1996). The two parts of the questions were asked separately to each participant but many of them had given one answer as they talked only about themselves. However (34/ 50) of participants answered the two parts of questions without overlap.

Most respondents (41/50) mentioned that diet regimen is an important component for the management of diabetes while fewer (31/50) knew that at least one kind of exercise is important. Further, just above half of the participants (26/50) mentioned taking medication treatment (insulin or tablets) on time as important in the management of diabetes. Those who did not highlight the importance of taking medication as prescribed may have the knowledge, but it is possible that they focused on other tasks which are more disruptive for them. However, only (15/50) mentioned the three elements of diabetes management; diet regimen, practice exercise and taking medication on time all together as important for managing diabetes, which indicates that awareness of advice is low among the participants. In the exemplar 1 (below) the participant focused only on diet regimen and smoking and ignored the other elements of management. It is however unclear whether this reflects forgetfulness, a

147

lack of knowledge or because he thinks this is more important than the other aspects of treatment.

Exemplar 1
People with diabetes should avoid sweets, juices, sugar, (stopping smoking is impossible for me), carbohydrates, and meats; for meats only the white one such as fish and chicken breast (P: 188/T2/Pk).

In the exemplar 2 (below) by way of contrast the participant gave a clear summary of all three elements of diabetes management.

Exemplar 2
People with diabetes must take their insulin injection or medication on time ... the food also should contain little amount of carbohydrates… exercise is also very important for diabetics (P: 636/T2/Ak).

The sample also shows that people with Type 1 diabetes (10/15) and those with good and average knowledge (12/15) are more likely to mention the three elements of diabetes management.

Another important factor mentioned by participants that affects the management of diabetes is to avoid stress. The majority highlighted life events and also the day-to-day working demands and living (Broom and Whittaker 2004). Stress is known to have a negative effect on diabetes (Lloyd et al., 2005). As many as (17/50) of participants mentioned that avoiding stressful life style is important to control diabetes. Regarding this, (8/17) of participants mentioned that they can't avoid stressful life condition and that is why their sugar level is always high. The quote below highlights this. Although the participant was classified among the poor knowledge group, she acts as an expert and believes her poor control was a result of stress.

148

Exemplar

They should follow a diet regimen…. but the most important thing is to avoid stress, in my case stress makes my sugar levels high, I always feel stress and I'm sure without stress even if I stopped taking my insulin injection I will be fine (P:726/T1/Pk)

Interestingly, more than half of participants (18/34) who answered the two parts of the question mentioned that they can't follow their own health advice. This may indicate that awareness about diabetes alone was not enough to persuade people with diabetes to manage their condition (Coates and Boore, 1996; Johnson, 1996) and that other factors such as self-efficacy may play an important role in the management of diabetes (Sarkar et al., 2006). In the exemplar below the participant speaks of the importance of the three elements of diabetes management yet also finds adherence difficult.

Exemplar

I: what should diabetic patients do to manage their condition?

P: Oh.. You can do a lot, for instance medication should be taken on time … watch what you eat; .. don't eat too much food especially fatty food.. no juice or soft drink and remember! even diet drinks contain sugar… eat lots of salad… walking is very useful, more than running. Walking helps to control weight and blood sugar levels.

I: what do you actually do?

P: I can't do all of these things… yes I go for walks but stress is unavoidable. Also I like soft drink so much if you ask me to do anything, I think I can do it, but I can't stop drinking soft drinks (P: 750/T1/Gk).

In this respect, people with Type 1 diabetes (9/12) showed more resistance to following recommendations compared with those with Type 2 (9/22). This indicates that, Type 1 diabetics have more difficulty following recommendations.

7.2.3. Divergent beliefs and practices regarding diabetes

Other issue that affect management of diabetes are divergent beliefs and practices regarding diabetes and its management. These problems were common among a number of interviewees (17/50). The following are the most common beliefs and practices regarding diabetes among the sample.

- Diabetes is primarily caused by traumatic events

- It is permissible to eat everything but sugar and sweets.

- Eat lots of fruits to have enough vitamins, vitamins are essential for diabetes

- Diabetic food is only available in Chemist's and is expensive

- Diabetics should eat only vegetables.

- Diet or type of food is not an essential element of the management of diabetes.

- Insulin is a toxic substance we should take care of

- Anti-diabetic tablets make teeth fall out.

It is generally agreed that stressful life condition including traumatic events are not one of the causes of diabetes (Helgeson et al., 2010). However, it may play an important role to speeding up the onset of diabetes if other risk factors are present (Lloyd et al., 2005). In the

sample, 'Diabetes is primarily caused by a traumatic event' were the most common beliefs (9/17), which may come at the expense of other factors which are more important to pay attention to such as obesity and unhealthy food. Exemplar 1 below highlights this idea.

Exemplar 1

I became a diabetic because of a traumatic event that happened to me when I heard that my only son drowned in the sea. I was really shocked and felt very sick. Soon my mouth became dry and I frequently needed to go to the toilet. (P:149/T2/Gk).

Another common belief (6/20) related to the diet regimen, it seems that this belief results from lack of nutritional knowledge rather than cultural norms, even though the latter may be used to rationalise non-adherence. For instance, in the exemplar 2 below, the participant believed that exercise and medication were sufficient for the management of diabetes without acknowledging the essential nature of an appropriate diet regimen. Also, in the exemplar 3, the participant stated that people with diabetes should just eat vegetables without eating other types of food. Generally, a meat free diet would be very difficult for most Libyans as the majority of Libyan dishes are cooked with meat (see section 2.5.2).

Exemplar 2

Don't listen to people who say don't eat this or that food; this is not the right thing to do. Diabetes needs only two things to be managed successfully: to keep taking the medication and to keep walking (P: 286/T2/Gk).

Exemplar 3

People with diabetes shouldn't eat sweets or dates, dates are not good. They should eat just vegetables ... I can't follow a diet regimen because if I do that mean I wouldn't eat anything good (P: 0591/T2/Pk).

The other two were related to the medication treatment (insulin doses and anti-diabetic tablets), and the belief that medication is in fact harmful as in exemplar 3 below.

Exemplar 4
..when I was diagnosed as a diabetic the doctor gave me tablets for treatment. These tablets made my teeth fall out but when I changed to insulin treatment I became much much better (P:188/T2/Pk).

As noted in other studies (Mann et al., 2009; Henderson, 2010) divergent beliefs and practices regarding diabetes and its management represent significant barriers to effective management. Many participants in the current study hold beliefs about cause of diabetes and management of diabetes that are not congruent with appropriate health advice. Such beliefs could be important targets for health providers to improve diabetes self-management.

7.2.4. Consequences of not controlling blood glucose levels

The participants were aware that uncontrolled diabetes can lead to complications. Several respondents had been given information about common diabetes-related health complications, particularly in relation to eyes, kidneys, teeth, feet, nerve damage and cardiovascular disease (CVD).

Some of the complications were more well-known than others. For example most of participants (42/50) knew that vision could be affected by uncontrolled blood glucose levels or had already been affected by it, whereas just a few (10/50) mentioned CVD. However, only 14/50 of the participants knew three complications together (the majority of these (13/14) were from the good and average knowledge group). That indicates that many of

participants are at risk to develop diabetic complications. It's clear from exemplar 1 below that participants were not sure about the complications and how to deal with what may well happen.

Exemplar 1
I don't know much about that but I hear from patients that they got problems with their eyes because they don't control their sugar, and also I heard from a nurse that if diabetics don't control their sugar they will have a kidney failure (P: 718/T2/Pk).

In addition, some of participants reported fearing complications especially gangrene (diabetic foot) and said that they didn't like talking about these problems as shown in the exemplar 2 below. This will require consideration in relation to the ways of teaching/ learning in health education sessions.

Exemplar 2
Many of problems can happen, I don't like to talk about them but I'm really frightened of gangrene (P: 151/T2/Pk).

Also, a few participants considered diabetes complications to be inevitable, and that their actions would not change their condition, even if they were to adhere to the advice of their doctor, as shown by exemplar 3 below.

Exemplar 3
… even if we followed the recommendation of good food and everything, the problems still happened for myself. Even when I adhere to the advice of doctor, my blood sugar always remains high (P: 247/T1/ Ak).

However, knowing the consequences of not controlling blood glucose levels or the complications of diabetes can increase the belief of the serious of the disease. Such belief

may plays an important role in the management of diabetes, according to the HBM perceived seriousness and susceptibility to diabetic complication increases adherence to the diabetes regimen (Dunning and Martin, 1998; Tan, 2004). However, there was no direct relationship between those who knew the consequences and those who reported greater adherence to diabetes regimen.

7.2.5. Knowledge about the last reading and the normal range of sugar level

Blood glucose testing is an important tool for monitoring health. Therefore, in order to encourage diabetics to examine their blood sugar, the Benghazi Diabetic Centre recommends that every time patients come to the clinic for a routine visit they should do a blood glucose test (as a general rule). A positive relationship between knowing the value of a blood glucose test and diabetes control have been found in the literature review; for example Heisler et al. (2005) found that people who knew their most HbA_{1c} is associated with better glycaemic control than those who did not know the value. The interviewees were asked whether they knew their last reading of blood glucose test and whether it was high or in normal range. In fact the sample showed good knowledge about the reading, (35/50) of the interviewees knew their level of sugar and whether it was high or not, as in the exemplar 1 below.

Exemplar 1
The last reading of my test was 153 mg I knew that is high as it should less than 120 mg; but if I compare this one to that one in the past, this result is good as previously I got 500 mg. (P: 624/ T2/Ak).

A few participants (10/50) knew their level of sugar but didn't know whether that was high or not. Only (3/50) interviewees didn't know their reading and the normal range of sugar level as it is shown in the exemplar 2 below, all three of these were from the poor knowledge group.

Exemplar 2
The last reading is ...umh...umh... [son interjects: it was 74mg].. that means my sugar level is low (P:367/T2/Pk).

Knowing the reading and normal range of blood sugar test, may be seen as a good sign of awareness and engagement with health professionals, which may lead to better health outcomes. However, the study showed no clear relationship between those who knew their reading with those who reported greater adherence to diabetes regimen. An explanation for this could be that many of the participants, who had reported higher results because of poor control, may have felt discouraged from making an effort to improve their condition.

7.2.6. Source of the information received

All the participants in this study had at least 12 months experience of living with diabetes (sample inclusion criteria). People gain knowledge about their disease from different educational resources. In order to identify the sources of information, questions such as *from where did you get this information or who told you that* were asked during the interview. Most of the participants indicated more than one source of information and these were grouped as follows:

i.   Doctors and health professionals

ii.   Lecture at the clinic, leaflet, and booklets

iii. TV, Radio, and Internet

iv.   Personal experience and other patients experience

v.   Family and friends

At the time of collecting data for this study there was no formal education program at the clinic or anywhere else in the city. The only education program was a lecture that the clinic provided 2-3 times a week. Few participants (10/50) mentioned that they attended some of the lectures and they added the lectures were useful, as in exemplar 1 below.

Exemplar 1

I learnt lots of tips during the lecture and also how to inject myself with insulin

(P: 104/T2/Ak).

Interestingly, one of the participants mentioned that the lectures were useful and informative but sometimes became scary because of the information about diabetic complications. This may indicate that understanding the consequences of diabetes is necessary even if it could possibly cause negative results. Again, how to manage perceived risk to motivate patients without causing negative influences is an important issue and it needs further investigation; exemplar 2 below highlights this idea.

Exemplar 2

..the lectures were good but sometimes I felt so frightened because they talked lots about bad things that could happen to diabetics (P: T2/ 151).

The interviews show that TV, Radio, and website were the most common sources of information (30/50). The interviewees also show that although most (43/50) participants had a positive family history of diabetes, few (12/50) received informational support from family and friends. In addition, half of the participant (25/50) mentioned that their information did not come from doctors or health staff, indicating poor communication between the participants and the medical staff (Brannon and Feist, 2000) and lack of informational support from their health care providers. Exemplar 1 below illustrates that TV and internet websites are in fact often regarded as the 'best' source of information for diabetics.

Exemplar1

My information comes from TV. I think TV and the internet are the best sources of information, for me and for most diabetics. I like to collect as much as I can, this makes me feel better (P: 697/T1/ Gk).

While the participant in exemplar 2 explains that doctors are not the best source of information, TV, posters and booklets are much better. However, there was little acknowledgement of the fact that the media only advertises diabetic products rather than provide health advice per se. The health benefits of products may also be exaggerated, so the media may in fact not be always a positive resource. Exemplar 3 also criticises the information received from doctors.

Exemplar 2

157

My mother has lots of information she is really good. The doctor doesn't tell you much ... just he says 'take care of your food', I also get information from TV especially local channels, also from posters at the clinic and booklets (P: 266/T2/Ak).

Exemplar 3
The doctor says just a few words: 'take care of your food and practice exercise ... there is nothing more' (P: 726/T2/Pk).

The sample also shows no clear difference between Type 1 and Type 2 diabetes or between the different levels of knowledge about diabetes regarding to source of information.

Health care professionals need to recognise that their advice is only one of a variety of sources of information used by patients. Indeed, if doctors offer 'just a few words' their advice is more likely to become lost in the marketplace of healthcare. Clearly greater dialogue is needed particularly when patients frequently receive information from sources that may not be congruent with appropriate health advice.

7.2.7. Level of adherence to diet regimen, physical activities, and medication

Adherence to medical advice is essential for the successful management of diabetes (Ciechanowski, Katon et al. 2001) and typically covers diet, physical activities and medication. Knowing something and doing it are two different things so participants were asked about the latter in relation to the 3 main aspects of treatment. The reason for focussing on these aspects rather than keeping follow-up appointment or self-monitoring test, was because the majority of diabetics in Libya must attend the clinic every two weeks to receive their medication, and before that they must do a blood glucose test and see their doctor. In

addition most people living with diabetes in Libya do not have access to glucometers for self-monitoring at home (Roaeid and Kablan 2007).

7.2.7.1. Adherence to diet regimen

People with diabetes should follow a special diet regimen depending on their health status and personal circumstances including age, weight, level of activity and types of diabetes (Canadian Diabetes Association Clinical Practice Guidelines Expert Committee 2008), see section 4.5.3 for more information. It is particularly important therefore that diabetics understand how to calculate how many carbohydrates their body needs, what foods they should or shouldn't eat to control their blood sugar. However, there was considerable evidence of limited knowledge about what constituted of healthy food for people with diabetes.

Diet for most of the participants meant following the Libyan traditional healthy food (see section 2.5.2) rather than a particular diabetic regimen. A traditional Libyan diet is generally perceived as good for diabetics and would tend to include wholemeal bread, Bazin and dishisha (food mainly composed of barley flour with grain), vegetable soup and fruits. However, the majority didn't consider how much they should eat from these types of food.

Dietary regimens are often difficult to implement (Nelson et al., 2002) and the majority of participants showed low levels of concern about it. For instance, although there was a dietician to provide advice at the clinic, just few participants mentioned that they were seen by the adviser. The sample also shows that (23/50) of participants reported that they

followed a diet regimen, which is mainly consist of Libyan traditional healthy foods. The quote below is an example about the diet regimen.

Exemplar
....I followed a diet regimen, ...my food is of course a piece barley bread (whole meal), I never eat white bread, most of my food is vegetarian such as vegetable soup (Zucchini, Pumpkin, carrot), and one or two spoons of rice and macaroni (P:018/T2Ak).

In addition, the interviewees were asked to offer reasons for not following a diet regimen. Not all the participants were keen to talk about their reasons of non-adherence. However (11/50) of the sample mentioned that, diet regimen is difficult to follow because of their social life, especially when out with family and friends or on special occasions. Shultz et al. (2001) studied barriers to adherence of diet found that both educators and diabetics emphasize that eating away from home was a barrier to adherence to the diet regimen, particularly in term of selection of food and portion size. Generally, within the Libyan community, there is a tendency to gather very frequently for social occasions where food is served, and this could have a negative influence on the control of diabetes. In addition, the sign of hospitality and social etiquette in Libya is serving the guests with large amounts of food which can be considered ill-mannered to refuse (Khoury, 2001). People often eat from one common bowl which makes it still harder to either refuse eating or estimate portion sizes, counting is very important in diet regimen (ADA, 2004). This indicates that eating away as a part of social life and culture may have a negative impact on their regimen as illustrated in the exemplar 1 below. Social and family support are associated with better diabetes self-management particularly diet regimen, both in Western and Middle East countries (Wen, Parchman, & Shepherd, 2004; Fattah Badr,

160

Elmabsout, & Denna, 2014). The participant in exemplar 2 shows support from his family in adhering to the diet.

Exemplar 1

..the habits of Libyan society is difficult and sometimes prevents someone from maintaining their dietary regimen, for instance in occasions when there are some delicious meals and in the presence of friends acquaintances, it is very hard not to indulge (P:066/T2/Ak).

Exemplar 2

I don't follow a diet regimen when I am far from my home… but when I am home my mother cooks healthy food [diet regimen] (P: 750/T2/Gk).

20% of participants (10/50) felt that following a diet regimen is too expensive for them. The real figure is in fact likely to be more than this because it is embarrassing to say food is expensive in Libyan culture. The two examples below demonstrate the difficulties experienced by participants when budgeting for a diabetic diet, particularly when on a low income.

Exemplar 1

I don't follow any dietary regimen because diabetic food is expensive. I have tried it before but it was very expensive. It cost me about 200 Libyan dinars [about £100] a month (P: 679/T2/Gk).

Exemplar 2

… look I want to tell you one thing, Doctor told the patient not to eat rice, macaroni and so on …and eat white meat and fruits.. He can only do that if his wages is more than 1000

161

Libyan dinar! .. One kilo of bananas is 2 dinar, one kilo of apples is 3 dinar, fish is 9 dinar and my salary is 250 dinar a month. What I can buy is rice and macaroni!! (P: 0151/T2/Pk).

On the other hand, a few participants (7/50) reported that they stopped following diet regimen as a result of having hypoglycaemia as reported in the exemplar below. This is clearly due to lack of knowledge about the principles of diet regimen regarding hypoglycaemia control. Study by Roaeid and Kablan (2007) in Libya found that (41.4%) of the sample did not know the symptoms of hypoglycaemia.

Exemplar
I don't follow my diet regimen because when I do so i.e. I stopped eating sweets and ate less carbohydrate.. I frequently get hypoglycaemia (P: 329/T2/Pk).

In addition, three participants (3/50) reported that they had stopped following a diet regimen because of feeling bored and tired as a result of having had diabetes for a long period of time, as in exemplar below which has a quote from a young man who has had Type 1 diabetes for 15 years.

Exemplar

To be honest I feel bored from following a diet regimen; I have been a diabetic for a long time and I don't care about watching what I'm eating anymore (P: 472/ T1/ Ak).

Although, many participants have a positive family history of diabetes the current study shows that, half of participants felt that their relatives follow their dietary regimens more carefully than them. This perhaps demonstrates regret, as in exemplar 1 below.

Exemplar 1

Many of my family have diabetes my husband, my father and mother… to be honest they are better than me especially in eating healthy food and avoiding sweet things. In respect to other things such as taking medication on time we all are good (P:329/T2/Pk).

In exemplar 2 below the participant explains that although there are a number of family members living with diabetes they all have difficulty to adhering to their regimens.

Exemplar 2

Many of my family are diabetics ...my sisters are also diabetic they have the same problem of eating unhealthy food as I do.. we all are sometimes careless about food but we try to help and advice each other to solve this problem (P:085/T2/Ak).

Evidence from this current study suggests that having a family history of diabetes has no effect on adherence to the diet regimen. Other factors such as economic disadvantage and self-efficacy by way of contrast may play an important role.

Many human activities, such as habits related to food, have been performed over long periods of time and become difficult to change. The adoption of a new diet regimen for people with diabetes has both cognitive and skill elements to it. People with diabetes need to learn basic knowledge about their diet regimens and they also need to practice the new diet until this new behaviour becomes a normal routine in their life (Rosenstock, 1985).

7.2.7.2. Adherence to physical activity

Physical activity is an important part in the management of diabetes (ADA, 2011), see section 4.5.4, yet only half of the interviewees (25/50) reported that they exercise at least

3 times a week for most this means walking. Physical activities is also a difficult task in diabetes management especially when it is not a part from previous individual lifestyle or before diagnosed as diabetic, the majority of Libyan adults do not do any kind of physical activity (WHO, 2009). In this study more Type 1 diabetes participants engaged in regular physical activity (13/20) compared with Type 2 diabetes (12/ 30).This difference may be because of that Type 1 diabetes are usually younger than Type 2 as illustrated in the example below (a young man 25 years living with Type 1 diabetes).

Exemplar
Walking is the only thing that I always do. Walking makes me feel I am in a good condition. I walk lots during my work and every day after my dinner for about one hour (P: 818/T1/Gk).

The other half of the interviewees reported that they didn't practice any kind of regular exercises or they practice exercise occasionally. In addition several (11/25) inactive participants justified this because they had no time due to work or being otherwise busy suggesting that, while good, exercise is generally not a priority in the management of diabetes. In general, keeping fit or taking physical activity is not a part of Libyan regular routine, therefor learning a new behaviour and maintaining it is not an easy task for them (Rosenstock, 1985), accordingly it is unlikely that many of them would include or maintain any kind of physical activities as highlighted in the exemplar 1 below.

Exemplar 1
I was doing some sport but not now because I'm currently busy. Sport is very useful for diabetics, especially people of my age (197/T2/Gk).

Religious and social norms act as further obstacles that prevent women from taking up exercise (Pfister, 2006). Three women participants provided explanation of these issues. For example, women are expected to be under the supervision and control of their families at all times. In the exemplar 2 below, a mother only goes for a walk once a week because of the limited availability of her accompanying son. However, she considers other activities around the home, that form part of her domestic chores, are sufficient exercise. Similarly, in exemplar 3, a young woman has cited how it is difficult to undertake exercise in the Libyan community because of the lack of opportunities for women to take part in sporting activities, as most gymnasiums and sports facilities that are provided are solely for men, and there is a lack of community support for women.

Exemplar 2
I sometimes go for a walk, once a week with my son. Also, I have stairs in my house which I go up and down many times doing daily housework which I think is enough (149/T2/Gk).

Exemplar 3
For women in this community in Libyan culture, it is so hard to practice exercise…. there is no good place to practice exercise and nobody supporting women in doing so (P: 304/ T1/ Pk).

7.2.7.3. Adherence to the medical regimens

There is strong evidence indicated that intensive treatment control of diabetes can decrease morbidity and mortality among both Type 1 and Type 2 (UKPDS, 1998; DCCT, 1993). Non-adherence to the appropriate medication treatment as prescribed may lead to poor health outcomes, increase use of medical resource, and inappropriate change in treatment plan (Dunbar-Jacob and Mortimer-Stephens, 2001; Al-Qasem et al., 2011).

The majority of interviewees (39/50) reported greater level of adherence to the medication treatment. Many studies including Roaeid and Kablan (2007) in Libya and El-Shazly et al. (2000) in Egypt indicated that adherence to the medication treatment (insulin or tablets) is regarded by participants as much easier than other aspects of the diabetes regimen (Rubin and Peyrot, 1992; Whittemore, 2000; Nelson et al., 2002).

Exemplar
....my treatment is two doses of insulin one at the morning and the second one at night; I can say I'm very careful about taking them on time every day (P: 306/T1/Pk).

Another reason for high adherence to the medication treatment could be the health care system model in Libya. For example this may because of medications are free of charge and diabetes tends to be managed through acute model of treatment within primary health. On such a model of treatment more emphasis would be on taking medication, thus explaining why half of participants (see section 7.2.6) mentioned that their general information (e.g. diet and physical activity) about diabetes did not come from their GP.

A large minority (11/50) of the interviewees however reported on not taking their medication regularly, despite it is free and medically controlled. This means that there is greater risk for these people to develop complications of diabetes. The participants were questioned about the reason for not taking their medication or insulin injection on time, (5/11) mentioned that the medication or insulin syringes was not available for them. In fact people with diabetes are usually provided with all medical services and medication free of charge (Kadiki and Roaed, 1999). However there was a shortage of medications in some occasions at the clinic as it mentioned in the exemplar 1 below.

Exemplar 1

Yes sometimes I stopped taking my insulin but just for one or two nights because my insulin runs out, or sometimes the clinic didn't give syringes and the one in the private chemist is very bad, it's painful (P: 624/T2/Ak).

Others (3/11) reported that they sometimes skipped their night dose because of fearing hypoglycaemia. In the exemplar 2 the participant thought that when diabetics eat less food than usual at dinner they need not take the night dose.

Exemplar 2

..my treatment is taking pills twice a day, morning and at night… when I feel that I didn't eat well at dinner I do not take the night pill because I fear low blood sugar (P:066/T2/Ak).

Prevention of hypoglycaemia is very important especially among people with Type 1 and Type 2 diabetes who used insulin, teaching them how to adjust their insulin use, carbohydrate intake, and exercise is a necessary to prevent them from hypoglycaemia, unawareness of hypoglycaemia can severely affect their diabetes control and quality of life (ADA, 2011). The other three participants reported no specific reason for not adhere to their medication.

Although, the majority of participants in the current study show good levels of adherence to the medication treatment, it significant to understand why some other did not, to avoid any health related problem that may take place.

7.2.8. Experience with clinic services

Diabetics' satisfaction with the health care services is an important indicator of continued use of services and improved adherence to the medical regimens (Alazri and Neal, 2003). The importance of patients' satisfaction is well documented in the literature review many studies found that satisfied patients are more likely to adhere to advice regarding dietary regimen, physical activity, medications use, and follow-up visits (Alazri and Neal, 2003; Delamater, 2006; Al-Aujan et al., 2012).

Therefore, in the current study interviewees were questioned whether the service that have been received at the clinic was good or bad and what they would like to see the clinic do. Most of the respondents (31/50) of the sample indicated that they feel satisfied with the clinic services. Whereas 17 of the sample pointed out that they are not satisfied with the services because of shortage of resources, crowding at the clinic and unqualified staff. At the same time (10/31) of those satisfied with services mentioned the same problem as well.

The differences between the participants' feeling of satisfaction may be because of the different level of expectation about the clinic services. In exemplar 1 below, for example, the participant felt satisfied about the services simply because they offer medication and the clinic has become less crowded.

Exemplar 1
... the clinic these days is good. There are enough medications for everyone and the clinic is less crowded now (801/T2/Pk).

In exemplar 2 by way of contrast the participant clearly wants more than a prescription service. The participant wants quality time with qualified doctors.

Exemplar 2

I come to this clinic just when my medication runs out. I would like to see qualified doctors who spend more time with patients and explain everything step by step, and to see the clinic more organized (P:750/T1/Gk).

The differences between those who reported satisfaction or dissatisfaction about the services of the clinic was not related to their level of knowledge or socio-economic status. However, given the general impression that health care services in the public sector are poor compared to the private sector, many participants may feel that the current level of service was to be expected and is normal for the public sector. For instance, exemplar 3 below illustrates that the participant only came to the clinic for medication, and he would go to the private clinic for other services or advice.

Exemplar 3

I think the clinic is good, the medication is usually available and that what we need from them, if I want to talk to the doctor about something important I go to the private clinics they are much better. (271/T1/Pk)

A number of participants (3/50) considered that the atmosphere at the clinic was unfriendly and that the staff were disrespectful. For instance, the participant quoted in exemplar 4 below, blamed his failure to seek the further advice of the dietician on the way their initial dealings had been conducted.

Exemplar 4

To be honest I don't like to come to the clinic as the staff have no respect for the patients. One day I came to see the dietician and she didn't treat me well… she was not very friendly and talked to me in an aggressive way, and from that time on I haven't visited a dietician again (457/T2/Ak)

7.2.9. The difference between the three levels of knowledge group

The interviews show that there were no clear difference between the three groups of knowledge regarding to the level of adherence and their resource of information. The only difference was that poor knowledge group were less aware of the general management of diabetes (section 7.2.2), the complication of diabetes (section 7.2.3), and blood glucose test (section 7.2.3) compared with other groups, see table (37) below.

Table (37): The different between the three knowledge groups in the sample

Themes	The difference	Notes
Theme 1 definition	No	
Theme 2 Know the three elements of diabetes management	Yes	Good and average knowledge groups were more aware about the three elements
Theme 3 Divergent beliefs	No	
Theme 4 Knowing complication	Yes	Good and average knowledge groups were more aware about complication of diabetes
Theme 5 Knowing reading test	Yes	People with poor knowledge group knew less about the blood glucose test
Theme 6 Source of information	No	
Theme 7 Adherence level	No	
Theme 8 Experience of clinic services	No	

7.2.10. The difference between Type 1 and Type 2 diabetes

The sample shows that Type 1 diabetes were more knowledgeable about the management of diabetes compared with Type 2, also Type 1 diabetes were more adherent to exercise compared with Type 2(see section 7.2.2). Whereas Type 2 was more informed about blood glucose tests compared with Type 1 (see section 7.2.5).

Another important difference was regarding to the definition of diabetes, nearly half of Type 2 diabetes defined diabetes as signs and symptoms, whereas no one with Type 1 diabetes gave this definition (see section 7.2.1), table (38) above shows the importance different between Type 1 and Type 2 diabetes.

Table (38): The different between type 1 and type 2 diabetes in the sample

Themes	The difference	Notes
Theme 1 definition ➤ Pancreas and insulin ➤ Signs and symptoms ➤ As friend	No Yes No	No one from Type 1 diabetes defined as signs and symptoms
Theme 2 ➤ Know the three elements of diabetes management ➤ Following their own advice	Yes Yes	Type 1 knew more about the three elements of management of diabetes while type 2 were more adhere to their advice
Theme 3 Divergent beliefs	No	
Theme 4 Knowing complication	No	
Theme 5 Knowing reading test	Yes	Type 2 were more aware about the blood glucose test
Theme 6 Source of information	No	
Theme 7 adherence to ➤ Diet regimen ➤ Physical activity ➤ Medication	No Yes No	Type 1 were more adhere to practicing exercise
Theme 8 Experience of clinic services	No	

7.3. Concluding remarks

7.3.1. Participant' diabetes knowledge

The assessment of participants' knowledge about diabetes in this study has focussed on the general information about the following area: diabetes management, divergent beliefs, complication of diabetes and knowledge about the routine blood glucose test, and how participants defined diabetes.

The study shows that information about general management of diabetes was poor among the participants. Although many spoke about the importance of dietary regimens, only a minority (15/50) of participants knew that management of diabetes should also include, practicing exercise frequently and taking medication treatment as prescribed. The qualitative findings also show divergent beliefs and practices (16/50) within in the sample. This could represent significant barriers to effective management of diabetes. The most common belief linked diabetes (onset and progression) with traumatic life events. Such beliefs could be important targets for health providers to improve diabetes self-management.

Knowledge about the complications of diabetes was also poor. Only (10/50) of participants knew that diabetes could affect their heart and cause cardiovascular disease (CVD), only (14/50) of participants knew three complication or more about diabetes. In contrast, the participants show good knowledge about blood glucose test. Many of participants (35/50) knew their reading and the normal range of the test. However, there was no clear relationship between those who knew their reading with those who reported greater adherence to diabetes regimen.

Another important finding was that, many of participants who are educated defined diabetes as pancreatic deficiencies and lack of insulin, and many participants from Type 2 diabetes

defined diabetes as a signs and symptoms, whereas other participants defined diabetes as a good or bad relationship. There was no clear relationship between the definition of diabetes and the level of knowledge or adherence.

In addition, half of participants mentioned that their information was not from doctors or other staff in the health services. This could be due to the lack of resources and overcrowding in clinics in Libya. Many patients have reported that doctors have no time to meet their educational needs along with poor communication healthcare providers. However, many of participants mentioned more than one other important sources of information. TV, Radio and Internet websites (30/50) were the most common while information from family was the least popular.

The interview results reveal that knowledge about diabetes is poor; this is mostly due to the lack of formal diabetes education and the low level of school education achievements among the sample.

7.3.2. Level of adherence

The present findings seem to be consistent with other research which found that adherence to one task of diabetes regimens is different to another task of diabetes regimens (Ruggiero, Glasgow et al. 1997; Peyrot, Rubin et al. 2005). For example, many of participants (39/50) reported good level of adherence to the medications treatment. Whereas many of participants (27/50) reported that they don't follow any kind of diet regimen and half of the sample mentioned that they didn't practice regular exercise. Another important finding was that the level of satisfaction about the health care services at the clinic was good (31/50) but seems to have no effect on adherence to the diabetes management.

There are a number of possible reasons for this:

i. Lack of knowledge: for example, not taking their medication through fear of hypoglycaemia, or not recognising the value of physical activity as an important part of diabetes treatment.

ii. Lack of social support: for example, a number of participants felt difficulty in following diet regimen because of social life activity and celebration time.

iii. Economic factors: such as healthy food is costly or they have to work many hours thus was no enough time for physical activity.

iv. Health care system; for example lack of communication between diabetics and their health providers and the availability of medication and syringes for insulin.

Identifying what causes poor adherence to the diabetic regimens is difficult due to both the complexity of the disease and the limited understanding of human behaviour. Clearly further qualitative research is needed in which deep interviews would enrich understanding of adherence among Libyan people with diabetes.

CHAPTER 8- DISCUSSION THE MAIN FINDING OF QUESTIONNAIRE AND INTERVIEWS

8.1. Introduction

The chapter aims to provide a comprehensive discussion of the key results of the study. In order to achieve this goal, the chapter is divided into four main sections: The first section is an introduction to the chapter including the main research questions of the study followed by the main demographic finding. The second section presents discussion of the main research questions in the study. The third is a review of the triangulation results. The fourth section is the conclusion and recommendations of the study including limitation of the study and recommendation for future research.

The research set out to examine the current diabetes knowledge among people with diabetes in Libya and explore any factors that enhance adherence to treatment and management of the condition. This aim is broken down into the following research questions:

i. What is the current level of knowledge among adults with diabetes in Libya?

ii. To what extent do people with diabetes adhere to medical advice as identified by HbA$_{1c}$ value and patient self-reporting?

iii. What are the main factors that facilitate and enhance adherence to health advice?

iv. Is there any difference between Type 1 and Type 2 diabetes regarding to level of knowledge, adherence and self-efficacy.

8.2. Demographic finding

The sample consisted of 855 participants of which 52.2 % were female and 47.8 % were male. The percentage of male and female in the current study is very similar to the distribution of gender in Libya. In 2007 the distribution in Libya was 50.62 % male and 49.38 % female (Otman and Karlberg, 2007). This shows that, with respect to gender, the study is representative of the wider population in Libya.

The age of participants, range from 18 to 96 years old. The mean age and standard deviation of participants was 51.91 years (SD =13.17). This is similar to the study conducted to assess the standards of care and patients' knowledge in the same place by Roaeid and Kablan (2007) where the mean age and standard deviation was 52 years (SD =15).

The duration of diabetes since diagnosis ranges from 12 to 500 months (1 year to 41.5 years). The mean and standard deviation of diabetes duration was 128.29 months (10.7 years) (Sd = 92.10). The mean of duration is lower than (12.1 years) in the study conducted by Roaeid and Kablan (2007) and higher than (8 years) in the Al-Adsani et al. (2009) study which assessed diabetes knowledge in adults with Type 2 in Kuwait.

Of the 855 participants in this study 89.2% had Type 2 diabetes and just 10.8% had Type1 diabetes. This again is similar to the study conducted by Roaeid and Kablan (2007) whereby the percentage of Type2 was 87.2 % and Type1 was 12.8%. Typically Type2 usually accounts for approximately 90-95% of people with diabetes globally (ADA, 2004).

In this study, 14% of the cohort is educated up to university degree level. However over a third of the sample 35.9% were classified as have no formal education (for the purpose of this

study, this is classified as illiterate). This figure is low compared to the finding of Roaeid and Kablan (2007) study which found 74.2% illiteracy and Al-Adsani et al. (2009) study which was 45%. The difference between the Roaeid and Kablan study and the current study is probably due to the fact that the data was collected at a different period of time; the data for the Roaeid and Kablan study was collected in 2002 prior to numerous advances in the education system. The percentage for Libyan illiteracy was 12.6 % in 2004, including mainly elderly people, as the government had successfully achieved high levels of literacy among the younger age groups; the level of illiteracy has decreased considerably since that time (Otman and Karlberg, 2007).

Of the 855 participants in the current study 52.7% had a positive family history of diabetes in a first-degree relative (blood relative) which is less compared to the finding of Al-Adsani et al. (2009) study which indicated (69.6%) of sample had a positive history of diabetes.

The study also shows a high percentage of complications with 74 % of the participants reporting one or more diabetes related complications, which, is higher than the finding of Al-Adsani et al. (2009) study which was 56.6%. The most common complication was related to vision problems (retinopathy) with nearly 40% of total participants experiencing this. Poor adherence to medical advice may be related to this high number of complications. A study by Roaeid and Kablan (2007) found that 36.6 % diabetic patients in Benghazi Diabetes Centre had had no fundus examination for over 1 year which is indicative of inadequate care.

8.3. Discussion of results

This section discusses and interprets the main findings reported by the two main data collection methods the questionnaire survey in Phase One study and the interviews in Phase Two study. The section presents and discusses the main research questions in the study.

Question 1: What is the current level of knowledge among adults with diabetes in Libya?

It was important in this study to evaluate the level of diabetes knowledge not just because knowledge is an important factor for the management of diabetes, but also because most of the studies assessing the relationship between adherence and diabetes knowledge were carried out in developed countries (Toljamo and Hentinen, 2001; Vermeire et al., 2007; Nau, 2012). It is assumed that people in these countries have higher levels of literacy and education which is correlated with better adherence and management. However, the relationship between knowledge about diabetes and good glycaemic control is sometimes contradictory. Some studies have shown a positive relationship (Colleran et al., 2003; Lerman, 2005; McPherson et al., 2008); whilst others argue that although knowledge of diabetes is essential it is not always enough to improve glycaemic control or self-management (Coates and Boore, 1996; Heisler et al., 2005).

i.   *Evaluation of diabetes knowledge*

In this study, results from both the DKT questionnaire and interview show low levels of diabetes knowledge among the participants. The questionnaire result indicated that on average the participants answered 48.6 % of the total DKT questionnaire correctly. Compared with other studies from the region that used the same DKT questionnaire, the

participants in this study had the lowest level of knowledge. For example Al-Adsani et al. (2009) assessed diabetes knowledge using the same Arabic version of the DKT questionnaire in 5114 Kuwaiti participants with Type2 diabetes and reported that 58.9% of their sample answered the total DKT questionnaire correctly. Other cross sectional study by Mufunda et al. (2012) in Zimbabwe found that in a sample of 58 participants with diabetes reported that 63.1% answered the total DKT questionnaire correctly.

In the same test, on the general diabetes knowledge subscale (DKT-14) the current study found 52.53% of participants correctly answered the items and only 42.75% of participants correctly answered the items on insulin use related knowledge subscale (DKT-9) which were lower than the finding of in Al-Adsani et al. study in Kuwait and the findings of Mufunda et al. study in Zimbabwe.

One explanation for the low level of knowledge found in this study could be due to the relatively high percentage (35.9 %) of people having no formal education among the sample. In comparison all the participants had at least secondary level of education in the study by Mufunda et al. (2012). In many studies, the level of achievement in school has been found to be a key factor in improving diabetic knowledge (Bautista-Martinez et al., 1999; Abdullah et al., 2001). However, compared with the Al-Adsani et al. (2009) study, the current study showed a low level of knowledge despite the sample having higher level of literacy. Therefore, while literacy must be important, this suggests that other factors influence knowledge in the two countries, such as health education programmes which are currently considered to be under-developed in Libya (WHO, 2007).

Studies have shown that diabetes knowledge is generally poor in both developed and developing countries (Habib and Aslam, 2003; Murata et al., 2003; Roaeid and Kablan,

2007). For example, Murata et al. (2003) assessed diabetes knowledge in 248 veterans with Type 2 diabetes in the USA using the DKT and found that only 65% were able to answer the questions correctly.

Also, whilst participants talked about their condition during the interview, they showed a lack of basic knowledge about the management of diabetes, complications of diabetes and the causes of diabetes. For example less than one-third (15/50) of participants described that the management of diabetes should also include, diet regimen and regular exercise in addition to taking medication as prescribed, which are all important parts of diabetes management (DCCT, 1993; UKPDS, 1998). These may reflect that many participants focus on one aspect, mostly diet regimen, more than the others which indicated that awareness about the broad concept of the management of diabetes require more consideration.

In addition, although the majority (74%) of the participants reported knowing about one or more diabetic complications in the results of the questionnaire, generally knowledge about complications of diabetes was poor. For example, a small number of only 20% (10/50) of the participants knew that diabetes could affect their heart and increase risk of cardiovascular disease (CVD). Also, less than one-third (14/50) of participants knew of three or more complications related to diabetes. The impression created by this study is that there is a poor level of knowledge about diabetic complication and is consistent with the previous study by Roaeid and Kablan (2007) which indicated that people with diabetes in Libya generally have a low level of knowledge about diabetes complication. Studies indicate that on-going health education programs and refreshing knowledge are

very important to maintain and promote self-management (ADA, 2006; Dunning, 2009) which is clearly missed in the diabetic health care programme in Libya.

Interestingly, the participants show good knowledge about the blood glucose test. Nearly three-quarters (35/50) of participants knew their reading and the normal range of the test. Indeed, these values were expected to be associated with a good level of adherence. However, there was no clear relationship between those who knew their reading with those who reported greater adherence to a diabetes regimen. A different finding was found in a study by Heisler et al. (2005) which highlighted that people with diabetes who knew their HbA_{1c} value were associated with better understanding glycaemic control than those who did not know their value.

An explanation for this could be that diabetes in many developing countries tends to be managed through an acute or biomedical model of treatment (WHO, 2001; Baghbanian and Tol, 2012), whereby the main point of conversation between doctors and people with diabetes is about the result of the test. Also, many of the participants, who had reported higher results because of poor control, may have felt discouraged from making an effort to improve their condition.

In gaining such personal insights, another important theme that emerges in the current study was the divergence of beliefs and practices regarding diabetes and its management. This was clearly seen among the interviewees in nearly one-third of the sample (17/50) where diabetes was viewed primarily as a traumatic event. This kind of belief can deflect attention away from the more obvious risk factors such as being overweight/obese and unhealthy food; it can shift blame away from an individual to a more supernatural cause

181

or certainly something outside their control. The findings are consistent with those of Shakibazadeh et al. (2011) and Majeed-Ariss, R., et al. (2013) in which their participants thought that the cause of diabetes were attributed to events or stress of daily life including economic difficulties and social problems.

The second most common belief was related to the diet regimen. It seems that this belief results from lack of nutritional knowledge rather than cultural norms, for instance some participants thought that it is permissible to eat everything but sugar and sweets, whilst others believe that vegetables are the only food that diabetics should eat. This is particularly difficult because most of the Libyan dishes are cooked with meat (see section 2.5.2). Furthermore, another common belief was related to medication treatment (insulin doses and anti-diabetic tablets), and the belief that medication is in fact harmful. This finding is consistent with previous studies, which indicated that people with diabetes often hold beliefs about the likely cause, and management of their condition that differ from their health professional medical approach (Cohen et al., 1994; Murphy and Kinmount, 1995; Gale et al., 2008).

ii.   *Meaning of diabetes*

Another finding was related to the meaning that participants give to diabetes. According to Bury (1991) the meaning of diabetes cannot be readily separated from its context and that two contextual factors are particularly important. The first relates to the *consequences* of living with a condition or the disruption it causes; and the second relates to its symbolic *significance*, whether positive or negative, and how this impacts on social interaction. Both of these contextual issues were pertinent in these findings depending on how diabetes was defined by participants.

The current study found that many of participants who are educated and classified as possessing good and average knowledge groups in Phase One defined diabetes as pancreatic deficiencies and lack of insulin. This was the most common definition and sought to minimise both the consequences and significance of diabetes. This meaning is reductive and based on a medical model drawn from health professionals and the literature given to diabetics (Broom and Whittaker, 2004). The definition reflects what patients read or hear from medical personnel about the disease and has no clear connection with his/her experience of the disease.

The second most common definition views diabetes in terms of consequences or the signs and symptoms that participants had experienced. In particular the consequences of the onset of diabetes and its disruptive symptoms on everyday life were highlighted. Feeling of difference had an impact on how these individuals regarded themselves and how they thought other people see that difference. Interestingly, all of the participants giving this definition were from Type 2 diabetes, which may indicate that late onset diabetes is experienced differently. Bury (1982) describes this phenomenon as 'biographical disruption' which causes people to rethink the world around them. He analysed three aspects of biographical disruption: the disruption of assumptions and behaviours, the disruptions in the person's biography and self-concept, and responses to the disruption and the mobilization of resources. Such insights would provide fertile ground for further qualitative research into the experience of diabetes in Libya.

People with Type 1 diabetes by way of contrast have lived with the condition for a longer time (usually since childhood) and so are more likely to come to terms with the signs and

symptoms of diabetes and feel 'normal'. As Bury (1991, p.435) states 'meanings surrounding illness often change as they interact with different stages of the life course'. The idea may be that people with Type 1 diabetes feel less biographically disrupted after having lived a long time with the condition; in a sense, living with the disease has been normalised into being part of everyday experience.

The others view diabetes as a *relationship*. Within this category, diabetes is typically perceived as a companion, who may act either as a 'good friend' or a 'bad friend'. As Bury (1991) suggested earlier, the relationship is rich in symbolic significance and, however it is perceived, is one to which the person with diabetes must learn to live with it.

It is interesting to note, that there was no clear relationship between the given definitions of diabetes and the level of knowledge or adherence to the medical advice.

iii. *Diabetes knowledge and educational level*

A significant correlation between level of knowledge about diabetes and education level has been found particularly among those with no formal education (over of a third of the sample). The study indicated that those with no formal education have a lower level of knowledge than educated people. The significant difference found in the current study, is consistent with the finding from the study by Abdullah et al., (2001) in the UAE and Al-Adsani et al., (2009) in Kuwait. The two studies used the same questionnaire to assess knowledge.

School education may also account for the disparity seen in the DKT in relation with gender, the female participants were found to be less knowledgeable about diabetes than the male participants. This might be due to the fact that a much higher proportion of females have no or less formal education compared to male participants (68.4 % versus 31.6 %). The positive relationship between diabetes knowledge and school education level was also found in the study by Abdullah et al. (2001) in the UAE. However, Sircar et al.'s (2010) study in the southern part of India found school education had no bearing on the level of knowledge. This might be because of the different measurement methods used between the studies and the fact that health education programs in the Arabic countries are generally poor (Roaeid and Kablan, 2007; Al-Adsani et al., 2009).

iv. *Source of diabetes knowledge*

The essential source of learning for people with diabetes usually come from health care providers, but other resources such as media, books, or the experiences of others (family and friends) are equally important (Elfituri et al., 1999). However, half of the participants mentioned that their information did not come from doctors or other health professionals which indicates the lack of an educational role among health care providers including poor communication skills in the management of diabetes. According to Elfituri et al. (2006) the health care providers in Libya have neither the time nor the specialized skills to work as health educational support. Therefore, it is important to pay more attention on developing the required skills for doctors and involve other professionals such as nurse practitioners and physician assistants, who typically work in collaboration with a physician in the management of diabetes. In the primary health care setting, in particular,

185

working within team is the way to achieve high quality of care for patients with chronic illness (Wagner, 2000).

In addition, the interviewees show that TV, Radio, and Internet were the most common sources of information (30/50). A study by Elfituri et al. (1999) evaluating health education programmes in Libya found that TV was the most favoured media of health education. The study also found that TV was ranked highest and booklets and leaflets lowest. Therefore, using TV and introducing other new media such as DVDs, mobile phone apps on improving diabetes knowledge could improve the health outcome among people with diabetes in Libya. However, these methods of learning should be considered as a part of on-going health education, studies have shown that increased diabetes knowledge does not necessarily improve self-care behaviour (McCaul et al., 1987; Johnson, 1996). Therefore, an effective health educational program aims to equip people with the skills for effective self-management is an important part of the management of diabetes (ADA, 2006; Dunning, 2009).

Family members and friends are usually the most important source of health knowledge for the patient (Elkamel, 1995). The questionnaire results for DKT 14 showed that family history of diabetes has a positive impact on diabetes knowledge but this was a small effect (small effect size) with minor differences between knowledge in the 2 groups. The mean and standard deviation were (7.80, 2.90) on those with family history and (7.61, 3.17) on those without family history. In the interview sample the majority (43/50) of participants had a positive family history of diabetes, however only 12/50 of the sample said that an information source came from family members. This suggests weak correlation between having family members with diabetes and increasing diabetes

knowledge. One explanation of this finding could be that social support particularly informational support from their family and friends (Langford et al., 1997) are very low among this sample. Ensuring that patients and their family are given up-to-date and relevant knowledge regarding their diabetes is a key aspect on any health education programme and is very important for improving the management of diabetes (ADA, 2006; Dunning, 2009).

In view of the sources of knowledge about diabetes mentioned above, it would seem that this is very low among the participants in this study because of a lack of formal health education programmes on diabetes in Libya. Also, with those people with diabetes and a low level of school achievement being particularly in need of more specialised health education programmes. The Libyan health care system tends to use a traditional knowledge-based source for health education such as lectures, leaflets, and TV and Radio programs. However, this method is mostly one directional to the target population and has little impact on changing behaviour (Redman et al., 1990) particularly with those with low levels of literacy. It is suggested that health education programs that teach self-management skills are more effective than information-only patient education in improving clinical outcomes (Bodenheimer et al., 2002).

Question 2: To what extent do people with diabetes adhere to health advice as identified by HbA$_{1c}$ value and patient self-reporting?

Measuring the level of adherence to health care advice among people living with diabetes is a complex issue. This is mainly due to the fact that diabetes management require several activities of care and a key concern is how adherence to these activities be identified and

measured (Khattab et al., 1999; Brannon and Feist, 2000). The current study uses the term of adherence as defined by WHO ''the extent to which a person's behaviour in term of taking medications, following diets or executing lifestyle changes corresponds with agreed recommendations from the health care provider''(WHO, 2003, p. 3). Also, based on the assumption that good adherence is most likely lead to better result of HbA_{1c} value.

Therefore, a combination of two measuring methods has been used for assessing adherence. The first was measuring HbA_{1c} as a biological marker in the Phase One study (n= 855), and the second was self-reporting method which reports on personal level of adherence in Phase Two study (n= 50). These are the most practical and common methods of measuring adherence (Brannon and Feist, 2000; Chatterjee, 2006), see section 4.3.

The study found that HbA_{1c} value of 855 individuals with diabetes was high, with 64 % of participants report poor glycaemic control. The HbA_{1c} mean for the total sample was (9.3, $\pm$ 2.3%) which is higher than the ADA (2002) and DCCT (1993) recommended levels ($HbA_{1c} <$ 7%). Compared with other studies it was higher than the finding of Al-Adsani et al. (2009) in Kuwait where the HbA_{1c} mean was 8.76 $\pm$ 2.3%; and the findings of Chew et al. (2011) in Malaysia, where the HbA_{1c} mean was 8.15 $\pm$ 1.44%. This may indicate that a significant number of participants in the current study are at risk of developing diabetic complications (DCCT, 1993; UKPDS, 1998).

As mentioned before, HbA_{1c} value is regarded as an outcome measure of adherence, however, it cannot specify which aspect of the diabetic regimen is poor. Therefore, during the interview in Phase Two of the study the participants were asked about their level of

adherence regarding some aspects of diabetes management such as taking medication treatment, diet regimen and physical activity.

The interview study was mainly focused on measuring adherence to the prescribed medications, diet regimen and regular physical activity. The results show that adherence to one task of a diabetes regimen (e.g. medication) is often at the expense of another task (e.g. diet) (Ruggiero et al., 1997; Peyrot et al., 2005). In the current study, the majority of participants (39/50) reported a good level of adherence to the medication, however, more than half (27/50) reported that they did not follow any kind of diet regimen and nor practice regular exercise. This finding is consistent with other studies which found that patients are more likely to take prescribed medication but are less likely to adhere to diet regimen or regular physical activity (Johnson, 1992; Khattab et al., 1999; Nelson et al., 2002).

This lack of adherence to two out of the three measures can often lead to poor glycaemic control. Several studies have shown a strong correlation between adherence to strict diet regimen or physical activity and good glycaemic control (UKPDS, 1990; Kulkarni et al., 1998; Morris and Wylie-Rosett, 2010; ADA, 2011). One explanation for the high HbA_{1c} found in the current study is probably due to the poor adherence to the diet regimen and physical activity among the participants. It is clear that good diabetic management requires people to adhere to all three tasks of diabetic care adherence.

In general, the current study found adherence among people with diabetes is poor as measured by HbA_{1c} and self-reporting methods. The finding in this study supports previous research which confirm that adherence among people with diabetes is generally poor

189

(Dunbar-Jacob and Mortimer-Stephens, 2001; Cramer, 2004; DiMatteo, 2004). This is mainly due to the fact that diabetes management is complex and requires, very often, life changing behaviours as well as medical treatment.

Question 3: What are the main factors that facilitate and enhance adherence to health advice?

A wide range of reasons have been found in the current study that may explain poor adherence to the health advice among Libyan adults with diabetes. The results of multiple regression tests in the Phase One study found five factors were significantly affecting HbA_{1c} level. These include: duration of the illness, self-efficacy, family history, complication of diabetes and the level of diabetes knowledge, with the strongest factor being self-efficacy, accounting for -0.214. However the model accounted for only 9.5% of the variance (Adjusted $R^2 = 0.095$) (F = 15.34, p < 0.01), which suggested that these factors are important but have little impact on the HbA_{1c} level.

In addition to these factors the result of Phase Two study found perceived high cost of healthy food, health care delivery system, culture, social support and stressful life are important factors that may explain poor adherence among the sample.

i.   Self-Efficacy

A negative relationship has also been found between self-efficacy and duration of diabetes. The data suggested that the longer the participants have been diagnosed with diabetes the lower their self-efficacy about the management of the condition. This finding differs from other studies such as McCleary-Jones (2011) which suggested that those with

greater length of time with diabetes and the older participants had higher self-efficacy levels. This suggests an increase in confidence over time in their ability to self-manage their diabetes. The onset of diabetes has also been examined, the study found that there was no significant correlation between the onset of diabetes and self-efficacy, which indicates that duration of diabetes was not an important factor in self efficacy.

An explanation for the different findings of this study could be that failure to control diabetes over time amongst participants may have led to a low level of self-efficacy. For example several participants in the current study expressed boredom and feeling tired of following medical recommendations, as a result of having had diabetes for a long time. Whilst others believed that diabetic problems and complications are inevitable. Bandura (1982) suggested that people stop carrying out the required regime because they either lose their confidence or they believe that they cannot change the outcome. Furthermore, Williams and Bond (2002) suggest that outcome expectancies moderate the relationship between self-efficacy and self-care and so if you feel you are not in control of the final outcome then you will reduce willingness to bother with self-care over time.

Another finding in the current study was that self-efficacy levels are higher among those taking oral hypoglycaemic treatment than those with insulin dependent treatment or on a combination of oral and insulin treatment. One explanation for this finding could be that many people with Type 2 diabetes are more likely to move to insulin treatment as a result of their poor control (Schoenthaler et al., 2012). In addition, many studies including the current study have found that poor HbA_{1c} control is higher among those with low self-efficacy (Padgett et al., 1988; Griva et al., 2000).

Low levels of self-efficacy have also been found with a number of participants in this study as they explained that adhering to their diet regimen is difficult in social settings and at celebration events. The literature suggested that social support particularly from family, may not directly improve adherence but it makes an important contribution to diabetes self-care through promoting greater self-efficacy (Williams and Bond, 2002). Family support in Libyan community has been considered as a facilitator of health behaviour (Aalto and Uutela, 1997; Elfituri et al., 1999).

Therefore the findings of this study suggest that diabetes education programmes that focus on increasing patients' confidence in their self-care abilities are likely to be effective.

ii. Duration, complications and treatment type of diabetes

Studies have previously found that variables such as duration, complications and treatment type of diabetes affect the management of diabetes and the level of adherence (Kilpatrick et al., 1996; Brannon and Feist, 2000; Basit et al., 2004; Elhwuegi et al., 2012). The current study also found that these three factors were statically significant affecting HbA_{1c} level.

The data suggested that the longer the participants have been diagnosed with diabetes the higher HbA_{1c} level, also that duration had an influence on self-efficacy. A possible explanation for this finding might be that people lose confidence in their ability to control the condition overtime, or that they get bored or frustrated about following the diabetes regimen and this increased over time as suggested by Bandura (1982). Another explanation could be that the longer duration of diabetes usually occurs in older people

and thus with advanced age the function of bodily organs, including the kidney and liver, would usually be in decline anyway (Mangoni and Jackson, 2004; McLean and Le Couteur, 2004). Several studies have found a negative correlation between age and HbA_{1c} (Pani et al., 2008; Ewenighi et al., 2012).

The study also found that those with one or more complications have higher HbA_{1c} level. An explanation for this finding might be that incidence of diabetes complication increase by longer duration of the illness and among older group (Basit et al., 2004; Elhwuegi et al., 2012). Furthermore the study also suggested that patients on oral hypoglycaemic treatment alone have a lower HbA_{1c} reading than those who are insulin dependent or on a mixed treatment plan of oral and insulin. This correlation may be due the fact that, patients with long term diabetes are more likely to move to the insulin treatment plan (Schoenthaler et al., 2012). Also other studies have reported that adherence among insulin users were lower than oral medication (Cramer, 2004).

iii.   Economic factor

Although the range of annual income is very large in the current study (Mean = 3327.34, SD = 2583.61), (1 Libyan Dinar = £ 0.50) the questionnaire result did not find any significant difference between low and high family income in the level of HbA_{1c}. A possible explanation for this result might be related to the fact that people with diabetes in Libya are provided with all medical services and medication free of charge (Kadiki and Roaed, 1999). However, the interview study found that 20% of participants (10/50) thought that following a diet regimen is expensive for them. That could be true, as many Libyan people are economically poor and healthy food such as fruits, vegetables and fish is sometimes too expensive especially when the choice of healthy food in Libyan

supermarkets is limited. Accessibility to healthy food choices can be a barrier for behavioural change to succeed. According to the CIA World Factbook (2012) it is estimated that 30% of the Libyan population are unemployed with 20% living below the poverty line in 2004. Diabetic health care services in Libya are mainly provided by Libyan public health services for free, though many Libyans are opting to go to the private health care sector for what they perceive as being a higher quality of service (WHO, 2007). This can be difficult for those with limited income. However, given that diabetes outcomes in terms of HbA_{1c} are not actually better for those who have paid for private services; the wealthier people may have wasted their money in some respects.

iv. Cognitive factors

The other important factor affecting adherence was the level of diabetes knowledge. The result of the quantitative data found that people with higher level of knowledge had also higher $HbA_{1c.}$ The correlation was significant but weak ($r = 0.11$, $p < 0.001$). The finding however is different to the findings of other studies (Colleran et al., 2003; McPherson et al., 2008) which found that diabetes knowledge is associated with better glycaemic control, but consistent with the finding of Al-Adsani et al. (2009) and Schoenthaler et al. (2012).

These findings might be attributed to diabetic patients gaining knowledge from the experience obtained over their long duration of diabetes and complications; consequently, the knowledge was higher with those with poor HbA_{1c} control. Also, the study found that people with an early age of onset of diabetes reported higher levels of knowledge but a poor HbA_{1c} level. This could be explained by people in the early age of onset being more likely to be educated about the disease. They could more easily gather knowledge and

information about diabetes than those with later onset. Therefore, with early onset and a long duration of disease, knowledge would be expected to increase. However, as a result of the long duration of the disease and complications as mentioned before (Basit et al., 2004; Elhwuegi et al., 2012), the level of HbA$_{1c}$ was also poor. Moreover, health education programs are under-developed in both Libya (Roaeid and Kablan, 2007; WHO, 2007) and Kuwait (Al-Adsani et al., 2009). This is also supports the idea that although knowledge is very important, it is not enough in itself to improve patient's diabetes management (Simmons, 2001; Heisler et al., 2005; Al-Adsani et al., 2009).

The interview study in some ways shows a positive relationship between level of knowledge and adherence. The result indicated that low level of knowledge about basic diabetes was associated with poor level of adherence. For example some participants have stopped taking their medication because they believe that the medication is harmful or because they fear getting hyperglycaemia. Meanwhile, others think that diet regimen is not important as long as an individual with diabetes is taking appropriate medication and undertaking physical activity. This indicates that participants have little knowledge about how the medication works and of how to avoid hyperglycaemia. In addition, others said that they did not adhere to the diet regimen because they think that diabetic food is just vegetables. Or that they found special diabetic food, as sold in pharmacies, expensive. This highlights a clear lack of good nutritional knowledge required for self-management of diabetes.

Two reasons may explain the low adherence among those with low level of knowledge. The first reason is the lack of communication between health care providers and patients. According to Elfituri et al. (2006) social and communication skills among Libyan health

care providers is poor. The second is that health education in Libya suffers from many problems such as lack of trained staff, lack of equipment and lack of clarity regarding objectives (Elfituri et al., 2006; WHO, 2007). Health education in Libya tends to be dominated by TV and Radio programs which aim to promote health knowledge, however, this method is mostly one directional to the target population and has little impact on changing behaviour (Redman et al., 1990).

In addition, at the time of collecting data for this study there was no formal or planned education program at the clinic or anywhere else in the city. The only education program was lectures that the clinic arranges 2-3 times a week. Only 20 per cent of participants in the interview mentioned that they attended a number of the lectures. Didactic lectures about diabetes are informal methods yet how does this really get patients to engage and share their experiences and ideas about managing their condition. The literature review suggests that formal health educational programs are more effective than informal or unplanned program when it aimed to change behaviour (Abdullah et al., 2001). Formal health education programmes with clear objectives can help people to engage more effectively with their healthcare professional and improve the management of diabetes. It is suggested that effective diabetes education, with a view to improving both biomedical and psychosocial aspects of diabetes is an essential part of diabetes education programs (Deakin et al., 2005; Nielsen et al., 2006; Trento et al., 2010).

v. Health care delivery system

The Health care delivery system can affect patient adherence to treatment (Al-Aujan et al., 2012; DiŢ et al., 2012). Factors such as patient-doctor relationship, length of appointment, allocation of resources and communication are very important. Also a

system that encourages communication and engagement with patients can improve adherence (Findings, 2003; Delamater, 2006). Patient satisfaction about health care delivery is an important factor for continued use of services and improved adherence to medical regimens (Alazri and Neal, 2003; Delamater, 2006; Al-Aujan et al., 2012).

The importance of patients' satisfaction is well documented in the literature review. A study of DiŢ et al. (2012) into patient satisfaction in a total of 85 participants with Type 2 diabetes attending an outpatient clinic in Romania, for example, found that patients' satisfaction was linked to a number of factors, i.e. more frequent medical visits, better doctor-patient communication, high levels of self-efficacy related to diabetes, more satisfaction with professional competence, interpersonal aspects, and the duration of the consultation. Another study by Al-Aujan et al. (2012), aimed at evaluating diabetic patients' satisfaction with their treatment amongst a total of 123 participants in a primary care clinic in Saudi Arabia, found that satisfied patients were more likely to adhere to advice regarding dietary regimen, physical activity, use of medication, and follow-up visits.

In the current study many of the respondents (31/50) of the sample indicated that they feel satisfied with the care they received at the Diabetes clinic. Whereas 17 of the sample pointed out that they are not satisfied with the services for a number of reasons. These include overcrowding, unnecessary long waiting time, unqualified staff, lack of communication between patients and their health providers, the atmosphere at the clinic was unfriendly, insufficient health educational support particular nutritional support, and sometimes unavailability of medication and syringes for insulin. The findings of the current study are consistent with those of Al-Aujan et al., 2012 in Saudi Arabia who

found 63% of their sample were satisfied and only 16% were unsatisfied. However, (10/31) of those satisfied with the clinic services in the current study mentioned the same problems as well. All identify concerns with care and management from the health service yet some are dissatisfied and others not. The reason behind these different was not clear, therefore future studies on this issue are recommended.

Health care services in Libya are generally regarded as poor partly because the system has more focus on quantity rather than quality (El Taguri et al., 2008; Benamer, 2012). In addition health care services for diabetes in Libya are operated through the primary health care and mainly within the concept of acute treatment models. Caring for diabetic patients should address the complexities of the disease and the on-going needs for treatment and education. The approach of acute care systems does not always produce the desired outcomes (WHO, 2001; Baghbanian and Tol, 2012) for diabetes treatment. Diabetes is a self-management disease that requires collaborative care which emphasizes providers to works closely with their patients on setting goals with their patient which include lifestyle change to achieve HbA_{1c} control (Delamater, 2006). It is suggested that nurses with additional training or experience in diabetes care and in techniques could play an important role to help patients become more active in self-managers of their illness (Aubert et al., 1998; Wagner, 1998). The training nurses and other health professional such as registered dietician have a limited role in the management of diabetes in Libya.

vi.   Culture barrier and lack of support

A positive relationship between social support and diabetes management has been found in the literature review (Garay-Sevilla et al., 1995; Fukunishi et al., 1998; Mayberry and Osborn, 2012). Although the current study has not focused on the social support issue, a

number of issues related to cultural barriers and a perceived lack of support have emerged. More than 20% (11/50) of participants in the interview sample expressed that there were cultural barriers and a lack of support from their family and friends. For example, there were difficulties in following an appropriate diet when away from home with family and friends or during a time of celebration, when there was little encouragement to stick with a recommended regimen. This result is consistent with the findings of Abdulhadi et al. (2007) in Oman which indicated that poor adherence to the diet regimen was associated with the local culture and traditional food habits. The findings in this current study could also be explained as the result of cultural barriers and a lack of social support. For instance, the most important sign of hospitality in Libya is to serve guests with a large amount of food. Likewise, in Oman dates, which are rich in sugar, are often offered frequently in social gatherings. People with diabetes often find it very difficult to be on their usual diet regimen because it may be considered ill-mannered to refuse such hospitality (Khoury, 2001; Abdulhadi et al., 2007).

Also, people in Arab societies are very welcoming and inviting. The frequency of social gatherings is high and usually more than 3 times a week (Nydell, 2006). This context could have a great effect on the level of adherence to a diet regimen. In addition, some families are not supportive to their diabetic members in the way that food is cooked and prepared; for example, in Libya food is usually eaten out of a common bowl which makes counting the portion of carbohydrates very difficult (ADA, 2004). A study by Elfituri et al. (1999) found that the most powerful factor that influences an individual's attempts to follow a healthy lifestyle in Libya is the family.

In addition, a few of the women participants described experiencing gender discrimination since most sports and recreational facilities were for males only which,

obviously, acted as a barrier for women who wished to undertake physical activity. Furthermore, due to religious and social norms, Muslim women must wear the hijab, which is not ideal for physical activity in public places (Goenka et al., 2007).

Also, the availability of private gyms is limited in Libya. Walking would seem to be a practical way for most women in Muslim societies, however, since most women are expected to be under the supervision and control of their family at all times, the availability of suitable companions to accompany a woman on a walk is an issue; hence, the patriarchal nature of Libyan society could also be a potential barrier for many women with diabetes (Pfister, 2006).

It is worth mentioning, the Libyan culture is well connected at the family level. This could help the patients be more pro-active at initiating self-care. However, lack of social support could be that be related to the collectivist structure of the Libyan community. Individualism and collectivism have an impact on people's way of thinking and behaviours towards seeking help from social support (Markus and Kitayama, 1991; Kim et al., 2008). People from individualistic societies such as UK or USA usually get more benefits from social support compared with people from a collectivist culture. This might seem at odds with what you would expect. Possibly it is because in an individualised culture people have more freedom and self-determination. Also they share the cultural assumption that individuals should proactively enhance their own well-being and that others have the freedom to offer help or not. By the way of contrast, people within collectivised cultures such as Libyan may find it more difficult to seek help and bring their personal problems to others because they share the cultural assumption that people should not weigh down their social networks with personal problems (Kim et al., 2008).

Therefore, the correlation between family support and diabetes in Libya needs further research.

Informational support is another important forum of support from the family and friend (Langford et al., 1997). However a lack of informational support was also reported in this study which indicated that the least amount of information sources came from family and friends. Diabetes education to family members and the community is needed (ADA, 2006; Abdulhadi et al., 2007; Dunning, 2009).

In addition, the quantitative phase in this study found that having a family member who is also diabetic might have a negative effect on their management of diabetes. The results indicate that those with family history of diabetes have higher HbA_{1c} (Mean = 9.61, Sd = 2.27) when compared with those without family history (Mean = 9.10, Sd = 5.40). The difference was small but may be important. A possible explanation of this negative effect may be that an individual has adopted or copied poor adherence from their family member. Many theories of behaviour such as Trans-Theoretical Model of Change, suggested stages through which individuals progress their various cognitive, motivational readiness to change. The stages includes: Pre-contemplation, Contemplation, Pre-action, Action; individuals are involved in behaviour change, and Maintenance the behaviour and avoiding relapse (Prochaska et al., 1992). However, an individual may copy behaviour from his/her family without passing through the stages of changing behaviour see section 3.9.5. Poor adherence in the current study was probably perceived in such a way that is socially accepted. As such, theories may not be useful for understanding the problem of adherence in Libya as all these theories tend to come from western countries which have very individualised societies.

vii.   Stressful lifestyle

Another important factor that affects the management of diabetes is to avoid stress and stressful conditions as much as possible. Stressful life events are associated with depression, anxiety, low self-esteem and behavioural problem and these kind of psychological problems can have a negative impact on diabetes management and adherence to treatment (Goetsch and Wiebe, 1995; Kramer et al., 2000).   Nearly one-third of the participants in the interview (17/50) thought that avoiding a stressful lifestyle is a key factor to control their diabetes and believed that their poor control condition is not because of poor adherence to treatment or diet/exercise. Such thoughts may have an effect on adherence to the diabetes regimens; individuals may not see diabetes as a controllable disease and so they do not perceive that they will benefit from the adherence to the recommended regimen. The Health Belief Model suggested that when the individual believe that there are cost benefits of performing the regimen (perceived benefits) (Brannon and Feist, 2000) he/she will adhere to that regimen. The HBM predicted that perceived benefits were directly related to adherence to diet regimen and self-monitoring blood glucose (Aalto and Uutela, 1997).

In addition, there is a general lack of any kind psychosocial support provided to diabetic patients in the clinic. The ADA (2011) has recommended screening for psychosocial problem such as depression and diabetes related distress, anxiety, eating disorder and cognitive impairment for people with diabetes mainly among those with poor control for improving diabetes management.

Question 4: Is there any difference between Type 1 and Type 2 diabetes regarding to level of knowledge, adherence and self-efficacy.

Another important aim in the current study was compare Type1 and Type2 regarding their diabetes knowledge, and level of adherence to the diabetes regimen. In this study, the quantitative phase found no significant difference between Type1 and Type2 diabetes. This finding was consistent with the finding of other studies (Khattab et al., 1999; Peyrot et al., 2005). Khattab et al. (1999) in their study aimed to identify some determinants of adherence to diet regime, medication and appointment in 249 participants with diabetes, the study indicated that there was no significant difference between Type1 and Type 2 diabetes the only difference was participants with Type 2 were more likely to adhere to the appointment. Peyrot et al. (2005) in their study found no difference between Type 1 and Type 2 in patient self-reported adherence, however health providers in the same study reported that adherence among people with Type 1 are better than Type 2. One possible explanation for the similarity between Type 1 and Type 2 found in the current study may be because 84 % of Type 2 diabetics in the current study were using insulin as a form of treatment.

Alternatively, the interview analysis did show some differences between Type 1 and Type 2 diabetes. However, this difference was expected because of the existence of other factors, for example people with Type 1 diabetes were more knowledgeable about the basic management of diabetes compared with Type 2 diabetes. This finding may be due to the fact that the number of educated participants with Type 1 diabetes was greater (84%) than those with Type 2 (62%). This finding was also supported from the quantitative result in the study, which indicates that those with no formal education had lower levels of knowledge compared with other educational groups. The differences were significant but small on DKT23 and DKT9, and moderate on DKT14.

Another finding related to their knowledge was that those with Type 1 diabetes were less knowledgeable about their blood glucose reading test. An explanation for this result could be that people with Type 1 feel more familiar with their reading test. They thus became less careful about their reading, or as is often said 'familiarity breeds contempt'; people with Type 1 have attended many appointments, check-ups their blood glucose several times over the years that make them perceived blood glucose test inefficiency.

Another finding was that people with Type 1 diabetes were more likely to adhere to exercise compared with Type 2. This can be explained as age related, as the majority of Type1 in the sample were younger than those with Type 2. The mean and standards deviation for age of Type1 in the total sample was (34.61 years, 7.4) compare to (54 years, 12.14) in Type2 diabetes.

8.4. A review of the triangulation results

To understand the problem of adherence among people with diabetes in Libya, this thesis employed a mixed methods design, with triangulation of quantitative and qualitative methods. The two methods have different approaches and views, with the results complementing each other and yielding a comprehensive picture. A review of triangulation results in the current study is presented below.

8.4.1. Confirmatory results

- Firstly, in the current study, results from both the quantitative and qualitative data show low levels of diabetes knowledge among the participants. The questionnaire result indicated that on average the participants had a low level of knowledge about

diabetes management, with only 48.6 % of the combined total of all the answers given to the questions in the questionnaire being correct. The interview also showed a lack of basic knowledge about the management of diabetes, and its causes and complications. In addition, the results of both the questionnaire survey and the interviews identified a lack of knowledge among those classified as having no formal education, which was a strong indication that consideration needs to be given to the provision of special education programmes for these groups.

- Secondly, results from both the quantitative and qualitative data show low levels of adherence. The HbA_{1c} mean for the total sample was (9.3, $\pm$ 2.3%) which is higher than the recommended levels of the DCCT (1993) and ADA (2002). The interview also showed a lack of adherence to the diet regimen and recommended physical activities. However, good adherence to the medication was found in the current study. The results indicated that adherence in term of HbA_{1c} value and self-reporting is low.

- Thirdly, the results of both the quantitative and qualitative study showed that self-efficacy was as a significant factor affecting the level of adherence. The quantitative data suggested that those who reported higher levels of self-efficacy had lower HbA_{1c} levels. Low levels of self-efficacy were also discovered during the interviews with, for example, a number of participants explaining that adhering to their diet regimen was difficult in social settings and at celebration events. The literature suggested that social support, particularly from the family, may not directly improve adherence but made an important contribution to diabetes self-care through its promotion of greater self-efficacy (Williams and Bond, 2002).

8.4.2. Complementary results

- Firstly, the result of the quantitative data found that people with a higher level of knowledge also had higher HbA_{1c}. These findings might be attributed to diabetic patients gaining knowledge from the experience obtained over the long duration of their diabetes condition and its complications; consequently, the knowledge was high with those with poor HbA_{1c} control. In some ways, the qualitative data suggested a positive relationship between level of knowledge and adherence. For example, some participants had stopped taking their medication because they believed that the medication was harmful or they were noted as having a fear of hyperglycaemia.

- Secondly, the quantitative data suggested that there was no difference between low and high family income for the level of HbA_{1c}. However, the result from the qualitative data found that 20% of participants perceived that following a diet regimen is expensive for them. Indeed, it could be true that cost of food is a factor, as many Libyan people are economically poor, and affordability of healthy food could be a problem for those trying to adhere to an appropriate diet regimen.

- Thirdly, the quantitative data suggested no significant difference between Type 1 and Type 2 diabetes in regard to diabetes knowledge and adherence level. On the other hand, the qualitative data suggested that people with Type 1 diabetes were more knowledgeable about basic management of it compared to those with Type 2 diabetes. However, this difference was expected because the number of educated participants with Type 1 diabetes was greater (84%) than those with Type 2 (62%). The qualitative data also suggested that people with Type 1 diabetes were more likely to adhere to recommended exercise when compared to those with Type 2. This can also

be explained as an age related issue, as the majority of people with Type 1 in the sample were younger than those with Type 2.

- Fourthly, a number of factors significantly predicted HbA_{1c} levels in the quantitative results, however more important factors emerged from the qualitative results such as social support, economic status and patient satisfaction with the services of the clinic. These results indicated the importance of using a triangulation of methods that complemented each other.

To summarise, a mixed method is not only a way of verifying or complementing data, it is also a method of providing a more comprehensive understanding of the area of study.

8.5. Conclusion and recommendation

The final section presents conclusions and recommendations of the research. It provides an overall summary of the major findings resulting from this study and details the conclusions drawn. This section is divided into limitations of the study, conclusions, recommendations of the study and recommendations for further research.

8.5.1. Limitations of the study

Every study has limitations, which is important to consider when drawing conclusions from its findings. The limitations within this study were as following:

The first limitation was related to the data collection method; although the data came from a relatively large sample (855), they were limited by the cross-sectional nature of the study

design of and its convenience sampling technique. This may have resulted in a sample that was not fully representative of the study population. The sample included only those who had visited the clinic at the time of the study. This meant that patients who were not able to visit for any reason, such as not feeling well enough, were not included. Their experience of diabetes may have been different from the participants included in the current study. Therefore, further studies should make an effort to reach underrepresented target groups.

Another limitation that may weaken the validity of the diabetes knowledge test was the lack of respondent knowledge; the low level of literacy among many of the study participants possibly leading to incorrect questionnaire answers. Indeed, many of the participants were elderly or of limited education, however, the study had a high response rate which may have helped to minimize the problem.

In addition, as the questionnaires were handed out while the participants were waiting for their routine examination, issues of tiredness, feeling rushed and anxiety could be have acted as limitations to the accuracy of the data.

The second limitation is related to measuring adherence; as an accurate valid method for assessing adherence has not yet been found (Brannon and Feist, 2000). To overcome this limitation the current study has used a combination of two methods namely: patient self-reporting and HbA_{1c} as an outcome of adherence. These are the most common and practical methods to measure adherence (Brannon and Feist, 2000; Sacks, 2008). However, the two methods have their own limitations such as patients over-reporting their level adherence (Brannon and Feist, 2000). In addition, HbA_{1c} levels are influenced by other factors such as duration of the illness (Lustman et al., 1981; Padgett, 1991; Johnson, 1996).

In addition, as it was a cross-sectional study, the participants responded during only one point in time and, therefore, the results do not reflect or predict any change that may occur over time. Adherence to recommendations and self-efficacy change over time; for example, adherence to recommended physical activity may be different between summer and winter, or the level of adherence to a diet regimen may differ during Ramadan. Therefore, further studies using longitudinal designs are recommended.

The third limitation of this study comes from the interview process itself. The researcher faced many constraints regarding gaining information and access to participants in the interviews. Generally, qualitative research methods are more commonly used and acceptable in democratic settings, which are not well developed in the MENA region, particularly with regard to health sciences. In such restricted systems, willingness to participate and speak openly may be difficult because of political repression, mistrust and suspicion of the interview process, and a lack of education and/or familiarity with such methods (Clark, 2006).

As stated elsewhere, the interview method has not been commonly used in Libya for at least two reasons; firstly, there is a general lack of interest in qualitative methods and, secondly, there is a particular cultural difficulty in being open and feeling free to tell your own story. In addition, much of the qualitative research on chronic diseases, and diabetes in particular, comes from sociology, anthropology, social psychology or nursing. These fields are not well established in Libya. Also, the medical profession is very powerful and dominates discourse in health and disease, and they prefer to use quantitative methods.

In relation to cultural issues there was a sense that people were reluctance to participate. For example from 60 individuals who agreed to participate; only 50 were interviewed. In addition, despite the fact that the interviewees tend to provide useful information, some of them answered most of the questions in short response-way, which made the interview more like a face-to-face questionnaire method. This also could be related to the culture reason or the lack of the experience of the researcher.

8.5.2. Conclusion

Poor adherence among people with diabetes is a common problem in every community. This is mainly due to the complexity that surrounds diabetes management, which makes adherence to health advice rather problematic. The research set out to examine the current diabetes knowledge among people with diabetes in Libya and explore any factors that enhance adherence to treatment and management of the condition. In order to achieve this aim, a mixture of both quantitative and qualitative methods has been applied.

The first important finding in the current study was that both quantitative and qualitative methods show low levels of diabetes knowledge among both types of diabetes, especially among those classed as having no formal education. The finding in this study supports previous research from both developed and developing countries that confirms that diabetes knowledge is generally poor. Moreover, the study confirms the importance of the levels of school education achieved in improving diabetic knowledge. Health literacy is an important aspect of developing knowledge, particularly with people with long term disease conditions who have low levels of education.

In the current study, the assessment of diabetes knowledge was successful as it was able to identify subgroups with limited levels of knowledge, such as people with no formal education. In addition, it has helped to identify some specific areas with low levels of knowledge, such as nutritional knowledge and knowledge about diabetes complication. This indicates that special education programs need to be considered for these groups and more emphasis needs to be placed on improving the level of education related to nutrition and complication of diabetes.

The second important result was the HbA_{1c} value, which was higher among study participants, on average, than the recommended levels by ADA (2002) & DCCT (1993). In addition, many of the participants in the interview reported low levels of adherence especially to diet regimen and physical activities; yet the majority of them reported good adherence to the medication. This finding is consistent with previous studies which indicated that that good or satisfactory adherence to all three regimens is rare and often where there is good adherence to one factor there will be poor adherence to another. Also, it showed that individuals are more likely to adhere to taking prescribed medication and less likely to adhere to diet regimen or physical activities. Furthermore, the influence of culture on Libyan health related behaviour could not be ignored; factors such as family support and food habits may have an effect on both diet and exercise adherence.

The study concluded that various factors may explain poor adherence and the lower level of HbA_{1c} level in the current study. These include: (1) self-efficacy about the management of the condition; (2) duration of illness; (3) type of treatment; (4) cognitive factors; (5) culture and social support; (6) economic factors; (7) stressful lifestyle; and (8) health care delivery

services. It is also noted that interactions between these factors are complex and affect both adherence and metabolic control.

Another important finding was related to the source of knowledge among people with diabetes. The study found that in the absence of formal health education, TV, Radio and the internet were an essential source of learning among people with diabetes in Libya. These sources of learning can be helpful but are not effective enough to improve diabetes knowledge and promote adherence to health advice. Planned health education programs are required.

Finally, the findings of this study revealed that there are no significant differences between Type 1 and Type 2 diabetes regarding adherence. Even though the interview analysis shows some differences, these are most likely to be due to differences in demographic features, such as age and education level.

8.5.3. Recommendations

Based on the current study results, many Libyans with diabetes showed a low level of diabetes knowledge and did not generally adhere to their diabetes self-care regimen. Therefore, practical recommendations for improving diabetes knowledge and health educational programmes will be presented, followed by recommendations related to health care system and policy, in order to improve the level of adherence and diabetes care services in Libya.

8.5.3.1. Recommendations for improving knowledge and health educational programme

i. Develop and implement health education programmes targeted at individuals with diabetes and their families. Ideally, these programmes should develop the opportunity for individuals and families to co-develop their own objectives in disease management.

ii. Considering the general low levels of education, diabetes education programmes should focus primarily on those with inadequate levels of knowledge of diabetes, particularly elderly people. In addition, health care providers should be aware of the impact of low educational level in the process of diabetes management. Therefore, it is important to develop and disseminate educational tools and resources for health providers to support these groups.

iii. The development and implementation of ongoing diabetes health education strategies should be considered, particularly for those who have had diabetes for a long time; such an addressing and enhancing of the individual's self-efficacy is an important aspect of diabetes management.

iv. Diabetes education programs should consider the psychological factors that are involved in the process of diabetes management and should be provided for both patients and health care providers.

v. The study found that TV, radio and websites are the most favoured way of receiving information among participants and, therefore, developing these sources and introducing other similar media, such as audiotape and mobile phone apps, could improve the general knowledge about diabetes management.

8.5.3.2. Recommendations for improving the level of adherence and diabetes care

   i.   The planners and managers of the health system, and health care providers generally, need to develop ways of assessing adherence and the factors that influence adherence in order to manage diabetes better. Also, a focus needs to be given to the prevention of diabetes complications, both by controlling disease progression and by supporting patient needs at all level of care.

   ii.   Health care providers need to acknowledge the social and cultural interpretation of diabetes and approach the patients accordingly. It would be particularly important to develop educational programs for supportive physical activities and nutritional knowledge for people with diabetes. This could be done through more development of dietician specialists who work with the patients and community health personnel who can develop exercise programmes. Exercise programmes should be designed with a concern for the peculiarities of Libyan culture, in order to encourage women to participate effectively.

   iii.   Develop and implement up-to-date diabetes education training for doctors and other health educators working with people with diabetes, to enhance health education programmes in Libya. Nurses are in a strong position to teach the patients about diabetes self-care management and the importance of adherence to their recommendation.

   iv.   Develop models for health care systems that effectively support diabetes care. Management of chronic diseases is different to acute diseases. This difference needs

to be reflected in the health systems and also in suitable academic health related education. Improved understanding of the chronic illness will help health care providers to support self-care in the management of diabetes. In addition, patient-centred practice should become an important future aspect of plans to improve health care services in Libya. There is a need for the dissemination of guideline principles that promote diabetes care.

v.   The national health authority should list diabetes care and health education in its priority plan, and allocate more financial resources to cover diabetes-related expenses and to support health education. Also, policies and activities to improve the quality of care for people with diabetes need to be promoted.

8.5.4. Future research recommendation

i.   A replication of this study conducted in different parts of the country with more focus on psychosocial factors related to the problem of adherence may lead to a better understanding of the barriers to adherence.

ii.   Further studies on the role of culture and social support on adherence particularly to diet and physical activities are needed in Libya.

iii.   More qualitative studies should examine the problem of management of diabetes involving health care providers and health authorities which are needed to improve health care services for diabetes in Libya.

iv.   The use of longitudinal design for studies rather than cross-sectional designs is also considered important for further diabetes studies because adherence and self-efficacy factors may change over time.

v.   Studies focusing on improving health education using a successful diabetes education program such as Dose adjustment for normal eating (DAFNE) for Type 1 and Diabetes education for self-management: on-going and newly diagnosed (DESMOND) for Type 2 in UK are needed in Libya.

vi.   As there is no accurate valid method for assessing adherence much work needs to be done to develop standardized, reliable and valid measurement tools.

References

Aalto, A. M. & Uutela, A. (1997). Glycemic Control, Self-Care Behaviors, and Psychosocial Factors Among Insulin Treated Diabetics: A Test of an Extended Health Belief Model. *International Journal of Behavioral Medicine,* **4**, 191.

Abdulhadi, N., Al Shafaee, M., Freudenthal, S., Ostenson, C. G. & Wahlstrom, R. (2007). Patient-provider interaction from the perspectives of type 2 diabetes patients in Muscat, Oman: a qualitative study. *BMC Health Serv Res,* **7**, 162.

Abdullah, L., Margolis, S. & Townsend, T. (2001). Primary health care patients' knowledge about diabetes in the United Arab Emirates. *Eastern Mediterranean Health Journal,* **7**, 662.

Adegoke, A. A. (2006). Strategies for modification of health behaviours. *IFE PSYCHOLOGIA,* **14**, 263.

Adler, A. I. (2011). Effectiveness of individual-level intervention to prevent vascular complications. In K. V. Narayan, D. Williams, E. W. Gregg & C. C. Cowie (Eds.), Diabetes public health: from data to policy. Oxford University Press.

Ahmed, A. (2003). Cultural aspects of diabetes mellitus in Sudan. *Practical Diabetes International,* **20**, 226-229.

Ajlouni, K., Khader, Y. S., Batieha, A., Ajlouni, H. & El-Khateeb, M. (2008). An increase in prevalence of diabetes mellitus in Jordan over 10 years. *J Diabetes Complications,* **22**, 317-24.

Ajzen, I. & Fishbein, M. (1980). *Understanding attitudes and predicting social behaviour.* Englewood Cliffs, NJ: Prentice-Hall.

Ajzen, I. (1991). The theory of planned behavior. *Organizational behavior and human decision processes,* **50**, 179-211.

Al-Adsani, A. M., Moussa, M. A., Al-Jasem, L. I., Abdella, N. A. & Al-Hamad, N. M. (2009). The level and determinants of diabetes knowledge in Kuwaiti adults with type 2 diabetes. *Diabetes Metab,* **35**, 121-8.

Al-Aujan, S., Al-Aqeel, S., Al-Harbi, A. & Al-Abdulltif, E. (2012). Patients' satisfaction with diabetes medications in one hospital, Saudi Arabia. *Patient Prefer Adherence,* **6**, 735-40.

Alazri, M. H. & Neal, R. D. (2003). The association between satisfaction with services provided in primary care and outcomes in Type 2 diabetes mellitus. *Diabetic Medicine,* **20**, 486-490.

Al-Hazzaa, H. M. (2004). Prevalence of physical inactivity in Saudi Arabia: a brief review. *East Mediterr Health J,* **10**, 663-70.

Ali, S., Stone, M. A., Peters, J. L., Davies, M. J. & Khunti, K. (2006). The prevalence of co-morbid depression in adults with Type 2 diabetes: a systematic review and meta-analysis. *Diabet Med,* **23**, 1165-73.

Aljasem, L. I., Peyrot, M., Wissow, L. & Rubin, R. R. (2001). The impact of barriers and self-efficacy on self-care behaviors in type 2 diabetes. *The Diabetes Educator,* **27**, 393-404.

Al-Khawaldeh, O. A., Al-Hassan, M. A. & Froelicher, E. S. 2012. Self-efficacy, self-management, and glycemic control in adults with type 2 diabetes mellitus. *Journal of Diabetes and its Complications,* **26,** 10-16.

Al-Lawati, J. A., Al Riyami, A. M., Mohammed, A. J. & Jousilahti, P. (2002). Increasing prevalence of diabetes mellitus in Oman. *Diabetic Medicine,* **19**, 954-957.

Al-Qasem, A., Smith, F. & Clifford, S. (2011). Adherence to medication among chronic patients in Middle Eastern countries: review of studies. *East Mediterr Health J,* **17**, 356-63.

American Diabetes Association (2002). Implications of the Diabetes Control and Complications Trial *Diabetes Care,* **25**, S25-S27.

American Diabetes Association (2004). Diagnosis and classification of diabetes mellitus. *Diabetes Care,* **27**, S5-S10.

American Diabetes Association (2006). Standards of Medical Care in Diabetes–2006. *Diabetes Care,* **29**, 1.

American Diabetes Association (2008). Economic costs of diabetes in the U.S. In 2007. *Diabetes Care,* **31**, 596-615.

American Diabetes Association (2011). Standards of Medical Care in Diabetes—2011. *Diabetes Care,* **34**, S11.

American Diabetes Association (2013). Economic Costs of Diabetes in the U.S. in 2012. *Diabetes Care*.

Anderson, R. M., Funnell, M. M., Fitzgerald, J. T. & Marrero, D. G. (2000). The Diabetes Empowerment Scale: a measure of psychosocial self-efficacy. *Diabetes Care,* **23**, 739-43.

Anderson, R. T., Pawaskar, M. D., Camacho, F. & Balkrishnan, R. 2011. Adult Diabetes and Quality of Life. Psychosocial Issues, and Sexual Health. In: NARAYAN, K. V., WILLIAMS, D., GREGG, E. W. & COWIE, C. C. (eds.) Diabetes public health: from data to policy. Oxford University Press.

Appleton, J., V. (2009). Starting a New Research Project. *In:* Neale, J. (ed.) *Research methods for health and social care.* New York: Palgrave Macmillan.

Arroyo, C., Hu, F. B., Ryan, L. M., Kawachi, I., Colditz, G. A., Speizer, F. E. & Manson, J. (2004). Depressive symptoms and risk of type 2 diabetes in women. *Diabetes Care,* **27**, 129-33.

Ary, D., Jacobs, L. C., Razavieh, A. & Sorensen, C. (2009). *Introduction to research in education.* USA: Wadsworth Pub Co.

Asharaf, A., Alshekteria, A., AlHadi, H., Ahmed, M. & Mohammed, A. (2010). An examination of primary health care quality in Benghazi, Libya. *Lib J Med*, **9**. URL: http://www.mejfm.com/July2011/qualityLibya.htm.

Aubert, R. E., Herman, W. H., Waters, J., Moore, W., Sutton, D., Peterson, B. L., Bailey, C. M. & Koplan, J. P. (1998). Nurse case management to improve glycemic control in diabetic patients in a health maintenance organization, A randomized controlled trial. *Annals of internal medicine,* **129**, 605-612.

Badran, M. & Laher, I. (2012). Type II Diabetes Mellitus in Arabic-Speaking Countries. *International Journal of Endocrinology,* **2012**, 11.

Baghbanian, A. & Tol, A. (2012). The introduction of self-management in Type 2 Diabetes care: A narrative review. *J Educ Health Promot,* **1**, 35.

Bagust, A., Hopkinson, P. K., Maslove, L. & Currie, C. J. (2002). The projected health care burden of Type 2 diabetes in the UK from 2000 to 2060. *Diabet Med,* **19 Suppl 4**, 1-5.

Balducci, S., Iacobellis, G., Parisi, L., Di Biase, N., Calandriello, E., Leonetti, F. & Fallucca, F. (2006). Exercise training can modify the natural history of diabetic peripheral neuropathy. *Journal of diabetes and its complications,* **20**, 216-223.

Balluz, L. S., Okoro, C. A. & Mokdad, A. (2008). Association between Selected Unhealthy Lifestyle Factors, Body Mass Index, and Chronic Health Conditions among Individuals 50 Years of Age or Older, by Race/Ethnicity. *Ethnicity & Disease,* **18**, 450-457.

Bandura, A. (1977). Self-efficacy: toward a unifying theory of behavioral change. *Psychological review,* **84**, 191.

Bandura, A. (1982). Self-Efficacy Mechanism in Human Agency. *American Psychologist,* **37**, 122-147.

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory.* Englewood Cliffs, NJ: Prentice-Hall, Inc.

Bandura, A. (1997). Self-efficacy: The exercise of control. New York: Freeman.

Bantle, J. P., Wylie-Rosett, J., Albright, A. L., Apovian, C. M., Clark, N. G., Franz, M. J., Hoogwerf, B. J., Lichtenstein, A. H., Mayer-Davis, E. & Mooradian, A. D. (2008). Nutrition recommendations and interventions for diabetes: a position statement of the American Diabetes Association. *Diabetes Care,* **31**, S61-S78.

Barrera, M., Strycker, L. A., MacKinnon, D. P. & Toobert, D. J. (2008). Social-ecological resources as mediators of two-year diet and physical activity outcomes in type 2 diabetes patients. *Health Psychology; Health Psychology,* **27**, S118.

Bartlett, J. D. (2000). Diabetes challenge in Russia. *Practical Diabetes International,* **17**, 197-199.

Basit, A., Hydrie, M. Z., Hakeem, R., Ahmedani, M. Y. & Masood, Q. (2004). Frequency of chronic complications of type II diabetes. *J Coll Physicians Surg Pak,* **14**, 79-83.

Bautista-Martinez, S., Aguilar-Salinas, C. A., Lerman, I., Velasco, M. L., Castellanos, R., Zenteno, E., Guillen, L. E., Murcio, R., Wong, B., Gomez Perez, F. J. & Rull-Rodrigo, J. A. (1999). Diabetes knowledge and its determinants in a Mexican population. *Diabetes Educ,* **25**, 374-81.

Becker, M. H. (1974). The Health Belief Model and Sick Role Behavior. *Health Education & Behavior,* **2**, 409-419.

Bell, J. S., Airaksinen, M. S., Lyles, A., Chen, T. F. & Aslani, P. (2007). Concordance is not synonymous with compliance or adherence. *British Journal of Clinical Pharmacology,* **64**, 710-711.

Benamer, H. (2012). Healthcare System in Libya Factual Report. URL: http://www.libyanhealthservices.com/uploads/1/0/3/7/10376524/healthcare_system_in_libya_factual_report_2012.pdf

Benamer, H., Bredan, A. & Bakoush, O. (2009). The Libyan doctors' brain drain: an exploratory study. *BMC Res Notes,* **2**, 242.

Berg, B. L. (2001). *Qualitative research methods for the social sciences* Boston: Allyn and Bacon.

Berg, B. L. (2007). *Qualitative Research Methods for the Social Sciences.* New York, USA: Pearson Education Inc.

Berg, J., Evangelista, L. s., Carruthers, D. & Dunbar-Jacob, J. M. (2009). Adherence. *In:* Larsen, P. D. & M., L. I. (eds.) *Chronic illness: Impact and interventions.* London: Jones & Bartlett Learning.

Beshyah, S. A. (2010). Non-communicable diseases and diabetes care guidelines: Epidemiology and call for collective action. February, 6th 2010, Dat Elmad

Conference Hall Complex, Tripoli, Libya. *Ibnosina Journal of Medicine and Biomedical Sciences,* **2**, 142-148.

Bizub, D. M. (2004). Do motivational readiness to change and self-efficacy affect treatment adherence among people with type 2 diabetes?

Black, S. A., Markides, K. S. & Ray, L. A. (2003). Depression predicts increased incidence of adverse health outcomes in older Mexican Americans with type 2 diabetes. *Diabetes Care,* **26**, 2822-8.

Black, T. R. (1999). *Doing quantitative research in the social sciences: An integrated approach to research design, measurement and statistics.* Sage Publications Ltd.

Bodenheimer, T., Lorig, K., Holman, H. & Grumbach, K. (2002). Patient self-management of chronic disease in primary care. *Jama,* **288**, 2469-75.

Boudreau, F. & Godin, G. (2009). Understanding physical activity intentions among French Canadians with type 2 diabetes: an extension of Ajzen's theory of planned behaviour. *International Journal of Behavioral Nutrition and Physical Activity,* **6**, 35.

Boulton, A. J. M. & Malik, R. A. (1998). Diabetic Neuropathy. *Medical Clinics of North America,* **82**, 909-929.

Boulton, A. J., Vinik, A. I., Arezzo, J. C., Bril, V., Feldman, E. L., Freeman, R., Malik, R. A., Maser, R. E., Sosenko, J. M., Ziegler, D. & American Diabetes, A. (2005). Diabetic neuropathies: a statement by the American Diabetes Association. *Diabetes Care,* **28**, 956-62.

Boutayeb, A., Twizell, E. H., Achouayb, K. & Chetouani, A. (2004). A mathematical model for the burden of diabetes and its complications. *Biomed Eng Online,* **3**, 20.

Bowling, A. (2002). *Research methods in health.* PA, USA: Open University Press Philadelphia.

Bowling, A. (2009). Research methods in health. Investigating health and health services. *Public health,* **124**, 122-122.

Brannon, L. & Feist, J. (2000). *Health psychology: An introduction to behavior and health.* USA: Wadsworth Publishing Company.

Bridle, C., Riemsma, R. P., Pattenden, J., Sowden, A. J., Mather, L., Watt, I. S. & Walker, A. (2005). Systematic review of the effectiveness of health behavior interventions based on the transtheoretical model. *Psychology & Health,* **20**, 283-301.

Broom, D., & Whittaker, A. (2004). Controlling diabetes, controlling diabetics: moral language in the management of diabetes type 2. *Social Science & Medicine,* **58**, 2371-2382.

Brownlee-Duffeck, M., Peterson, L., Simonds, J. F., Goldstein, D., Kilo, C. & Hoette, S. (1987). The role of health beliefs in the regimen adherence and metabolic control of adolescents and adults with diabetes mellitus. *J Consult Clin Psychol,* **55**, 139-44.

Brownson, C. A. & Heisler, M. (2009). The role of peer support in diabetes care and self-management. *Patient,* **2**, 5-17.

Bryman, A. (1998). Quantitative and qualitative research strategies in knowing the social world. *Knowing the social world*, 138-156.

Bryman, A. (2001). Social science research methods. Oxford: Oxford University Press.

Bryman, A. (2008). Why do researchers integrate/combine/mesh/blend/mix/merge/fuse quantitative and qualitative research. *Advances in mixed methods research*, 87-100.

Burnard, P. (1991). A method of analysing interview transcripts in qualitative research. *Nurse Educ Today,* **11**, 461-6.

Bury, M. (1982). Chronic illness as biographical disruption. *Sociology of Health and Illness,* **4**, 167-182.

Bury, M. (1991). The Sociology of Chronic Illness - a Review of Research and Prospects. *Sociology of Health & Illness,* **13**, 451-468.

Canadian Diabetes Association Clinical Practice Guidelines Expert Committee. (2008). Canadian Diabetes Association 2008 clinical practice guidelines for the prevention and management of diabetes in Canada. **32 (Suppl 1)**. URL: http://www.diabetes.ca/files/cpg2008/cpg-2008.pdf, [01/11/2012].

Carter-Edwards, L., Skelly, A. H., Cagle, C. S. & Appel, S. J. (2004). " They care but don't understand": family support of African American women with type 2 diabetes. *The Diabetes Educator,* **30**, 493.

Casey, M. M., Eime, R. M., Payne, W. R. & Harvey, J. T. (2009). Using a Socioecological Approach to Examine Participation in Sport and Physical Activity Among Rural Adolescent Girls. *Qualitative Health Research,* **19**, 881-893.

Cavill, N., & Bauman, A. (2004). Changing the way people think about health-enhancing physical activity: do mass media campaigns have a role? *Journal of sports sciences,* **22** (8), 771-790

Cerkoney, K. A. B. & Hart, L. K. (1980). The Relationship between the Health Belief Model and Compliance of Persons with Diabetes-Mellitus. *Diabetes Care,* **3**, 594-598.

Chatterjee, J. (2006). From compliance to concordance in diabetes. *Journal of medical ethics,* **32**, 507-510.

Chew, B., Khoo, E. & Chia, Y. (2011). Social Support and Glycemic Control in Adult Patients With Type 2 Diabetes Mellitus. *Asia-Pacific Journal of Public Health*.

Chodosh, J., Morton, S. C., Mojica, W., Maglione, M., Suttorp, M. J., Hilton, L., . . . Shekelle, P. (2005). Meta-Analysis: Chronic Disease Self-Management Programs for Older Adults. *Annals of internal medicine*, **143**(6), 427-438.

Christensen, N. K., Terry, R. D., Wyatt, S., Pichert, J. W. & Lorenz, R. A. (1983). Quantitative assessment of dietary adherence in patients with insulin-dependent diabetes mellitus. *Diabetes Care,* **6**, 245-50.

CIA World Factbook (2012). THE WORLD FACTBOOK: Libya. 24/9/2012 ed. USA: Central Intelligence Agency.

Ciechanowski, P. S., Katon, W. J. & Russo, J. E. (2000). Depression and diabetes: impact of depressive symptoms on adherence, function, and costs. *Arch Intern Med,* **160**, 3278-85.

Clark, J. A. (2006). Field research methods in the Middle East. *PS: Political Science & Politics,* **39**, 417-424.

Clark, N. M. & Becker, M. H. (1998). Theoretical models and strategies for improving adherence and disease management.

Clark, N. M. & Houle, C. R. (2008). Theoretical Models and Strategies for Improving Disease Management by Patients *In:* Riekert, K. A., Ockene, J. K. & Shumaker, S. A. (eds.) *The handbook of health behavior change.* New York Springer Publishing Company.

Clarke, P. (2003). Towards a greater understanding of the experience of stroke: Integrating quantitative and qualitative methods. *Journal of Aging studies,* **17**, 171-187.

Claude, J. & Amy, J. (2011). *An Application of Health Behaviour Models to Diabetic Treatment Adherence: A Comparison of Protection Motivation Theory and The Theory of Planned Behaviour.* Doctor of Philosophy dissertation University of Regina.

Clement, S. (1995). Diabetes self-management education. *Diabetes Care,* **18**, 1204-14.

Coates, V. E. & Boore, J. R. (1996). Knowledge and diabetes self-management. *Patient Educ Couns,* **29**, 99-108.

Cohen, M. Z., Tripp-Reimer, T., Smith, C., Sorofman, B. & Lively, S. (1994). Explanatory models of diabetes: patient practitioner variation. *Social science & medicine,* **38**, 59-66.

Colberg, S. R., Sigal, R. J., Fernhall, B., Regensteiner, J. G., Blissmer, B. J., Rubin, R. R., Chasan-Taber, L., Albright, A. L. & Braun, B. (2010). Exercise and Type 2 Diabetes The American College of Sports Medicine and the American Diabetes Association joint position statement executive summary. *Diabetes Care,* **33**, 2692-2696.

Colleran, K. M., Starr, B. & Burge, M. R. (2003). Putting diabetes to the test: Analyzing glycemic control based on patients' diabetes knowledge. *Diabetes Care,* **26**, 2220-1.

Coombes, L., Allen, D., Humphrey D., & Neale J. (2009). In-depth Interview. *In:* Neale, J. (ed.) *Research methods for health and social care.* New York: Palgrave Macmillan.

Cox, D. J. & Gonder-Frederick, L. (1992). Major developments in behavioral diabetes research. *J Consult Clin Psychol,* **60**, 628-38.

225

Cramer, J. A. (2004). A systematic review of adherence with medications for diabetes. *Diabetes Care,* **27**, 1218-24.

Creswell, J. W. & Clark, V. L. P. (2007). *Designing and conducting mixed methods research.* Wiley Online Library.

Creswell, J. W. (1998). *Qualitative inquiry and research design: Choosing among five traditions.* Thousand Oaks, CA: Sage.

Creswell, J. W. (2009). *Research design: Qualitative, quantitative, and mixed methods approaches.* Thousand Oaks, CA ; London: Sage Publications, Inc.

Creswell, J. W., Plano Clark, V. L., Gutmann, M. L. & Hanson, W. E. (2003). Advanced mixed methods research designs. *Handbook of mixed methods in social and behavioral research*, 209-240.

Davies, M. (2010). Psychological aspects of diabetes management. *Medicine,* **38**, 607-609.

Dawson, C. (2009). *Introduction to research methods: A practical guide for anyone undertaking a research project.* Oxford: How To Books Limited.

DCCT (1993). The Effect of Intensive Treatment of Diabetes on the Development and Progression of Long-Term Complications in Insulin-Dependent Diabetes Mellitus. *New England Journal of Medicine,* **329**, 977-986.

Deakin, T. A., McShane, C. E., Cade, J. E. & Williams, R. (2005). Group based training for self management startegies in people with type 2 diabetes mellitus. *Cochrane Database Syst Rev,* **Issue 2**, 1.

.

Delamater, A. M. (2006). Improving patient adherence. *Clinical Diabetes,* **24**, 71-77.

Denscombe, M. (2007). *The good research guide: for small-scale social research projects.* New York Open University Press.

Diabetes UK. (2005). Recommendations for the provision of services in primary care for people with diabetes. Diabetes. org. uk.

DiMatteo, M. R. (2004). Variations in Patients' Adherence to Medical Recommendations: A Quantitative Review of 50 Years of Research. Medical care, **42**(3), 200-209.

DiMatteo, M. R., Lepper, H. S. & Croghan, T. W. (2000). Depression is a risk factor for noncompliance with medical treatment - Meta-analysis of the effects of anxiety and depression on patient adherence. *Archives of Internal Medicine,* **160**, 2101-2107.

DiŢ, L., BĂBan, A. & DumitraŞCu, D. L. (2012). The impact of the disease severity on the type 2 diabetes mellitus patients satisfaction with quality of care. *(English),* **85**, 573-577.

Dunbar-Jacob, J. & Mortimer-Stephens, M. K. (2001). Treatment adherence in chronic disease. *J Clin Epidemiol,* **54 Suppl 1**, S57-60.

Dunning, T. & Martin, M. (1998). Type 2 diabetes: is it serious? *Journal of Diabetes Nursing,* **2**, 70-76.

Dunning, T. (2009). *Care of people with diabetes: a manual of nursing practice.* UK: Wiley-Blackwell.

Egede, L. E., & Soule, J. B. (2011). Diabetes and acute metabolic complications, infections, and inflammation In K. V. Narayan, D. Williams, E. W. Gregg & C. C. Cowie (Eds.), Diabetes public health: from data to policy Oxford University Press.

El Oakley, R. M., Ghrew, M. H., Aboutwerat, A. A., Alageli, N. A., Neami, K. A., Kerwat, R. M., . . . Bahron, A. M. (2013). Consultation on the Libyan health systems: towards patient-centred services. *The Libyan Journal of Medicine, 8*.

El Taguri, A., Elkhammas, E., Bakoush, O., Ashammakhi, N., Baccoush, M. & Betilmal, I. (2008). Libyan National Health Services The Need to Move to Management-by-Objectives. *Libyan J Med,* **3**, 113-21.

Elfituri, A. A., Elmahaishi, M. S., MacDonald, T. H. & Sherif, F. M. (2006). Health education in the Libyan Arab Jamahiriya: assessment of future needs. *East Mediterr Health J,* **12 Suppl 2**, S147-56.

Elfituri, A., Elmahaishi, M. & MacDonald, T. (1999). Role of health education programmes within the Libyan community. *Eastern Mediterranean health journal= La revue de santé de la Méditerranée orientale= al-Majallah al-ṣiḥḥīyah li-sharq al-mutawassiṭ,* **5**, 268.

Elhisadi, T. A. A. (2009). *Nutrition, Lifestyle and Diabetes-risk of School Children in Derna, Libya.* PhD, Justus-Liebig-University Giessen.

Elhwuegi, A. S., Darez, A. A., Langa, A. M. & Bashaga, N. A. (2012). Cross-sectional pilot study about the health status of diabetic patients in city of Misurata, Libya. *African Health Sciences,* **12**, 81-86.

Elkamel, F. (1995). The use of television series in health education. *Health education research,* **10**, 225-232.

Elkhammas, E. A., & Singh, N. (2010). Towards Reforming Health Care Services In Developing Countries: Taking Libya As An Example. *Ibnosina Journal of Medicine and Biomedical Sciences, 2*(4), 149-151.

Elo, S. & Kyngas, H. (2008). The qualitative content analysis process. *J Adv Nurs,* **62**, 107-15.

El-Shazly, M., Abdel-Fattah, M., Zaki, A., Bedwani, R., Assad, S., Tognoni, G. & Nicolucci, A. (2000). Health care for diabetic patients in developing countries: a case from Egypt. *Public Health (Nature),* **114**, 276-81.

Eltobgi, A. (2009). Libya has the highest prevalence of diabetes mellitus type 2 in North Africa and in the Arab world. *Endocrine Abstracts.*

Ewenighi, C. O., Dimkpa, U., Adejumo, B. I., Onyeanusi, J. C., Nnatuanya, I. N., Simon, U., Onoh, L. U. M. & Ezeugwu, U. (2012). The effect of age, gender, level of adiposity and diabetes duration on glycated hemoglobin reduction after anti-diabetic therapy in type-2 diabetic patients. *Journal of Diabetes Mellitus,* **2**, 245-250.

Farrell, K., Wicks, M. N. & Martin, J. C. (2004). Chronic disease self-management improved with enhanced self-efficacy. *Clin Nurs Res,* **13**, 289-308.

Fattah Badr, S., Elmabsout, A., & Denna, I. (2014). Family Support, Malnutrition and Barriers to Optimal Dietary Intake among Elderly Diabetic Patients in Benghazi, *Libya. J Community Med Health Educ*, **4,** (270), 1-6.

Field, A. P. (2009). *Discovering statistics using SPSS.* California, USA: SAGE publications Ltd.

Fife-Schaw, C., Sheeran, P. & Norman, P. (2007). Simulating behaviour change interventions based on the theory of planned behaviour: Impacts on intention and action. *Br J Soc Psychol,* **46**, 43-68.

Findings, K. E. Y. (2003). Poor adherence to long-term treatment of chronic diseases is a worldwide problem. 2003. *Rev Panam Salud Publica,* **14**, 218-21.

Fitzgerald, J. T., Funnell, M. M., Hess, G. E., Barr, P. A., Anderson, R. M., Hiss, R. G. & Davis, W. K. (1998). The reliability and validity of a brief diabetes knowledge test. *Diabetes Care,* **21**, 706-10.

Fowler, M. J. (2008). Microvascular and Macrovascular Complications of Diabetes. *Clinical Diabetes,* **26**, 77-82.

Franz, M. J., Bantle, J. P., Beebe, C. A., Brunzell, J. D., Chiasson, J. L., Garg, A., Holzmeister, L. A., Hoogwerf, B., Mayer-Davis, E. & Mooradian, A. D. (2002). Evidence-based nutrition principles and recommendations for the treatment and prevention of diabetes and related complications. *Diabetes Care,* **25**, 148-198.

Franz, M. J., Monk, A., Barry, B., McClain, K., Weaver, T., Cooper, N., Upham, P., Bergenstal, R. & Mazze, R. S. (1995). Effectiveness of medical nutrition therapy provided by dietitians in the management of non-insulin-dependent diabetes mellitus: a randomized, controlled clinical trial. *J Am Diet Assoc,* **95**, 1009-17.

Franz, M. J., Powers, M. A., Leontos, C., Holzmeister, L. A., Kulkarni, K., Monk, A., Wedel, N. & Gradwell, E. (2010). The evidence for medical nutrition therapy for type 1 and type 2 diabetes in adults. *J Am Diet Assoc,* **110**, 1852-89.

Freemantle, N., Holmes, J., Hockey, A. & Kumar, S. (2008). How strong is the association between abdominal obesity and the incidence of type 2 diabetes? *International journal of clinical practice,* **62**, 1391-1396.

Fukunishi, I., Horikawa, N., Yamazaki, T., Shirasaka, K., Kanno, K. & Akimoto, M. (1998). Perception and utilization of social support in diabetic control. *Diabetes Res Clin Pract,* **41**, 207-11.

Funnell, M. M., Anderson, R. M., Arnold, M. S., Barr, P. A., Donnelly, M., Johnson, P. D., Taylor-Moon, D. & White, N. H. (1991). Empowerment: an idea whose time has come in diabetes education. *The Diabetes Educator,* **17**, 37-41.

Galal, O. (2003). Nutrition-related health patterns in the Middle East. *Asia Pac J Clin Nutr,* **12**, 337-43.

Gale, L., Vedhara, K., Searle, A., Kemple, T. & Campbell, R. (2008). Patients' perspectives on foot complications in type 2 diabetes: a qualitative study. *The British Journal of General Practice,* **58**, 555.

Garay-Sevilla, M. E., Nava, L. E., Malacara, J. M., Huerta, R., Diaz de Leon, J., Mena, A. & Fajardo, M. E. (1995). Adherence to treatment and social support in patients with non-insulin dependent diabetes mellitus. *J Diabetes Complications,* **9**, 81-6.

General Peoples' Secretariat (1995). National strategy providing health for all and by all. Sert, Libya.

Glasgow, R. E. & Toobert, D. J. (1988). Social-Environment and Regimen Adherence among Type-Ii Diabetic-Patients. *Diabetes Care,* **11**, 377-386.

Glasgow, R. E., McCaul, K. D. & Schafer, L. C. (1987). Self-care behaviors and glycemic control in type I diabetes. *Journal of chronic diseases,* **40**, 399-412.

Goenka, N., Thomas, S., Shaikh, S., Morrisey, J. & Patel, V. (2007). Providing diabetes care to Arab migrants in the UK: cultural and clinical aspects. *The British Journal of Diabetes & Vascular Disease,* **7**, 283-286.

Goetsch, V. & Wiebe, D. (1995). Diabetes mellitus: considerations of the influence of stress. *In:* Goreczny, A. J. (ed.) *Handbook of health and rehabilitation psychology.* New York: Plenum Press.

Goetz, K., Szecsenyi, J., Campbell, S., Rosemann, T., Rueter, G., Raum, E., Brenner, H. & Miksch, A. (2012). The importance of social support for people with type 2 diabetes - a qualitative study with general practitioners, practice nurses and patients. *Psychosoc Med,* **9**, Doc02.

Gohdes, D. (1988). Diet therapy for minority patients with diabetes. *Diabetes Care,* **11**, 189-191.

Goldney, R. D., Phillips, P. J., Fisher, L. J. & Wilson, D. H. (2004). Diabetes, depression, and quality of life: a population study. *Diabetes Care,* **27**, 1066-70.

Goodall, T. A. & Halford, W. K. (1991). Self-management of diabetes mellitus: a critical review. *Health Psychol,* **10**, 1-8.

Gordis, L. (1979). Methodological issues in the measurement of patient compliance. *In:* Sackett, D. L. & Haynes, R. B. (eds.) *Compliance in health care.* Baltimore: Johns Hopkins University Press.

Green, J. & Thorogood, N. (2004). *Qualitative methods for health research.* London: Sage Publications Ltd.

Grinnell, R. M. & Unrau, Y. A. (2008). *Social work research and evaluation: Foundations of evidence-based practice.* New York: Oxford University Press.

Griva, K., Myers, L. B. & Newman, S. (2000). Illness perceptions and self efficacy beliefs in adolescents and young adults with insulin dependent diabetes mellitus. *Psychology & Health,* **15**, 733-750.

Gross, J. L., de Azevedo, M. J., Silveiro, S. P., Canani, L. H., Caramori, M. L. & Zelmanovitz, T. (2005). Diabetic nephropathy: diagnosis, prevention, and treatment. *Diabetes Care,* **28**, 164-76.

Haase, J. E. & Myers, S. T. (1988). Reconciling paradigm assumptions of qualitative and quantitative research. *West J Nurs Res,* **10**, 128-37.

Habib, S. S. & Aslam, M. (2003). Risk factors, knowledge and health status in diabetic patients. *Saudi Med J,* **24**, 1219-24.

Hardon, A., Boonmongkon, P., Streefland, P., Tan, M., Hongvivatana, T., Van der Geest, S. & Van Staa, A. (2001). *Applied health research manual: anthropology of health and health care.* Netherlands: Het Spinhuis.

Harris, M. I., Klein, R., Welborn, T. A. & Knuiman, M. W. (1992). Onset of NIDDM occurs at least 4–7 yr before clinical diagnosis. *Diabetes Care,* **15**, 815-819.

Harris, R. & Linn, M. W. (1985). Health beliefs, compliance, and control of diabetes mellitus. *South Med J,* **78**, 162-6.

Hearnshaw, H. and Lindenmeyer, A. (2005) 'What do we mean by adherence to treatment and advice for living with diabetes? A review of the literature on definitions and measurements', *Diabetic Medicine,* 23(7), 720-728.

Heinrich, E., Schaper, N. C. and de Vries, N. K. (2010) 'Self-management interventions for type 2 diabetes: a systematic review', *European Diabetes Nursing,* 7(2), 71-76.

Heisler, M., Piette, J. D., Spencer, M., Kieffer, E. & Vijan, S. (2005). The relationship between knowledge of recent HbA1c values and diabetes care understanding and self-management. *Diabetes Care,* **28**, 816-822.

Helgeson, V. S., Escobar, O., Siminerio, L. & Becker, D. (2010). Relation of stressful life events to metabolic control among adolescents with diabetes: 5-year longitudinal study. *Health Psychol,* **29**, 153-9.

Henderson, L. C. (2010). Divergent models of diabetes among American Indian elders. *Journal of cross-cultural gerontology,* **25**, 303-316.

Herman, W. H., Ali, M., Aubert, R., Engelgau, M., Kenny, S., Gunter, E., Malarcher, A., Brechner, R., Wetterhall, S. & DeStefano, F. (2009). Diabetes mellitus in Egypt: risk factors and prevalence. *Diabetic Medicine,* **12**, 1126-1131.

Hjelm, K., Isacsson, Å. & Apelqvist, J. (1998). Healthcare professionals' perceptions of beliefs about health and illness in migrants with diabetes mellitus. *Practical Diabetes International,* **15**, 233-237.

Holman, R. R., Paul, S. K., Bethel, M. A., Matthews, D. R. & Neil, H. A. W. (2008). 10-year follow-up of intensive glucose control in type 2 diabetes. *New England Journal of Medicine,* **359**, 1577-1589.

Horne, R., Weinman, J., Barber, N., Elliott, R., Morgan, M. & Cribb, A. (2005). Concordance, adherence and compliance in medicine taking. *London: NCCSDO*, 40-46.

Hsieh, H. F. & Shannon, S. E. (2005). Three approaches to qualitative content analysis. *Qual Health Res,* **15**, 1277-88.

Huang, M. F., Courtney, M., Edwards, H. & McDowell, J. (2010). Factors that affect health outcomes in adults with type 2 diabetes: a cross-sectional study. *Int J Nurs Stud,* **47**, 542-9.

Huddleston, J. S. (2009). Health Promotion and Behavior Change. *In:* Lowenstein, A. J., Foord-May, L. & Romano, J. (eds.) *Teaching Strategies for Health Education and Health Promotion: Working with Patients, Families, and Communities.* Canada: Jones and Bartlett Publishers

Ikeda, K., Aoki, H., Saito, K., Muramatsu, Y. & Suzuki, T. (2003). Associations of blood glucose control with self-efficacy and rated anxiety/depression in type II diabetes mellitus patients. *Psychological reports,* **92**, 540-544.

International Diabetes Federation (2003). *IDF Diabetes Atlas. 2nd ed*. Brussels, Belgium: International Diabetes Federation.

International Diabetes Federation (2009). *Diabetes Atlas, 4th ed. International Diabetes Federation* Brussels, Belgium: International Diabetes Federation.

International Diabetes Federation (2010). Health expenditure for diabetes, 2010 - MENA Diabetes Atlas. Diabetes Atlas.

International Diabetes Federation (2011). *IDF Diabetes atlas.* Brussels, Belgium: International Diabetes Federation, Executive Office.

Ivankova, N. V. & Stick, S. L. (2006). Students' Persistence in a Distributed Doctoral Program in Educational Leadership in Higher Education: A Mixed Methods Study. *Research in Higher Education,* **48**, 93-135.

Janz, N. K. & Becker, M. H. (1984). The health belief model: A decade later. *Health Education & Behavior,* **11**, 1-47.

Jeffcoate, S. L. (2004). Diabetes control and complications: the role of glycated haemoglobin, 25 years on. *Diabet Med,* **21**, 657-65.

Johnson, J. A. (1996). Self-efficacy theory as a framework for community pharmacy-based diabetes education programs. *Diabetes Educator,* **22**, 237-241.

Johnson, R. B. & onwuegbuzie, A. J. (2004). Mixed methods research: A research paradigm whose time has come. *Educational researcher.*

Johnson, S. B. (1992). Methodological issues in diabetes research. Measuring adherence. *Diabetes Care,* **15**, 1658-67.

Jordan, K., Ong, B. N. & Croft, P. (1998). *Mastering statistics: a guide for health service professionals and researchers.* Cheltenham, UK: Stanley Thornes Cheltenham.

Kadiki, O. & Roaeid, R. (2001). Prevalence of diabetes mellitus and impaired glucose tolerance in Benghazi Libya. *Diabetes & metabolism,* **27**, 647-654.

Kadiki, O. A. & Roaed, R. B. (1999). Epidemiological and clinical patterns of diabetes mellitus in Benghazi, Libyan Arab Jamahiriya. *East Mediterr Health J,* **5**, 6-13.

Kanavos, P., van den Aardweg, S. & Schurer, W. (2012). Diabetes expenditure, burden of disease and management in 5 EU countries. *London School of Economics Health.*

Kane, S. V. and Robinson, A. (2010) 'Review article: understanding adherence to medication in ulcerative colitis – innovative thinking and evolving concepts', *Alimentary pharmacology & therapeutics,* 32(9), 1051-1058.

Kavanagh, D. J., Gooley, S. & Wilson, P. H. (1993). Prediction of adherence and control in diabetes. *J Behav Med,* **16**, 509-22.

Khattab, M. S., Aboifotouh, M. A., Khan, M. Y., Humaidi, M. A. & al-Kaldi, Y. M. (1999). Compliance and control of diabetes in a family practice setting, Saudi Arabia. *East Mediterr Health J, 5*, 755-65.

Khoury, S. (2001). A cultural approach to diabetes therapy in the Middle East *Diabetes Voice, 46*, 23-25.

Kilpatrick, E. S., Dominiczak, M. H. & Small, M. (1996). The effects of ageing on glycation and the interpretation of glycaemic control in Type 2 diabetes. *QJM, 89*, 307-12.

Kim, H. S., Sherman, D. K. & Taylor, S. E. (2008). Culture and social support. *Am Psychol, 63*, 518-26.

Kim, H.-Y. (2013). Statistical notes for clinical researchers: assessing normal distribution (2) using skewness and kurtosis. *Restorative Dentistry & Endodontics, 38*, 52-54.

Kirscht, J. P. (1974). The health belief model and illness behavior. *Health Education & Behavior, 2*, 387-408.

Klein, R., Klein, B. E., Moss, S. E., DeMets, D. L., Kaufman, I. & Voss, P. S. (1984). Prevalence of diabetes mellitus in southern Wisconsin. *Am J Epidemiol, 119*, 54-61.

Knight, K., Dornan, T., & Bundy, C. (2006). The diabetes educator: trying hard, but must concentrate more on behaviour. *Diabetic Medicine, 23* (5), 485-501.

Kofi Annan (2001). Report of the Commission on Macroeconomics and Health. London.

Kohner, E., Stratton, I. & Aldington, S. (1993). Prevalence of diabetic retinopathy at diagnosis of NIDDM in the UKPDS. *Invest Ophthalmol and Vis Sci, 34*, 713.

Kramer, J. R., Ledolter, J., Manos, G. N. & Bayless, M. L. (2000). Stress and metabolic control in diabetes mellitus: methodological issues and an illustrative analysis. *Ann Behav Med, 22*, 17-28.

Kriska, A. M., LaPorte, R. E., Patrick, S. L., Kuller, L. H. & Orchard, T. J. (1991). The association of physical activity and diabetic complications in individuals with insulin-dependent diabetes mellitus: the Epidemiology of Diabetes Complications Study--VII. *J Clin Epidemiol, 44*, 1207-14.

Kulkarni, K., Castle, G., Gregory, R., Holmes, A., Leontos, C., Powers, M., Snetselaar, L., Splett, P. & Wylie-Rosett, J. (1998). Nutrition Practice Guidelines for Type 1 Diabetes Mellitus positively affect dietitian practices and patient outcomes. The Diabetes Care and Education Dietetic Practice Group. *J Am Diet Assoc,* **98**, 62-70; quiz 71-2.

Laaksonen, D. E., Atalay, M., Niskanen, L. K., Mustonen, J., Sen, C. K., Lakka, T. A. & Uusitupa, M. I. (2000). Aerobic exercise and the lipid profile in type 1 diabetic men: a randomized controlled trial. *Med Sci Sports Exerc,* **32**, 1541-8.

Langford, C. P., Bowsher, J., Maloney, J. P. & Lillis, P. P. (1997). Social support: a conceptual analysis. *J Adv Nurs,* **25**, 95-100.

Lantz, B. (2012). The large sample size fallacy. *Scandinavian Journal of Caring Sciences*, no-no.

Lee, J. K., Grace, K. A. & Taylor, A. J. (2006). Effect of a pharmacy care program on medication adherence and persistence, blood pressure, and low-density lipoprotein cholesterol: a randomized controlled trial. *Jama*, **296**, 2563-2571.

Lerman, I. (2005). Adherence to treatment: the key for avoiding long-term complications of diabetes. *Arch Med Res,* **36**, 300-6.

Library of Congress: Fedral Research Division (2005). COUNTRY PROFILE: LIBYA April 2005 - Library of Congress. 2005 ed. Library of Congress: Fedral Research Division.

Lloyd CE, H. N., Nouwen A, Pouwer F, Underwood L, Winkley K. (2010). The epidemiology of depression and diabetes. *In:* Katon W, M. M., Sartorius N, (ed.) *Depression and Diabetes.* Oxford: Wiley-Blackwell.

Lloyd, C., Smith, J. & Weinger, K. (2005). Stress and diabetes: a review of the links. *Diabetes Spectrum,* **18**, 121-127.

Lockington, T. J., Farrant, S., Meadows, K. A., Dowlatshahi, D. & Wise, P. H. (1988). Knowledge profile and control in diabetic patients. *Diabet Med,* **5**, 381-6.

Lorig, K. & González, V. M. (2000). Community-based diabetes self-management education: definition and case study. *Diabetes Spectrum,* **13**, 234-238.

Loveman, E., Frampton, G. K. and Clegg, A. (2008) 'The clinical effectiveness of diabetes education models for type 2 diabetes: a systematic review', *Health Technology Assessment,* 12(9), 1-136.

Lustman, P. J., Anderson, R. J., Freedland, K. E., de Groot, M., Carney, R. M. & Clouse, R. E. (2000). Depression and poor glycemic control: a meta-analytic review of the literature. *Diabetes Care,* **23**, 934-42.

Lustman, P. J., Carney, R. & Amado, H. (1981). Acute stress and metabolism in diabetes. *Diabetes Care,* **4**, 658-659.

Lutfey, K. E. & Wishner, W. J. (1999). Beyond" compliance" is" adherence". Improving the prospect of diabetes care. *Diabetes Care,* **22**, 635-639.

Mack, N., Woodsong, C. M., MacQueen, K. M., Guest, G. & Namey, E. (2005). Qualitative research methods: A data collector's field guide. Research Triangle Park, NC: Family Health International.

Madanat, H. N., Troutman, K. P. & Al-Madi, B. (2008). The nutrition transition in Jordan: the political, economic and food consumption contexts. *Promot Educ,* **15**, 6-10.

Maiman, L. A. & Becker, M. H. (1974). The Health Belief Model: Origins and Correlates in Psychological Theory*. *Health Education & Behavior,* **2**, 336-353.

Majeed-Ariss, R., Jackson, C., Knapp, P. & Cheater, F. M. 2013. A systematic review of research into black and ethnic minority patients' views on self-management of type 2 diabetes. *Health Expectations***,** n/a-n/a.

Mangoni, A. A. & Jackson, S. H. D. (2004). Age-related changes in pharmacokinetics and pharmacodynamics: basic principles and practical applications. *British Journal of Clinical Pharmacology,* **57**, 6-14.

Mann, D. M., Ponieman, D., Leventhal, H. & Halm, E. A. (2009). Misconceptions about diabetes and its management among low-income minorities with diabetes. *Diabetes Care,* **32**, 591-593.

Markus, H. R. & Kitayama, S. (1991). Culture and the Self - Implications for Cognition, Emotion, and Motivation. *Psychological review,* **98**, 224-253.

Marshall, S. M. (2004). Recent advances in diabetic nephropathy. *Postgrad Med J,* **80**, 624-33.

Martin, L. R., Williams, S. L., Haskard, K. B. & Dimatteo, M. R. (2005). The challenge of patient adherence. *Ther Clin Risk Manag,* **1**, 189-99.

Mayberry, L. S. & Osborn, C. Y. (2012). Family Support, Medication Adherence, and Glycemic Control Among Adults With Type 2 Diabetes. *Diabetes Care,* **35**, 1239-1245.

McCaul, K. D., Glasgow, R. E. & Schafer, L. C. (1987). Diabetes regimen behaviors. Predicting adherence. *Med Care,* **25**, 868-81.

McCleary-Jones, V. (2011). Health Literacy and Its Association with Diabetes Knowledge, Self-Efficacy and Disease Self-Management Among African Americans with Diabetes Mellitus. *ABNF Journal,* **22**, 25-32.

McLean, A. J. & Le Couteur, D. G. (2004). Aging biology and geriatric clinical pharmacology. *Pharmacological reviews,* **56**, 163-184.

McNabb, W. L. (1997). Adherence in Diabetes: Can We Define It and Can We Measure It? *Diabetes Care,* **20**, 215.

McPherson, M. L., Smith, S. W., Powers, A. & Zuckerman, I. H. (2008). Association between diabetes patients' knowledge about medications and their blood glucose control. *Res Social Adm Pharm,* **4**, 37-45.

Minet, L., Møller, S., Vach, W., Wagner, L. and Henriksen, J. E. (2010) 'Mediating the effect of self-care management intervention in type 2 diabetes: A meta-analysis of 47 randomised controlled trials', *Patient education and counseling,* 80(1), 29-41.

Mitchell, M. L. & Jolley, J. M. (2010). *Research design explained.* USA: Wadsworth Pub Co.

Morgan, D. L. (1998). Practical strategies for combining qualitative and quantitative methods: applications to health research. *Qual Health Res,* **8**, 362-76.

Morgan, D. L. (2006). Connected contributions as a motivation for combining qualitative and quantitative methods. *Applying qualitative and mixed methods in aging and public health research. Washington, DC: American Public Health Association.*

Morgan, D. L. (2007). Paradigms Lost and Pragmatism Regained Methodological Implications of Combining Qualitative and Quantitative Methods. *Journal of mixed methods research,* **1**, 48-76.

Morris, S. F. & Wylie-Rosett, J. (2010). Medical nutrition therapy: a key to diabetes management and prevention. *Clinical Diabetes,* **28**.

Morse, J. M. (1991). Approaches to qualitative-quantitative methodological triangulation. *Nurs Res,* **40**, 120-3.

Mufunda, E., Wikby, K., Bjorn, A. & Hjelm, K. (2012). Level and determinants of diabetes knowledge in patients with diabetes in Zimbabwe: a cross-sectional study. *Pan Afr Med J,* **13**, 78.

Mullooly, C. & Hanson, K. (2003). Physical activity/exercise. *A core curriculum for diabetes education, diabetes management therapies*, 59-92.

Murata, G. H., Shah, J. H., Adam, K. D., Wendel, C. S., Bokhari, S. U., Solvas, P. A., Hoffman, R. M. & Duckworth, W. C. (2003). Factors affecting diabetes knowledge in Type 2 diabetic veterans. *Diabetologia,* **46**, 1170-8.

Murphy, E. & Kinmount, A. L. (1995). No symptoms, no problem? Patients′ understandings of non-insulin dependent diabetes. *Family Practice,* **12**, 184-192.

Musaiger, A. (2004). Overweight and obesity in the Eastern Mediterranean Region: can we control it. *East Mediterr Health J,* **10**, 789-793.

Musaiger, A. O. (2002). Diet and prevention of coronary heart disease in the Arab Middle East countries. *Med Princ Pract,* **11 Suppl 2**, 9-16.

Musaiger, A. O. (2011). Overweight and obesity in eastern mediterranean region: prevalence and possible causes. *J Obes,* **2011**, 407237.

Natarajan, S., Clyburn, E. B. & Brown, R. T. (2002). Association of exercise stages of change with glycemic control in individuals with type 2 diabetes. *American Journal of Health Promotion,* **17**, 72-75.

National Health Service (2012). Factsheet No. 37: Foot care for people with diabetes in the NHS in England: The economic case for change. March 2012 ed. UK: NHS Diabetes

Nau, D. P. (2012). Recommendations for improving adherence to type 2 diabetes mellitus therapy--focus on optimizing oral and non-insulin therapies. *Am J Manag Care,* **18**, S49-54.

Nelson, K. M., Reiber, G. & Boyko, E. J. (2002). Diet and exercise among adults with type 2 diabetes findings from the third national health and nutrition examination survey (NHANES III). *Diabetes Care,* **25**, 1722-1728.

Nielsen, P. J., Hafdahl, A. R., Conn, V. S., LeMaster, J. W. & Brown, S. A. (2006). Meta-analysis of the effect of exercise interventions on fitness outcomes among adults with type 1 and type 2 diabetes. *Diabetes research and clinical practice,* **74**, 111-120.

Norris, S., Lau, J., Smith, S., Schmid, C. and Engelgau, M. (2002) 'Self-management education for adults with type 2 diabetes: a meta-analysis of the effect on glycemic control', *Diabetes Care,* 25, 1159 - 1171.

Nydell, M. K. (2006). Understanding Arabs: A guide for modern times, 4th Edition Bosten, Intercultural Press.

O'Cathain, A., Murphy, E. & Nicholl, J. (2007). Why, and how, mixed methods research is undertaken in health services research in England: a mixed methods study. *BMC Health Serv Res,* **7**, 85.

Omran, A. R. (2005). The epidemiologic transition: a theory of the epidemiology of population change. 1971. *Milbank Q,* **83**, 731-57.

Onwuegbuzie, A. J. & Leech, N. L. (2005). On becoming a pragmatic researcher: The importance of combining quantitative and qualitative research methodologies. *International Journal of Social Research Methodology,* **8**, 375-387.

Oppenheim, A. N. (1992). *Questionnaire design, interviewing and attitude measurement.* London, UK: Continuum Intl Pub Group.

Otman, W. & Karlberg, E. (2007). *The Libyan economy: economic diversification and international repositioning.* Aberdeen, UK: Springer.

Padgett, D. K. (1991). Correlates of Self-Efficacy Beliefs among Patients with Non-Insulin-Dependent Diabetes-Mellitus in Zagreb, Yugoslavia. *Patient education and counseling,* **18**, 139-147.

Padgett, D., Mumford, E., Hynes, M. & Carter, R. (1988). Meta-analysis of the effects of educational and psychosocial interventions on management of diabetes mellitus. *J Clin Epidemiol,* **41**, 1007-30.

Pani, L. N., Korenda, L., Meigs, J. B., Driver, C., Chamany, S., Fox, C. S., Sullivan, L., D'Agostino, R. B. & Nathan, D. M. (2008). Effect of Aging on A1C Levels in Individuals Without Diabetes Evidence from the Framingham Offspring Study and the National Health and Nutrition Examination Survey 2001–2004. *Diabetes Care,* **31**, 1991-1996.

Parahoo, K. (1997). *Nursing research: principles, process and issues.* New York: Palgrave Macmillan.

Pastors, J. G., Franz, M. J., Warshaw, H., Daly, A. & Arnold, M. S. (2003). How effective is medical nutrition therapy in diabetes care? *Journal of the American Dietetic Association,* **103**, 827-831.

Peyrot, M., Rubin, R. R., Lauritzen, T., Snoek, F. J., Matthews, D. R. & Skovlund, S. E. (2005). Psychosocial problems and barriers to improved diabetes management: results of the Cross-National Diabetes Attitudes, Wishes and Needs (DAWN) Study. *Diabet Med,* **22**, 1379-85.

Pfister, G. (2006). Islam and Women's Sports. *SangSaeng: Living together, helping each other*, 12-15.

Plano Clark, V. & Creswell, J. (2011). Designing and conducting mixed methods research. Thousand Oaks (California): Sage Publications.

Plotnikoff, R. C., Lippke, S., Courneya, K., Birkett, N. & Sigal, R. (2010). Physical activity and diabetes: an application of the theory of planned behaviour to explain physical activity for Type 1 and Type 2 diabetes in an adult population sample. *Psychol Health,* **25**, 7-23.

Pope, C. & Mays, N. (1995). Reaching the parts other methods cannot reach: an introduction to qualitative methods in health and health services research. *BMJ,* **311**, 42-5.

Pouwer, F., Geelhoed-Duijvestijn, P. H., Tack, C. J., Bazelmans, E., Beekman, A. J., Heine, R. J. & Snoek, F. J. (2010). Prevalence of comorbid depression is high in out-patients with Type 1 or Type 2 diabetes mellitus. Results from three out-patient clinics in the Netherlands. *Diabet Med,* **27**, 217-24.

Priester, R., Kane, R. L. & Totten, A. M. 2005. How the Current System Fails People With Chronic Illnesses.

Prochaska, J. O. & DiClemente, C. C. (1983). Stages and processes of self-change of smoking: toward an integrative model of change. *Journal of consulting and clinical psychology,* **51**, 390.

Prochaska, J. O. & DiClemente, C. C. (1984). *The transtheoretical approach: Crossing traditional boundaries of therapy.* Chicago: Dow Jones/Irwin

Prochaska, J. O., Diclemente, C. C. & Norcross, J. C. (1992). In Search of How People Change - Applications to Addictive Behaviors. *American Psychologist,* **47**, 1102-1114.

Punch, K. (2003). *Survey research: The basics.* London: Sage Publications Ltd.

Rahim, H. F. A., Sibai, A., Khader, Y., Hwalla, N., Fadhil, I., Alsiyabi, H., Husseini, A. (2014). Non-communicable diseases in the Arab world. *The Lancet, 383*(9914), 356-367.

Ramachandran, A., & Snehalatha, C. (2011). Diabetes prevention and control programs in developing countries In K. V. Narayan, D. Williams, E. W. Gregg & C. C. Cowie (Eds.), Diabetes public health: from data to policy Oxford University Press.

RAOSOFT. (2009). *Sample size calculation* URL: http://www.ezsurvey.com/samplesize.htm [20/ 11/2009].

Rappaport, J. (1987). Terms of empowerment/exemplars of prevention: toward a theory for community psychology. *Am J Community Psychol,* **15**, 121-48.

Redman, S., Spencer, E. A. & Sanson-Fisher, R. W. (1990). The role of mass media in changing health-related behaviour: a critical appraisal of two models. *Health Promotion International,* **5**, 85-101.

Roaeid, R. & Kablan, A. (2007). Profile of diabetes health care at Benghazi Diabetes Centre, Libyan Arab Jamahiriya. *Eastern Mediterranean health journal,* **13**, 168.

Roaeid, R. & Kadiki, O. (2011). Prevalence of long-term complications among Type 2 diabetic patients in Benghazi, Libya. *Journal of Diabetology,* **3**, 5.

Robertson, M. (2006). Sexual dysfunction in people with diabetes. *Diabetes Voice,* **51**, 22-25.

Roeloffs, C., Sherbourne, C., Unützer, J., Fink, A., Tang, L. & Wells, K. B. (2003). Stigma and depression among primary care patients. *General hospital psychiatry,* **25**, 311-315.

Rosenstock, I. M. (1974). Historical origins of the health belief model. *Health Education & Behavior,* **2**, 328-335.

Rosenstock, I. M. (1985). Understanding and enhancing patient compliance with diabetic regimens. *Diabetes care,* **8**, 610-616.

Rosenstock, I. M., Strecher, V. J. & Becker, M. H. (1988). Social learning theory and the health belief model. *Health Education & Behavior,* **15**, 175-183.

Rothman, A. J. (2000). Toward a theory-based analysis of behavioral maintenance. *Health Psychol,* **19**, 64-9.

Rubin, R. R. & Peyrot, M. (1992). Psychosocial problems and interventions in diabetes. A review of the literature. *Diabetes Care,* **15**, 1640-57.

Ruggiero, L., Glasgow, R., Dryfoos, J. M., Rossi, J. S., Prochaska, J. O., Orleans, C. T., Prokhorov, A. V., Rossi, S. R., Greene, G. W., Reed, G. R., Kelly, K., Chobanian, L. & Johnson, S. (1997). Diabetes self-management. Self-reported recommendations and patterns in a large population. *Diabetes Care,* **20**, 568-76.

Rutter, D. & Quine, L. (2002). Social cognition models and changing health behaviours. *In:* Rutter, D. & Quine, L. (eds.) *Changing health behaviour: Intervention and research with social cognition models.* Maidenhead, BRK England: Open University Press.

Saadi, H., Carruthers, S. G., Nagelkerke, N., Al-Maskari, F., Afandi, B., Reed, R., Lukic, M., Nicholls, M. G., Kazam, E., Algawi, K., Al-Kaabi, J., Leduc, C., Sabri, S., El-Sadig, M., Elkhumaidi, S., Agarwal, M. & Benedict, S. (2007). Prevalence of diabetes mellitus and its complications in a population-based sample in Al Ain, United Arab Emirates. *Diabetes Res Clin Pract,* **78**, 369-77.

Sacks, D. B. (2008). Translating hemoglobin A1c into average blood glucose: implications for clinical chemistry. *Clinical chemistry,* **54**, 1756-1758.

Sanders, P. & Wilkins, P. (2010). *First steps in practitioner research: a guide to understanding and doing research in counselling and health and social care.* Ross-on-Wye: PCCS.

Sarason, I. G., Levine, H. M., Basham, R. B. & Sarason, B. R. (1983). Assessing Social Support - the Social Support Questionnaire. *Journal of personality and social psychology,* **44**, 127-139.

Sarkar, U., Fisher, L. & Schillinger, D. (2006). Is Self-Efficacy Associated With Diabetes Self-Management Across Race/Ethnicity and Health Literacy? *Diabetes Care,* **29**, 823-829.

Savoca, M. & Miller, C. (2001). Food selection and eating patterns: Themes found among people with type 2 diabetes mellitus. *Journal of Nutrition Education,* **33**, 224-233.

Schafer, L. C., Glasgow, R. E., McCaul, K. D. & Dreher, M. (1983). Adherence to IDDM regimens: relationship to psychosocial variables and metabolic control. *Diabetes Care,* **6**, 493-8.

Schneider, S. H., Khachadurian, A. K., Amorosa, L. F., Clemow, L. & Ruderman, N. B. (1992). Ten-year experience with an exercise-based outpatient life-style modification program in the treatment of diabetes mellitus. *Diabetes Care,* **15**, 1800-10.

Schoenthaler, A. M., Schwartz, B. S., Wood, C. & Stewart, W. F. (2012). Patient and physician factors associated with adherence to diabetes medications. *Diabetes Educ,* **38**, 397-408.

Shaban, M. C., Fosbury, J., Kerr, D. & Cavan, D. A. (2006). The prevalence of depression and anxiety in adults with Type 1 diabetes. *Diabet Med,* **23**, 1381-4.

Shakibazadeh, E., Larijani, B., Shojaeezadeh, D., Rashidian, A., Forouzanfar, M. H. & Bartholomew, L. K. (2011). Patients' perspectives on factors that influence diabetes self-care. *Iranian Journal of Public Health,* **40**, 146-158.

Shiu, A. T., Kwan, J. J. Y. & Wong, R. Y. (2003). Research in brief. Social stigma as a barrier to diabetes self-management: implications for multi-level interventions. *Journal of Clinical Nursing,* **12**, 149-150.

Shultz, J. A., Sprague, M. A., Branen, L. J. & Lambeth, S. (2001). A comparison of views of individuals with type 2 diabetes mellitus and diabetes educators about barriers to diet and exercise. *Journal of Health Communication,* **6**, 99-115.

Simmons, D. (2001). Personal Barriers to Diabetes Care: Is It Me, Them, or Us?: Preface. *Diabetes Spectrum,* **14**, 10-12.

Simon, G. E., Katon, W. J., Lin, E. H. B., Rutter, C., Manning, W. G., Von Korff, M., Ciechanowski, P., Ludman, E. J. & Young, B. A. (2007). Cost-effectiveness of systematic depression treatment among people with diabetes mellitus. *Archives of general psychiatry,* **64**, 65-72.

Sircar, A. R., Sircar, S., Sircar, J. & Misra, S. (2010). Patients' concepts and attitudes about diabetes. *J Diabetes Complications,* **24**, 398-403.

Skinner, T. C. & Cradock, S. (2000). Empowerment: what about the evidence? *Practical Diabetes International,* **17**, 91-95.

Skyler, J. S., Bergenstal, R., Bonow, R. O., Buse, J., Deedwania, P., Gale, E. A. M., Howard, B. V., Kirkman, M. S., Kosiborod, M. & Reaven, P. (2009). Intensive glycemic control and the prevention of cardiovascular events: implications of the ACCORD, ADVANCE, and VA Diabetes Trials. *Circulation,* **119**, 351-357.

Slife, B. D. & Williams, R. N. (1995). *What's behind the research?: Discovering hidden assumptions in the behavioral sciences.* Thousand Oaks, California: Sage Publications, Inc.

Snowling, N. J. & Hopkins, W. G. (2006). Effects of different modes of exercise training on glucose control and risk factors for complications in type 2 diabetic patients: a meta-analysis. *Diabetes Care,* **29**, 2518-27.

Sommer, L. (2011). The theory of planned behaviour and the impact of past behaviour. *International Business & Economics Research Journal (IBER),* **10**.

Sprague, M. A., Shultz, J. A., Branen, L. J., Lambeth, S. & Hillers, V. N. (1999). Diabetes educators' perspectives on barriers for patients and educators in diabetes education. *Diabetes Educ,* **25**, 907-16.

Steinsbekk, A., Ø Rygg, L., Lisulo, M., Rise, M. B. and Fretheim, F. (2012) 'Group based diabetes self-management education compared to routine treatment for people with type 2 diabetes mellitus. A systematic review with meta-analysis', *BMC health services research,* 12(1), 213-231.

Stettler, C., Allemann, S., Juni, P., Cull, C. A., Holman, R. R., Egger, M., Krahenbuhl, S. & Diem, P. (2006). Glycemic control and macrovascular disease in types 1 and 2 diabetes mellitus: Meta-analysis of randomized trials. *Am Heart J,* **152**, 27-38.

Strecher, V. J., DeVellis, B. M. E., Becker, M. H. & Rosenstock, I. M. (1986). The role of self-efficacy in achieving health behavior change. *Health Education & Behavior,* **13**, 73-92.

Sulaiman, N., Hamdan, A., Tamim, H., Mahmood, D. A. & Young, D. (2010). The prevalence and correlates of depression and anxiety in a sample of diabetic patients in Sharjah, United Arab Emirates. *BMC Fam Pract,* **11**, 80.

Tan, M. Y. (2004). The relationship of health beliefs and complication prevention behaviors of Chinese individuals with Type 2 Diabetes Mellitus. *Diabetes research and clinical practice,* **66**, 71-77.

Tashakkori, A. & Teddlie, C. (1998). *Mixed methodology: Combining qualitative and quantitative approaches.* Thousand Oaks, California: Sage Publications, Inc.

Tashakkori, A. & Teddlie, C. (2003). *Handbook of mixed methods in social & behavioral research.* Thousand Oaks, Claifornia: Sage Publications, Inc.

Tavakol, M. & Dennick, R. (2011). Making sense of Cronbach's alpha. *International Journal of Medical Education,* **2**, 53-55.

Taylor, S. E., Sherman, D. K., Kim, H. S., Jarcho, J., Takagi, K. & Dunagan, M. S. (2004). Culture and social support: who seeks it and why? *Journal of personality and social psychology,* **87**, 354.

Thogersen-Ntoumani, C. & Fox, K. R. (2005). Physical activity and mental well-being typologies in corporate employees: A mixed methods approach. *Work & Stress,* **19**, 50-67.

Thompson-Reid, P. & Ernst, K. L. 2011. The Diabetes Prevention and Control Programs in the United States and Public Health Law and Policy. In: NARAYAN, K. V., WILLIAMS, D., GREGG, E. W. & COWIE, C. C. (eds.) Diabetes public health: from data to policy. Oxford University Press.

Toljamo, M. & Hentinen, M. (2001). Adherence to self-care and glycaemic control among people with insulin-dependent diabetes mellitus. *Journal of advanced nursing,* **34**, 780-786.

Trento, M., Gamba, S., Gentile, L., Grassi, G., Miselli, V., Morone, G., Passera, P., Tonutti, L., Tomalino, M., Bondonio, P., Cavallo, F., Porta, M. & Investigators, R. (2010). Rethink Organization to iMprove Education and Outcomes (ROMEO): a multicenter randomized trial of lifestyle intervention by group care to manage type 2 diabetes. *Diabetes Care,* **33**, 745-7.

Trento, M., Passera, P., Tomalino, M., Bajardi, M., Pomero, F., Allione, A., Vaccari, P., Molinatti, G. M. & Porta, M. (2001). Group visits improve metabolic control in type 2 diabetes: a 2-year follow-up. *Diabetes Care,* **24**, 995-1000.

Tripp-Reimer, T., Choi, E., Kelley, S. & Enslein, J. C. (2001). Cultural barriers to care: inverting the problem. *Diabetes Spectrum,* **14**, 13-22.

UK Prospective Diabetes Study (1990). UK Prospective Diabetes Study 7: response of fasting plasma glucose to diet therapy in newly presenting type II diabetic patients. *Metabolism,* **39**, 905-912.

UK Prospective Diabetes Study (1998). Intensive blood-glucose control with sulphonylureas or insulin compared with conventional treatment and risk of complications in patients with type 2 diabetes (UKPDS 33). *lancet,* **352**, 837-853.

Ulin, P. R., Robinson, E. T. & Tolley, E. E. (2005). *Qualitative methods in public health: A field guide for applied research.* San Francisco,CA: Jossey-Bass Inc Pub.

UNDP's Human development Indicators (2011). Libya Country Profile: Human Development Indicators, HDI values and rank changes in the 2011 Human Development Report. UNDP.

Van Der Ven, N. C., Weinger, K., Yi, J., Pouwer, F., Ader, H., Van Der Ploeg, H. M. & Snoek, F. J. (2003). The confidence in diabetes self-care scale: psychometric properties of a new measure of diabetes-specific self-efficacy in Dutch and US patients with type 1 diabetes. *Diabetes Care,* **26**, 713-8.

Van Nes, F., Abma, T., Jonsson, H. & Deeg, D. (2010). Language differences in qualitative research: is meaning lost in translation? *European journal of ageing,* **7**, 313-316.

Verma, M., Paneri, S., Badi, P. & Raman, P. G. (2006). Effect of increasing duration of diabetes mellitus type 2 on glycated hemoglobin and insulin sensitivity. *Indian J Clin Biochem,* **21**, 142-6.

Vermeire, E., Hearnshaw, H., Ratsep, A., Levasseur, G., Petek, D., van Dam, H., van der Horst, F., Vinter-Repalust, N., Wens, J., Dale, J. & Van Royen, P. (2007). Obstacles to adherence in living with type-2 diabetes: an international qualitative study using meta-ethnography (EUROBSTACLE). *Prim Care Diabetes,* **1**, 25-33.

Wagner, E. H. (1998). More Than a Case Manager. *Annals of internal medicine,* **129**, 654-656.

Wagner, E. H. (2000). The role of patient care teams in chronic disease management. *BMJ,* **320**, 569-72.

Wang, C. Y. & Fenske, M. M. (1996). Self-care of adults with non-insulin-dependent diabetes mellitus: influence of family and friends. *Diabetes Educ,* **22**, 465-70.

Wang, J. Q. & Tak-Ying Shiu, A. (2004). Diabetes self-efficacy and self-care behaviour of Chinese patients living in Shanghai. *J Clin Nurs,* **13**, 771-2.

Watson M. & Coombes, L. (2009). Survey. *In:* Neale, J. (ed.) *Research methods for health and social care.* New York: Palgrave Macmillan.

Wen, L. K., Parchman, M. L., & Shepherd, M. D. (2004). Family support and diet barriers among older Hispanic adults with type 2 diabetes. *FAMILY MEDICINE-KANSAS CITY-, 36*, 423-430.

Werner, P. (2004). Reasoned Action and Planned Behavior. *In:* Peterson, S. J. & Bredow, T. S. (eds.) *Middle range Theories: Application to Nursing Research.* Philadelphia: Lippincott Williams & Wilkins.

Whiting, D. R., Guariguata, L., Weil, C. & Shaw, J. (2011). IDF diabetes atlas: global estimates of the prevalence of diabetes for 2011 and 2030. *Diabetes Res Clin Pract,* **94**, 311-21.

Whittemore, R. (2000). Strategies to facilitate lifestyle change associated with diabetes mellitus. *J Nurs Scholarsh,* **32**, 225-32.

Wild, S., Roglic, G., Green, A., Sicree, R. & King, H. (2004). Global prevalence of diabetes: estimates for the year 2000 and projections for 2030. *Diabetes Care,* **27**, 1047-53.

Williams, K. & Bond, M. (2002). The roles of self-efficacy, outcome expectancies and social support in the self-care behaviours of diabetics. *Psychology, Health & Medicine,* **7**, 127-141.

World Bank. (2012). *Libya*. URL: http://data.worldbank.org/country/libya [07/08/2013].

World Data on Education (2007). Libyan Arab Jamahiriya - International Bureau of Education - UNESCO. *2006-2007.* April 2007 ed.: UNESCO-IBE.

World Health Organization (1980). WHO Expert Committee on Diabetes Mellitus. Education. Second report. Technical report series 646 Geneva.

World Health Organization (2001). Adherence to long-term therapies: policy for action. *World Health Organization.* Geneva: World Health Organization.

World Health Organization (2003). Adherence to long-term therapies: evidence for action. Geneva: World Health Organization.

World Health Organization (2006). Definition and diagnosis of diabetes mellitus and intermediate hyperglycemia: report of a WHO/IDF Consultation. Geneva: World Health Organization.

World Health Organization (2007). Health System profile: Libya, Eastern Mediterranean Regional Health System Observatory. Geneva: World Health Organization

World Health Organization (2009). *STEP wise approach to chronic disease risk factor surveillance: report from Libya*. URL: http://www.who.int/chp/steps/libya/en/ [1/7/ 2010].

World Health Organization (2011). Country cooperation strategy for WHO and the Libyan Arab Jamahiriya 2010-2015. *Cairo: Regional Office for the Eastern Mediterranean*.

World Health Organization (2013). *Health Education*. URL: http://www.who.int/topics/health_education/en/ [01/07/2013].

Wulsin, L. R. & Singal, B. M. (2003). Do depressive symptoms increase the risk for the onset of coronary disease? A systematic quantitative review. *Psychosomatic medicine,* **65**, 201-210.

Yach, D., Stuckler, D. & Brownell, K. D. (2006). Epidemiologic and economic consequences of the global epidemics of obesity and diabetes. *Nat Med,* **12**, 62-6.

Zabaleta, A. M. and Forbes, A. (2007) 'Structured group-based education for type 2 diabetes in primary care', *British Journal of Community Nursing,* 12(4), 158-162.

Zgibor, J. C. & Songer, T. J. (2001). External barriers to diabetes care: addressing personal and health systems issues. *Diabetes Spectrum,* **14**, 23-28.

Zimmet, P. (2009). Preventing diabetic complications: a primary care perspective. *Diabetes Res Clin Pract,* **84**, 107-16.

Appendix (1)

Ethical Approval

<u>**Ethical Approval**</u>

10/HEA/004 - Knowledge and Adherence to health advices among adults with diabetes in Libya

Liverpool John Moores University Research Ethics Committee (REC) reviewed the above project and I am happy to inform you the Committee are content to give a favourable ethical opinion

Approval is given on the understanding that:

- any adverse reactions/events which take place during the course of the project will be reported to the Committee immediately;
- any unforeseen ethical issues arising during the course of the project will be reported to the Committee immediately;
- any substantive amendments to the protocol will be reported to the Committee immediately.
- the LJMU logo is used for all documentation relating to participant recruitment and participation e.g. poster, information sheets, consent forms, questionnaires. The JMU logo can be accessed at www.ljmu.ac.uk/images/jmulogo

For details on how to report adverse events or amendments please refer to the information provided at
http://www.ljmu.ac.uk/RGSO/RGSO_Docs/EC8Adverse.pdf

Please note that ethical approval is given for a period of five years from the date granted and therefore the expiry date for this project will be February 2015. An application for extension of approval must be submitted if the project continues after this date.

Yours sincerely

PP:

Brian Kerrigan

Chair of the LJMU REC

Tel: 0151 231 3110

E-mail:a.f.williams@ljmu.ac.uk

CC: Supervisor

Translation the consent of Benghazi Diabetes Centre

Date: 16/02/2010

Re: Request to Conduct PhD Field Work in Benghazi Diabetes Centre

Dear Mr Walid Elkharam

We write to inform you that the Benghazi Diabetes & Endocrinology Centre in Libya has welcomed Mr. Elkharam to conduct his PhD work study in the Clinic.

Please do not hesitate to contact us again for any further information.

Sincerely

Dr Tarek Elsharif

The General Manger of Benghazi diabetes Canter

Tel: 00218 61 9092027/9099176
Fax: 00218 61 9098836
PO BOX: 376
E-mail: info@bdec.org.ly

Appendix (2)

Subheading

Liverpool John Moores University

QUESTIONNIRE FOR PEOPLE WITH DIABETES

The questionnaire will take no longer than 20 minutes to complete

(1). BACKGROUND INFORMATION

This section is background information about you and your diabetes. Please read each item and then tick <u>one or answer</u> the following items as appropriate:

1. Gender Male ☐ Female ☐	2. Age last birthday .... years	3. Education a. Primary/intermediate ☐ b. Secondary/diploma ☐ c. University and above ☐ d. None ☐
4. Annual income: ………… (Libyan Dinars)	5. Family history of diabetes [in a first-degree relative(s)] Yes ☐ No ☐	6. Presences of any diabetes complications (eye, nerve, kidney, and heart disease). Yes ☐ No ☐
7. How long have you had Diabetes? ………….. Months	8. Type of treatment a. Diet ☐ b. Oral ☐ c. Insulin ☐ d. Oral and insulin ☐	9. Last result of Glycosylated hemoglobin test (HbA1$_c$) …………………

Appendix (3)

Diabetes knowledge Test (DKT)

The questionnaire originally presented here cannot be made freely available via LJMU Digital Collections because of copyright. The diabetes knowledge test was sourced at Fitzgerald, J., et al. (1998). "The reliability and validity of a brief diabetes knowledge test." Diabetes Care 21: 706 - 710.

Appendix (4)

DIABETES SELF EFFICACY SCALE

The confidence in diabetes self-care scale presented here cannot be made freely available via LJMU Digital Collections because of copyright. The questionnaire was sourced at Van Der Ven, N. C., et al. (2003). "The confidence in diabetes self-care scale: psychometric properties of a new measure of diabetes-specific self-efficacy in Dutch and US patients with type 1 diabetes." Diabetes Care 26(3): 713-718.

Appendix (5)

Consent Forms- Phase One Study

LIVERPOOL JOHN MOORES UNIVERSITY

CONSENT FORM

Knowledge of and adherence to health advices among adults with diabetes in Libya

Phase one study

Mr. Walid M.A. Elkharam, Faculty of Health & Applied Social Science, Liverpool John Moores University

1. I confirm that I have read and understand the information provided for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily

2. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving a reason and that this will not affect my legal rights.

3. I understand that any personal information collected during the study will be anonymised and remain confidential

4. I agree to take part in the above study

Name of Participant   Date   Signature

Name of Researcher   Date   Signature

Name of Person taking consent   Date   Signature
(if different from researcher)

Note: When completed 1 copy for participant and 1 copy for researcher

Appendix (6)

The Q-Q plot

Normal Q-Q Plot of HbA1c Test result

Normal Q-Q Plot of Total knowledge score

264

Normal Q-Q Plot of Total score of self efficacy

Normal Q-Q Plot of Total general diabetes knowledge
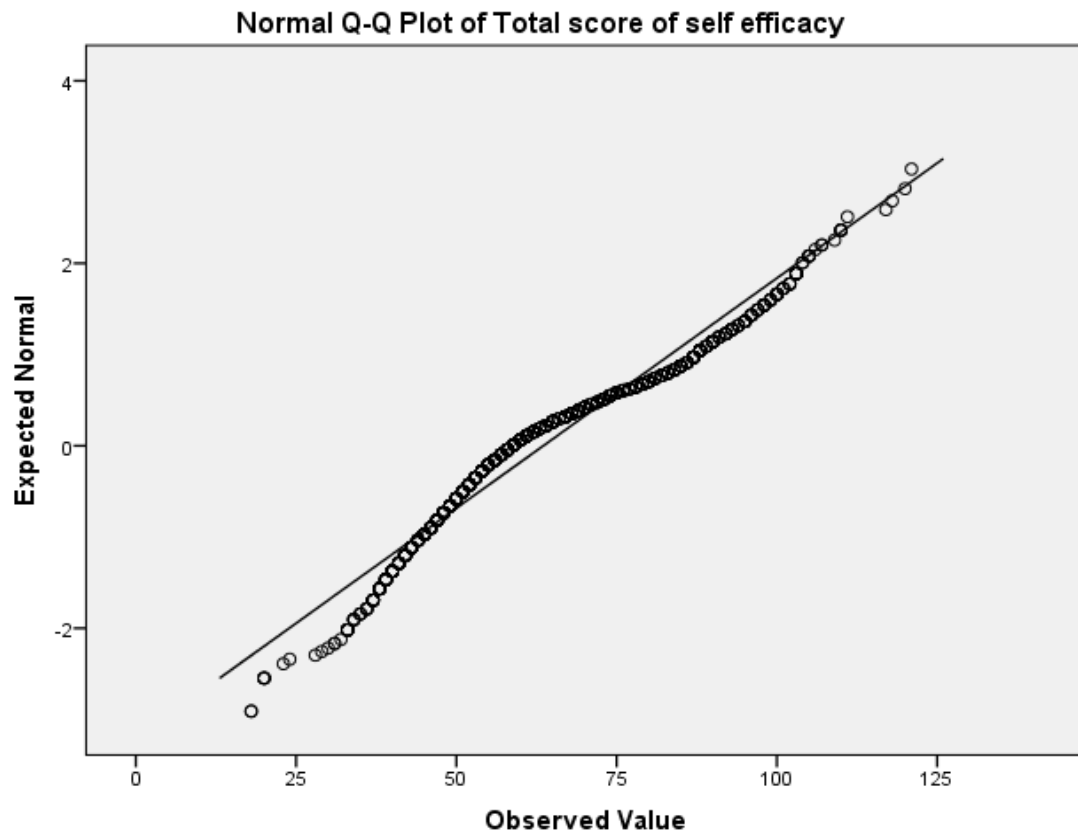
Appendix (7)

Consent Forms- Phase Two Study

LIVERPOOL JOHN MOORES UNIVERSITY

CONSENT FORM

Knowledge of and adherence to health advices among adults with diabetes in Libya

Phase two study

Mr. Walid M.A. Elkharam, Faculty of Health & Applied Social Science, Liverpool John Moores University

5. I confirm that I have read and understand the information provided for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily

6. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving a reason and that this will not affect my legal rights.

7. I understand that any personal information collected during the study will be anonymised and remain confidential

8. I agree for the interview to be tape recorded

9. I agree to take part in the above study

Name of Participant   Date   Signature

Name of Researcher   Date   Signature

Name of Person taking consent   Date   Signature
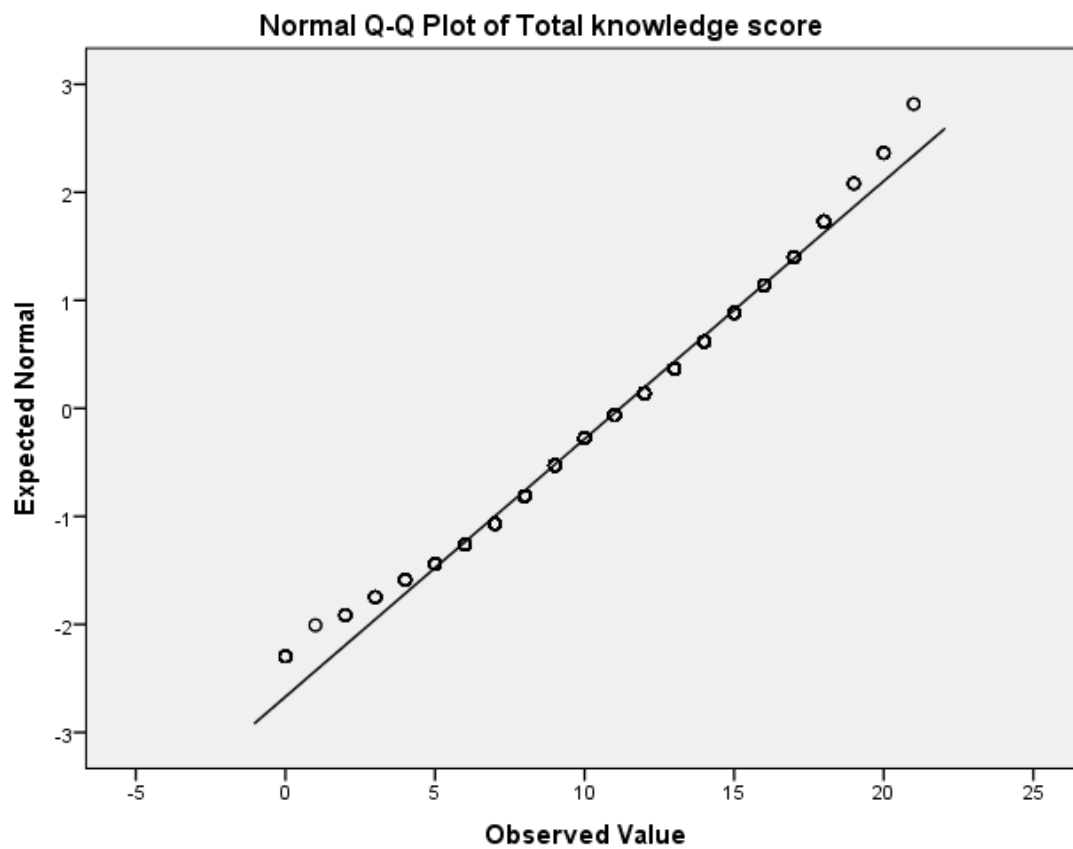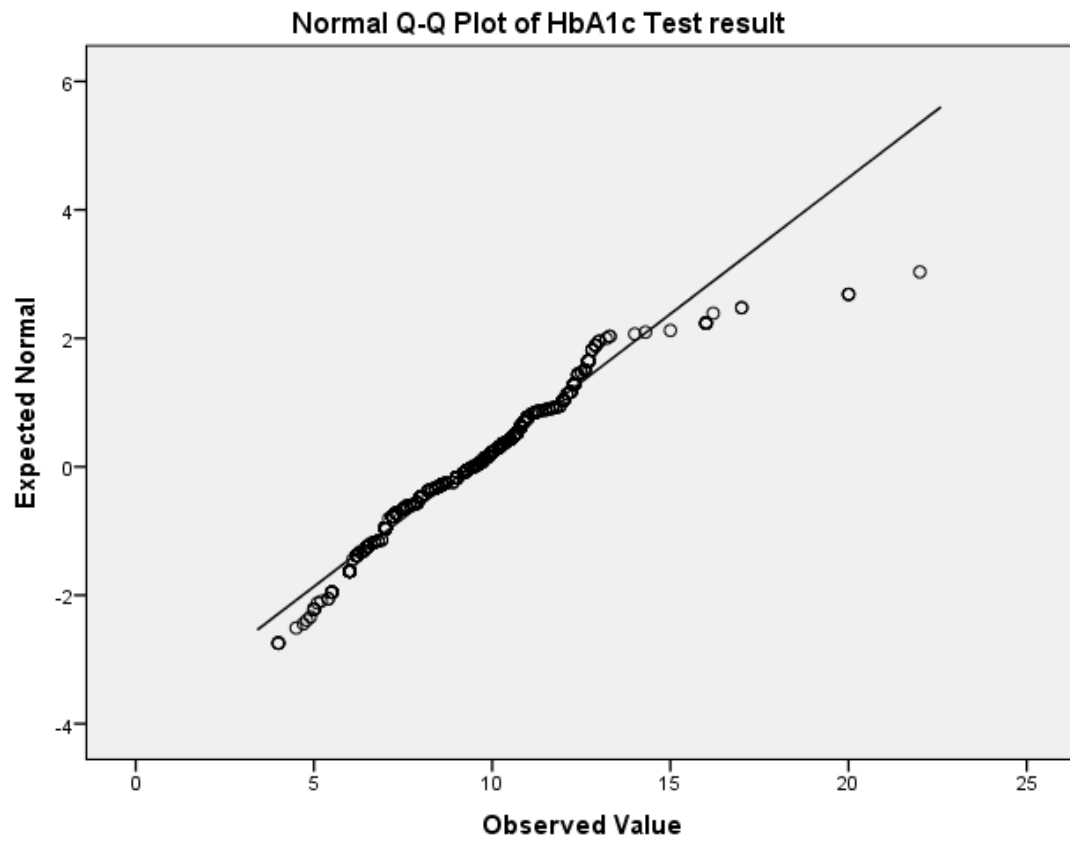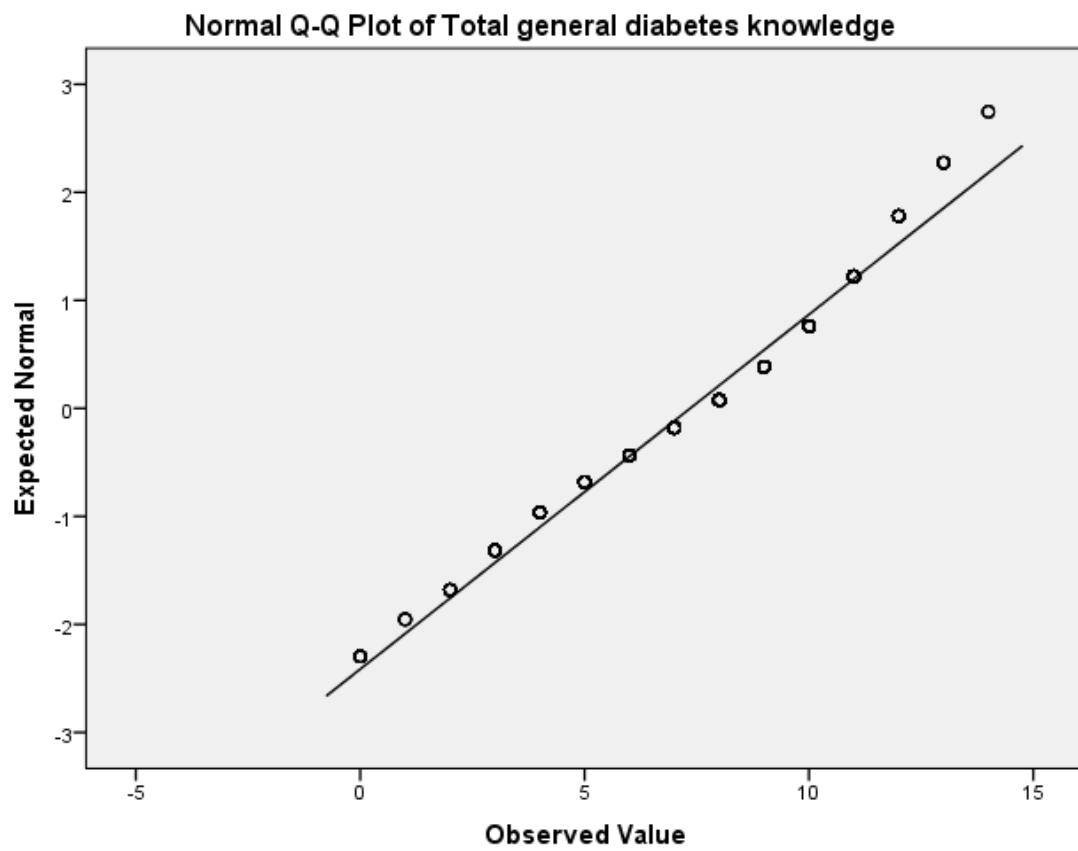*(if different from researcher)*

Note: When completed 1 copy for participant and 1 copy for researcher

267

Appendix (8)

Interview schedule Question and prompts

<u>Interview schedule Question and prompts</u>

1. What do you know about diabetes?
   - Where do you get this information from?
   - Who told you that

2. What should diabetic patients do to manage their condition?
   - What do you actually do to manage your condition?

3. Do you know what will happen if diabetic patients do not control their blood glucose level?
   - How did you get this information?
   - Do you think this information is useful in day to day management? (if no, why not?)

4. Do you know anybody with diabetes?
   - If yes what this person has told you about diabetes?
   - How different are you from this person in relation to manage your condition? and why?

5. What kind of diabetes treatment do you follow?
6. How often should you take your medication?
   - Do you take it as often as you should?
   - If not, why not?

7. Do you have a diet regimen?
   - Who advise you to take the diet regimen?
   - If yes, what is does this consist of?
   - Do you always adhere to it?
   - If no, how does this vary from your diet?
   - How often do you vary from your diet (on a week average)?
   - On what sort of occasions do you vary from your diet?
   - What happens to your diet when you are at a party?

8. Do you ever exercise?
   - Why? / Why not?
   - What kind of regular exercise do you perform?
   - How often (on a week average)?

9. What kind of information your doctor/nurse has gave you about diabetes?

10. Did your family/ friends present to you information about diabetes and its management?

11. Do you ever attend a health education session about diabetes?
    - Where and by whom?
    - Do you think it was helpful?
    - If not why?

12. What about TV,
    Radio,
    Magazine,
    Website   how much information do you get from these?

13. Do you know your latest blood glucose reading?
    - What do you think about it?

14. What would you like to see the clinic do to help?

Appendix (9)

Master list of themes and sub-themes

Master list of themes and sub-themes:

Themes	Subthemes
1. Idea about diabetes (what is diabetes?):	1.1.Pancreas/ Insulin 1.2.Advice/ recommendation 1.3.Signs/ Symptoms 1.4. Causes 1.5. Relationship
2. Awareness about the management of disease	2.1.Diet regimen 2.2. Sport 2.3. Medication 2.4. Stress
3. Divergent beliefs and practices regarding diabetes:	3.1.Food 3.2.Medication 3.3.Causes of diabetes
4. Consequences of not control blood glucose level:	4.1. Vision problem 4.2. Kidney problem 4.3. CVD 4.4. Nerve problem 4.5. Diabetic foot 4.6. Teeth problem
5. Knowledge about the last reading and the normal range of glucose test:	5.1.Know the reading 5.2.Know the reading and normal range 5.3.Don't know
6. Source of the information	6.1.Doctor/ health staff 6.2.Personal experience / patient experience 6.3.Lecture/clinic/ leaflet/ booklet 6.4.Family / friends 6.5.TV/ Radio/ Internet
7. Adherence level:	7.1.Idea of little amount of food as an adherence to diet regimen 7.2.Adherence to diet regimen 7.3.Adherence to sport 7.4.Adherence to medications
7.1 Causes of not adhere to 7.1.diet regimen	 7.1.1. Expensive 7.1.2. Hypoglycaemia 7.1.3. Type of job 7.1.4. Family issue 7.1.5. Go out / party / difficult

	7.2.Sport	7.2.1. Health problem/ age 7.2.2. Women issue 7.2.3.No times / type of job
	7.3.Medications	7.3.1. Availability 7.3.2. Fearing of Hypoglycemia 7.3.3. Feel sorry about taking so many injection
8. Experience with clinic services		
	8.1.Feel satisfaction or not	9.1.1. Satisfaction 9.1.2. Not satisfaction
	8.2.Causes of not satisfaction	9.2.1. Crowding at the clinic 9.2.2. Unqualified staff 9.2.3. Shortage of medication/ services

Appendix (10)

Analysis sheet

Analysis sheet

1. Idea about diabetes (what is diabetes?):

Pancreas/ Insulin	Advice/ recommendation	Signs/ Symptoms	Causes	Relationship
589/t1/p, 620/t1/p, 657/t1/g, 818/t1/g, 018/t1/g, 679/t1/g, 299/t1/a, 415/t1/a, 266/t1/a, 700/t1/a,	271/t1/p, 364/t1/p, 750/t1/g, 247/t1/a,	xxxxxx	762/t1/p, 589/t1/p, 548/t1/p, 679/t1/g, 687/t1/a,	304/t1/p, 306/t1/p, 162/t1/p, 247/t1/a,
257/t2/p, 197/t2/g, 050/t2/g, 038/t2/g, 813/t2/g, 066/t2/a, 104/t2/a, 025/t2/a, 624/t2/a, 085/t2/a, 435/t2/a , 671/t2/g	664/t2/g, 671/t2/g, 286/t2/g, 050/t2/g,	059/t2/p, 188/t2/p, 015/t2/p, 367/t2/p, 801/t2/p, 718/t2/p, 329/t2/p, 041/t2/g ,057/t2/g,636/t2/a, 457/t2/a,151/t1/a, 435/t2/a	171/t2/p, 059/t2/p, 571/t2/p.	197/t2/g, 671/t2/g, 057/t2/g, 050/t2/g, 066/t2/a, 104/t2/a, 025/t2/a,

2. Awareness about the management of disease

Diet regimen	Sport	Medication	Stress
304/t1/p. 306/t1/p, 762/t1/p 548/t1/p, 620/t1/p, 750/t1/g, 657/t1/g, 818/t1/g, 018/t1/g, 679/t1/g, 299/t1/a, 687/t1/a, 247/t1/a, 415/t1/a, 266/t1/a,	271/t1/p, 304/t1/p, 306/t1/p, 548/t1/p, 620/t1/p, 750/t1/g, 657/t1/g, 818/t1/g, 018/t1/g, 679/t1/g, 299/t1/a, 87/t1/1, 247/t1/a, 415/t1/a, 266/t1/a, 700/t1/a,	271/t1/p, 304/t1/p, 306/t1/p, 762/t1/p, 750/t1/g, 657/t1/g, 818/t1/g, 018/t1/g, 679/t1/g, 299/t1/a, 247/t1/a, 415/t1/a, 700/t1/a,	364/t1/p, 762/t1/p, 620/t1/p, 750/t1/g, 018/t1/g, 299/t1/a, 266/t1/a,
059/t2/p, 188/t2/p, 257/t2/p, 015/t2/p, 367/t2/p, 801/t2/p, 718/t2/p, 329/t2/p, 197/t2/g, 664/t2/g, 671/t2/g, 286/t2/g, 050/t2/g, 041/t2/g, 057/t2/g, 149/t2/g, 038/t2/g, 066/t2/a, 104/t2/a,025/t2/a, 624/t2/a, 085/t2/a, 636/t2/a, 457/t2/a, 151/t1/a, 435/t2/a	257/t2/p, 015/t2/p, 801/t2/p, 718/t2/p, 671/t2/g, 050/t2/g, 041/t2/g, 057/t2/g, 038/t2/g, 813/t2/g, 066/t2/a, 104/t2/a, 085/t2/a, 636/t2/a, 435/t2/a	801/t2/p, 329/t2/p, 197/t2/g, 664/t2/g, 671/t2/g, 286/t2/g, 050/t2/g, 813/t2/g, 104/t2/a, 025/t2/a, 636/t2/a, 151/t1/a, 435/t2/a	571/t2/p, 257/t2/p, 015/t2/p, 367/t2/p, 664/t2/g, 286/t2/g, 041/t2/g, 149/t2/g, 038/t2/g, 636/t2/a,

3. Divergent beliefs and practices regarding diabetes:

Food	Medication	Causes of diabetes
271/t1/p, 589/t1/p	364/t1/p,	762/t1/p, 687/t1/a, 266/t1/a
059/t2/p, 571/t2/p, 041/t2/g,	188/t2/p, 197/t2/g,	171/t2/p, 257/t2/p, 059/t2/p 149/t2/g, 624/t2, 636/t2,

4. Consequences of not control blood glucose level:

Vision	Kidney	CVD	Nerve	Diabetic foot	Teeth
271/t1/p, 304/t1/p, 306/t1/p, 762/t1/p, 589/t1/p, 620/t1/p, 750/t1/g, 657/t1/g, 818/t1/g, 018/t1/g, 679/t1/g, 299/t1/a, 687/t1/1, 247/t1/a, 415/t1/a, 266/t1/a, 700/t1/a,	762/t1/p, 620/t1/p, 750/t1/g, 018/t1/g, 679/t1/g, 299/t1/a, 415/t1/a, 266/t1/a, 700/t1/a,	762/t1/p, 548/t1/p, 657/t1/g, 818/t1/g, 266/t1/a,	657/t1/g, 679/t1/g, 700/t1/a,	306/t1/p, 548/t1/p, 750/t1/g, 299/t1/a,	589/t1/p, 657/t1/g, 818/t1/g, 018/t1/g, 415/t1/a, 266/t1/a,
059/t2/p, 188/t2/p, 571/t2/p, 257/t2/p 015/t2/p,, 367/t2/p, 718/t2/p, 329/t2/p, 197/t2/g, 664/t2/g, 671/t2/g, 286/t2/g, 050/t2/g, 057/t2/g, 149/t2/g, 038/t2/g, 813/t2/g, 066/t2/a, 104/t2/a, 025/t2/a, 624/t2/a, 085/t2/a, 636/t2/a, 457/t2/a, 435/t2/a	188/t2/p, 571/t2/p, 257/t2/p, 015/t2/p, 718/t2/p, 329/t2/p, 197/t2/g, 664/t2/g, 286/t2/g , 050/t2/g, 057/t2/g, 149/t2/g, 066/t2/a, 813/t2/g, 104/t2/a, 624/t2/a , 085/t2/a, 636/t2/a, 457/t2/a	329/t2/p, 671/t2/g,, 025/t2/a, 085/t2/a, 636/t2/a,	171/t2/p, 257/t2/p, 015/t2/p, 664/t2/g, 286/t2/g, 038/t2/g, 066/t2/a, 104/t2/a, 457/t2/a,	801/t2/p, 671/t2/g, 151/t1/a,	059/t2/p, 571/t2/p, 257/t2/p, 329/t2/p, 050/t2/g, 813/t2/g, 104/t2/a, 025/t2/a, 624/t2/a

5. Knowledge about the last reading and the normal range of glucose test:

Know the reading	Know the reading and normal range	Don't know
271/t1/p, 306/t1/p, 687/t1/a, 247/t1/a, 415/t1/a,	304/t1/p. 762/t1/p, 589/t1/p, 620/t1/p, 162/t1/p, 750/t1/g, 657/t1/g, 818/t1/g, 018/t1/g, 679/t1/g, 299/t1/a, 266/t1/a, 700/t1/a,	548/t1/p,
188/t2/p, 718/t2/p, 329/t2/p, 286/t2/g, 025/t2/a,	171/t2/p, 059/t2/p, 571/t2/p, 257/t2/p, 801/t2/p, 197/t2/g, 664/t2/g, 671/t2/g, 050/t2/g, 041/t2/g, 057/t2/g, 149/t2/g, 038/t2/g, 813/t2/g, 066/t2/a, 104/t2/a, 624/t2/a, 085/t2/a, 636/t2/a, 457/t2/a, 151/t1/a, 435/t2/a	015/t2/p, 367/t2/p,

6. Source of the information

Doctor/ health staff	Personal experience / patient experience	Lecture/clinic/ leaflet/ booklet	Family / friends	TV/ Radio/ Internet
271/t1/p, 304/t1/p, 306/t1/p, 589/t1/p, 548/t1/p, 299/t1/a, 687/t1/1, 247/t1/a, 415/t1/a,	364/t1/p, 762/t1/p, 162/t1/p, 750/t1/g, 018/t1/g, 679/t1/g, 299/t1/a, 687/t1/a, 266/t1/a, 700/t1/a,	589/t1/p, 48/t1/p, 750/t1/g, 266/t1/a, lecture	304/t1/p. 306/t1/p, 548/t1/p, 299/t1/a, 687/t1/1, 247/t1/a,	364/t1/p, 306/t1/p, 548/t1/p, 620/t1/p, 162/t1/p, 750/t1/g, 818/t1/g, 018/t1/g, 679/t1/g, 415/t1/a, 266/t1/a,
188/t2/p, 571/t2/p, 367/t2/p, 801/t2/p, 718/t2/p, 329/t2/p, 664/t2/g, 286/t2/g, 057/t2/g, 066/t2/a, 104/t2/a, 025/t2/a, 636/t2/a, 457/t2/a, 151/t1/a, 435/t2/a	171/t2/p, 059/t2/p, 571/t2/p, 257/t2/p, 015/t2/p, 367/t2/p, 197/t2/g, 664/t2/g, 050/t2/g, 057/t2/g, 149/t2/g, 104/t2/a, 636/t2/a, 457/t2/a	059/t2/p, 801/t2/p, 329/t2/p, 197/t2/g, 671/t2/g, 286/t2/g, 050/t2/g, 057/t2/g, 038/t2/g, 066/t2/a, 104/t2/a, 085/t2/a, 636/t2/a, 151/t1/a lecture	041/t2/g, 149/t2/g, 813/t2/g, 025/t2/a, 624/t2/a, 636/t2/a,	171/t2/p, 059/t2/p, 188/t2/p, 257/t2/p, 015/t2/p, 801/t2/p, 718/t2/p, 329/t2/p, 197/t2/g, 671/t2/g, 050/t2/g, 057/t2/g, 149/t2/g, 813/t2/g, 104/t2/a, 025/t2/a, 085/t2/a, 636/t2/a, 151/t1/a

7. Adherence level:

Idea of little amount of food	Diet regimen	Sport	Medication
271/t1/p, 364/t1/p, 762/t1/p, 589/t1/p, 620/t1/p, 162/t1/p, 818/t1/g, 247/t1/a,	620/t1/p, 162/t1/p, 018/t1/g,	306/t1/p, 620/t1/p, 162/t1/p, 750/t1/g, 657/t1/g, 818/t1/g, 018/t1/g, 299/t1/a, 687/t1/1, 415/t1/a, 266/t1/a, 700/t1/a,	271/t1/p, 304/t1/p. 306/t1/p, 762/t1/p, 548/t1/p, 620/t1/p, 162/t1/p, 818/t1/g, 018/t1/g, 679/t1/g, 299/t1/a, 687/t1/1, 247/t1/a, 415/t1/a, 266/t1/a, 700/t1/a,
171/t2/p, 188/t2/p, 257/t2/p, 367/t2/p, 197/t2/g, 050/t2/g, 025/t2/a, 085/t2/a, 457/t2/a,	367/t2/p, 286/t2/g, 041/t2/g, 149/t2/g, 636/t2/a,	059/t2/p, 571/t2/p, 257/t2/p, 718/t2/p, 671/t2/g, 286/t2/g, 050/t2/g, 041/t2/g, 038/t2/g, 104/t2/a636/t2/a, 435/t2/a	171/t2/p, 059/t2/p, 571/t2/p, 015/t2/p, 367/t2/p, 801/t2/p, 718/t2/p, 329/t2/p, 197/t2/g, 664/t2/g, 671/t2/g, 286/t2/g , 050/t2/g, 041/t2/g, 149/t2/g, 813/t2/g, 104/t2/a, 025/t2/a, 085/t2/a, 636/t2/a, 457/t2/a, 151/t1/a, 435/t2/a

8. Causes of not adherence to medical advice
   a. Causes of not adhere to diet regimen

Expensive	Hypoglycaemia	Type of job	Family issue	Go out / party / difficult
271/t1/p, 679/t1/g, 687/t1/a, 700/t1/a,	657/t1/g, 415/t1/a,	271/t1/p, 750/t1/g,	299/t1/a,	271/t1/p, 364/t1/p, 304/t1/p. 762/t1/p, 750/t1/g, 247/t1/a, 624/t2/a
171/t2/p, 015/t2/p, 664/t2/g, 671/t2/g, 085/t2/a, 636/t2/a,	801/t2/p, 329/t2/p, 104/t2/a 151/t1/a,		050/t2/g,	718/t2/p, 050/t2/g, 041/t2/g, 066/t2/a,

   b. Causes of not adhere to sport

Health problem/ age	Women issue	No times / type of job
679/t1/g,	304/t1/p. 589/t1/p	271/t1/p,
367/t2/p, 085/t2/a,		171/t2/p, 801/t2/p, 329/t2/p, 197/t2/g, 149/t2/g, 813/t2/g, 066/t2/a, 025/t2/a, 085/t2/a, 457/t2/a,

   c. Causes of not adhere to medication

Availability	Fearing of Hypoglycemia	Feel sorry /
589/t1/p, 750/t1/g,	364/t1/p. 700/t1/a,	038/t2/g,
188/t2/p, 718/t2/p, 624/t2/a	066/t2/a	

9. Experience with clinic services

Satisfaction	Not satisfaction	Crowding	Unqualified staff	Shortage of medication/ services
271/t1/p, 589/t1/p, 48/t1/p, 162/t1/p, 657/t1/g,818/t1/g, 299/t1/a, 687/t1/a, 415/t1/a,	364/t1/p, 304/t1/p, 306/t1/p, 620/t1/p, 750/t1/g, 018/t1/g, 679/t1/g, 247/t1/a, 266/t1/a, 700/t1/a,	364/t1/p, 304/t1/p, 589/t1/p, 679/t1/g, 247/t1/a,	364/t1/p, 750/t1/g, 018/t1/g, 266/t1/a,	364/t1/p, 306/t1/p, 679/t1/g, 247/t1/a,
059/t2/p,188/t2/p, 571/t2/p, 257/t2/p,367/t2/p, 801/t2/p, 718/t2/p,197/t2/g, 664/t2/g, 286/t2/g,050/t2/g, 041/t2/g, 057/t2/g, 149/t2/g,066/t2/a, 104/t2/a624/t2/a, 085/t2/a, 636/t2/a, 457/t2/a, 151/t1/a, 435/t2/a	171/t2/p, 015/t2/p, 329/t2/p, 671/t2/g, 038/t2/g, 813/t2/g, 025/t2/a,	664/t2/g, 286/t2/g 038/t2/g, 025/t2/a, 636/t2/a, 151/t1/a	015/t2/p, 038/t2/g, 085/t2/a, 457/t2/a	571/t2/p, 015/t2/p, 329/t2/p, 197/t2/g, 671/t2/g, 057/t2/g, 813/t2/g, 066/t2/a, 624/t2/a, 085/t2/a, 636/t2/a, 457/t2/a, 151/t1/a

Appendix (11)

Posters presentation or published abstracts and article related to this PhD study

ARTICLE

Knowledge of and Adherence to Health Advice among Adults with Diabetes in Libya

Walid M. Elkharam[1], Rose Khatri[1], Akhtar H. Wallymahmed[1], Ivan Gee[1], Tawfeg Elhisadi[2]

[1]Faculty of health and Applied Social Science Liverpool John Moores University, UK,
[2]Facultyof Medical Technology Public health Department Derna, Libya

Abstract

Background: Non-adherence to medical and health care advice is a common problem, though reasons for non-adherence can differ across different groups and societies as well as between individuals. **Objective:** to examine diabetes knowledge among people with both type1 and type2 diabetes in Libya and explore any other factors that enhance adherence to treatment and management of the condition. **Methods:** A cross-sectional survey design was used to collect data from adults with type1 or type2 diabetes who have been diagnosed for 12 months or more, in Benghazi Diabetes Centre, which is one of the oldest and largest diabetes registries in Libya. A total of 855 participants were asked to fill in two questionnaires; the "Michigan Diabetes Knowledge Test" to investigate the level of diabetes knowledge and the Confidence in diabetes Self-care Scale to assess self-efficacy. For the purpose of the study descriptive statistics and inferential statistical tests were conducted. **Results:** Diabetes knowledge is very poor especially among females and those classed as illiterate within the sample. The mean HbA_{1c} of 9.4 was higher than the recommended levels. Four variables namely knowledge about diabetes, duration of illness, family history and self-efficacy significantly predicted levels of HbA_{1c}. **Conclusion:** Based on the above findings, two different program of diabetes education would be recommended. The first would target those with inadequate levels of knowledge about diabetes, particularly women and people with long duration diabetes. The second would be for both healthcare professionals and people with type 1 and type 2 diabetes considering the psychological factors that are involved in diabetes management.

Key words: Diabetes management, Diabetes Education, Glycemic control, HbA1c,

Introduction

Diabetes mellitus (DM) is now considered one of the most common non-communicable diseases worldwide (1,2). It

is highly prevalent for all age groups worldwide (3) It is estimated that the number of people with diabetes worldwide was about 366 million in 2011 and will increase to 552 million in 2030 (4). According to the International Diabetes Federation's (IDF) statistics released 75% of that figure will be from developing countries (3). Five of the top ten countries estimated to have the highest prevalence of diabetes are from the Middle East and North Africa region (MENA). In Libya, the prevalence of diabetes has recently been reported to be as high as 16.4 % (5). It is important that an individual with diabetes adheres to health care advice to prevent or minimize acute and long-term complications including retinopathy, neuropathy, nephropathy and cardiovascular disease (6). Diabetes complications impact considerably on the person's quality of life and the health economy in general. Diabetes is considered the fifth leading cause of death in most high-income countries (7). Unlike other chronic medical conditions, diabetes is classed as a self-managed/self-care condition. This is because diabetes is a twenty-four hour a day condition for life which requires many dietary and life style change (8). It has been argued that 98% of diabetes care is essentially self-care (6). Hence adherence to the health care advice is crucial for effective self-management.

High levels of non-adherence to diabetes treatment have been reported (9,10). Non-adherence to health advice is a multi-factorial dilemma determined by different factors including patients' knowledge, attitude and belief about their illness, self-efficacy duration and complexity of the management regimen (10,11). However reasons of non-adherence vary across different groups and societies as well as between individuals. There has been little research in this area in the MENA countries in general and particularly in Libya. Hence we undertook this study.

Patients and Methods

Aims and Objectives

We wished firstly to assess the levels of diabetes knowledge among adults with diabetes in Libya, secondly to evaluate the levels of adherence (as measured by HbA_{1c}) to health advice with regards to diabetes management, thirdly to investigate the factors which facilitate and enhance adherence to health care advice and lastly to explore the relationship between self-efficacy and diabetes management.

Research Design

A cross-sectional sampling survey design was used to collect data from adults with diabetes type 1 or type 2 who have been diagnosed for 12 months or more. Participants were asked to fill in two questionnaires in Benghazi Diabetes Centre, which is one of the oldest and largest diabetes registries in Libya.

Participants

A total of 855 participants took part in the study. Ninety two patients had type 1 diabetes and 763 had type 2 diabetes. They were recruited whilst attending the diabetes center for their routine care. Of these 446 were females and 409 were males. The mean (SD) age of the whole group was 51.9 (13.2); ranging from 18-96 years.

Study Tools

Two questionnaires were used to collect data from all the participants.

a. Michigan Diabetes Knowledge Test (DKT): The DTK questionnaire of the University of Michigan Diabetes Research and Training Centre was designed to investigate the level of diabetes knowledge. It comprises of 23 items which include 14 items as a general test of management diabetes and 9 items for insulin use (12). Following measurement of diabetes knowledge, the sample was divided into three

Table 1. The range of knowledge score according to the level of knowledge.

Knowledge level	DKT score 23 items	DKT score 14 items general knowledge	DKT score 9 items related to insulin use
Poor knowledge	<11	<7	<5
Average knowledge	11-17	7-11	5-7
Good knowledge	> 17	> 11	> 7

groups based on their response of knowledge of diabetes. The range of the knowledge score was categorized in three different ways as proposed previously by Al-Adsani et al. (13) i.e. for all 23 items, for general knowledge using the first 14 items and for knowledge related to the insulin therapy using the remaining 9 items (Table 1). DKT were scored as 0 for incorrect response and 1 for a correct response. Therefore, the minimum score possible is 0 and the maximum is 23.

b. The Confidence in Diabetes Self-Care Scale (CIDS): The brief CIDS Scale is a self-report questionnaire to as-

sess self-efficacy; it was designed for type 1 diabetes (14). It comprises 20 items to test patient's possibilities and capacities with diabetes management which include performing activities for treatment, self-observation and control of their general health condition and self-regulation to improve the conditions. However, because the participants in the present study had both type 1 and type 2 diabetes, the original questionnaire was modified to 21 items to incorporate questions relating to type 2. Scores for the scale were obtained by adding the items from the scale according to what type of treatment each participant was currently receiving at the time of data collection (Table 2). A

Table 2. Score for Self-efficacy Scale.

Treatment that participant was currently receiving	Number of items used from scale
Diet only treatment	17
Oral hypoglycemic agents	18
Insulin	20
Oral hypoglycemic agents & Insulin	21

Table 3: Demographic characteristic of the sample	
Age	18 -96 years
Gender	Male: 409 (47.8%); Females: 446 (52.2%)
Type of diabetes	Type 2: 763 (89.2%) and Type 1: 92 (10.8%)
Education level	307 (35.9%) illiterate 219 (25.6%) obtained a primary school degree, 207 (24.2%) secondary school or diploma 120 (14 %) a university degree
Treatment type	Lifestyle measures only: 12 (1.4%) oral treatment: 106 (12.4%) insulin treatment: 588 (68.8%) combined oral and insulin treatment: 149 (17.4)
Duration of diabetes	12-500 months (1-41.5 years)
Annual income	Mean (3327.34) Standard deviation (2583.61)

subheading containing socio-demographic information was designed and appended to the two questionnaires. Socio-demographic data included age, gender, education level, family history of diabetes, duration of diabetes in years, type of treatment and income. The subheading also includes self-reported known complications of diabetes. In addition, data on the most recent HbA_{1c} value (within the previous three months prior to data collection) were extracted from the case records.

Outcome Measures

Demographic information which include: Age, gender, education, family history of diabetes, duration of diabetes in years, type of diabetes and type of treatment and income.

Diabetes knowledge, self-efficacy, HbA_{1c} and presence of any diabetes complications.

Data Analysis

The Statistical Package for the Social Sciences (SPSS, version 17) was used to analyze the data. Descriptive statistics and inferential statistical tests including correlations, t-test, One-Way ANOVA and multiple regressions were performed to explore the relationship between variables and to compare the statistical significant difference between two or more groups.

Table 4. Complication of diabetes among the participants						
Problems	Vision	Kidney	Nerve	CVD	More than one	None
Number	352	100	254	177	180	222
Percent %	41.2 %	11.7 %	29.7 %	20.7 %	21.1%	26%

Table 5. The relationship between DKT 23 and education level			
Groups	Knowledge 23, Mean (SD)	F	P
Low literacy	10.0 (4.4)		
Primary/Intermediate	11.6 (4.0)		
Secondary/Diploma	12.5 (3.7)	17.1	0.001
Uni. Degree	11.3 (4.1)		

Table 6. Factors are predicted HbA_{1c} levels			
Predictor variables	Standardized Coefficients	T	P
	Beta		
DKT 23	0.085	2.474	.014
Self-efficacy	-0.214	-6.336	.000
Duration of DM	0.078	2.206	.028
Family history	0.151	4.401	.000
Complication	0.111	3.241	.001
Educated or not	-0.059	-1.676	.094

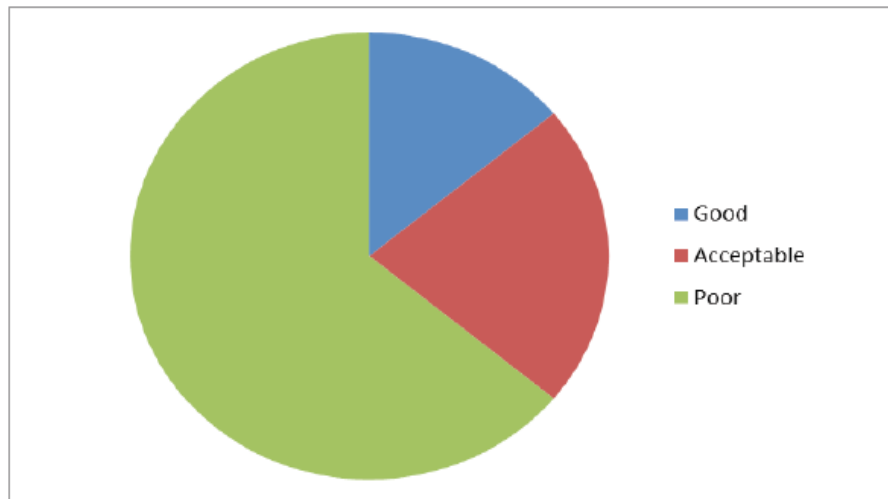**Figure 1.** Distribution of degrees of glycemic control as good (HbA1c <7%), acceptable (7-8%) and poor (>8%).
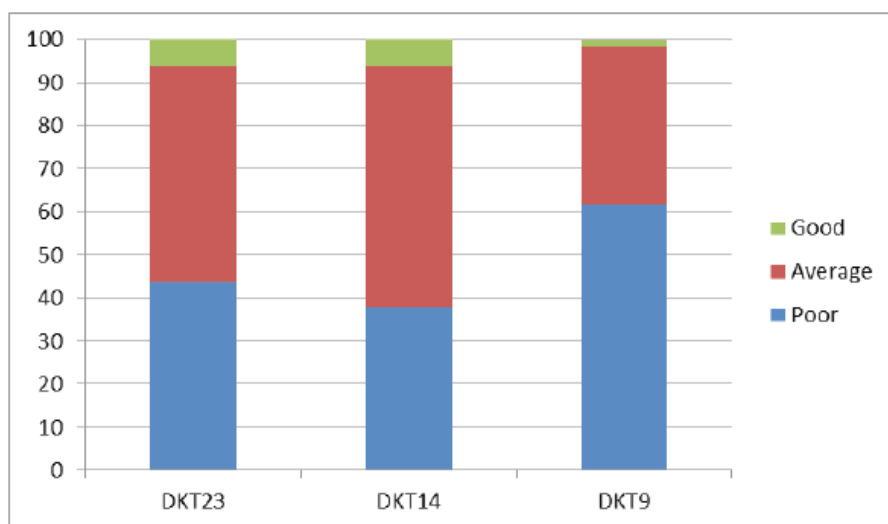

Figure 2. Categories of diabetes knowledge scores (poor, average and good) measured by DKT23 (overall knowledge), DKT14 (for non-insulin therapy related knowledge) and DKT9 (for insulin therapy-related knowledge).

285

Results

Patients' Characteristics

The characteristic of the 855 participants has been summarized in the table 3. The mean age and standard deviation of participants was 51.9 years (SD =13.2). The mean and standard deviation of diabetes duration was 128 months (16.1 years) (SD = 92.1).

DKT Scores

The range of score for the sample is 0 to 21 and the mean and standards deviation of the total sample score is 11.2 (SD = 4.2), which indicate less than fifty per cent of the participant (48.6, SD= 18.3) correctly answered the DKT 23. The DKT data were further analyzed as described above (Table 1). This resulted in the sample being divided into three different groups (DKT23, DKT14 & DKT9) based on their measured knowledge of diabetes. The results of the three subgroups are presented in Figure 1. The participants reported moderate level of self-efficacy, with the mean and standard deviation of the total sample 3.2 (SD = 1.1) in the diabetes self-efficacy scale.

Glycemic Control

The mean (SD) for HbA_{1c} was 9.4 (2.4) %. Data were further analyzed, and the sample was divided into three groups based on HbA_{1c}: Group 1 with HbA_{1c} less than 7%, denoted as 'good' control. Group 2 with HbA_{1c} between 7-8 % denoted 'acceptable' whilst group 3 with HbA_{1c} higher than 8 % denoted as 'poor' control. Table 4 shows that 63.2 % of participants had had poor glycemic control and just above 14% of the participants had had HbA1c indicative of good glycemic control.

Frequency of Diabetic Complications

Seventy four per cent of the participants reported one or more diabetes complications. The numbers of participants and the respective reported diabetes-related complications are detailed in table 5. The most common complication was related to vision with nearly 40% of total participants experiencing this. Some participants experience more than one complication (21%), whilst 26% of participants reported no known complications.

Relationship between Variables

An independent t-test results showed is no significant difference in duration of diabetes, HbA_{1c} test result, level of diabetes knowledge, and self-efficacy scales between type 1diabetes and type 2 diabetes. There was a significant difference between males and females; females were less knowledgeable than males about diabetes in general with respective mean (SD) scores being 10.9 (4.5) versus 11.5(3.8) on DKT 23; p= 0.026* and 7.07(3.3) versus 7.7(2.5); p= 0.005** for DKT 14. In addition, a one way ANOVA test used to compare four groups for educational level (Table 4) suggested that those with lowest level of literacy were significantly different from the remaining 3 groups as they had lower levels of knowledge about diabetes. Multiple regression with conducted with the HbA_{1c} as the dependent variable and knowledge score (DKT 23), self-efficacy, duration of diabetes, family history, complication problem and education status as predictor variables. The results indicated that model accounted only for 9.5% of the variance (Adjusted R^2 = 0.095) (F = 15.34, p < 0.01) as shown in table 7.

Discussion

Non-adherence to medical advice for people with diabetes is a common problem in every community. This is mainly due to the fact that diabetes management is surrounded by numerous factors which make adherence to health advice rather problematic. In general, studies have shown that adherence among people with diabetes is poor (9, 16). This current cross-sectional survey study of 855 individuals with diabetes has used HbA_{1c} value to measure adherence and found that the majority (43.7%) of participants reported poor glycemic Control. The HbA_{1c} mean for the total sample was (9.3 ± 2.3) which is higher than the ADA (1) and DCCT (2) recommended. This current study indicated that duration of the illness; self-efficacy, family history, and complication of diabetes and the level of diabetes knowledge were significantly affecting HbA_{1c} level. According to this study the longer the participants have been diagnosed with diabetes the higher HbA_{1c} level and the lower self-efficacy level about the management of the condition. A possible explanation for this might be that people lose confidence in their ability to control the condition over time. Bandura (17) suggests that people stop carrying out the required regime because they either lose their confidence or they believe that they cannot change the outcome. The other important factors affecting HbA_{1c} level was the level of diabetes knowledge which indicated that people with higher level of knowledge had also higher HbA_{1c}. This finding is however is different to the finding of other studies (18, 19) which found that diabetes knowledge is associated with better glycemic control. The positive correlation found in this current study is, however consistent with the finding of Al-Asani et al. (13). These findings might be attribute to the fact that health education programs are poor in Libya

(20), similarly to Kuwait (13) and diabetic patients gained knowledge from experience obtained over their long duration of diabetes and complications. It is also supports the idea that although knowledge is very important, it is not enough in itself to improve patient's diabetes management (13,21,22). The present study also indicated that on average the participants answered 48.6 % of the total DKT questionnaire correctly. Studies (20,23,24) from both developed and developing countries have shown that diabetes knowledge is generally poor. A study conducted in Kuwait (13) which also used the diabetes knowledge test (DKT) with 5114 adults with type2 diabetes found that only 58.9 % were able to correctly answer the questionnaire. Murata et al. (24) assessed diabetes knowledge in 248 veterans with type 2 diabetes in the USA using DKT. They also found that only 65% were able to answer the questions correctly. In the general diabetes knowledge part (14 items) the current study found that nearly 60% of participants have average knowledge and over a third of the sample have poor knowledge. Alternatively, the study found that most of participants have poor knowledge in the insulin use related knowledge (9 items).

In the present study comparing males with females showed that, the female participants were found to be less knowledgeable about diabetes than the male participants according to the general diabetes knowledge section. This might be due to the fact that a much higher proportion of females were illiterate compared to male participants (68.4 % versus 31.6 %). However, there was no significant difference between male and females in the insulin use related knowledge; this might be something which warrants further exploration. Another important finding was that, this study did not show any significant difference between type1 and type2 diabetics in the level of knowledge .One possible explanation for this could be due to the fact that 84.5 % of type2 diabetics were using insulin as a form of treatment. The study also found a significant difference between level of knowledge and level of education. The study indicates that illiterate people (over of a third of the sample) have a lower level of knowledge than educated people. However, this finding is different to those reported by other studies for example a study by Sircar et al. (25) in the southern part of India have found that levels of education had no bearing on the level of knowledge. The significant difference found in the current study, is however consist with the finding of the Al-Adsani et al. study in Kuwait (13). This might be due the fact that the number of patients with low level of literacy in these countries was higher than those in Sircar et

al. study (25). A strong positive relationship between self-efficacy and good adherence to medical advice has been reported in the literature (26,27). The finding in this study supports previous research (28, 29) which confirms that those who reported higher level of self-efficacy had lower HbA_{1c} level. Overall, the participants in the current study reported a moderate level of self-efficacy (3.2 ± 1.1). The study has also shown that a family history of diabetes has a positive impact on diabetes knowledge, which suggests that knowledge is being passed down from the experience of their family. Although the range of annual income is very large (Mean = 3327, SD = 2584 Libyan Dinars), (1 Libyan Dinar = 0.50 GBP); the present study did not find any difference between low and high family income in the level of diabetes knowledge or HbA_{1c}. A possible explanation for this result might be related to the fact that people with diabetes in Libya are provided with all medical services and medication free of charge (30).

In conclusion, the results of this study show that HbA_{1c} was higher than the recommended levels by ADA (1) and DCCT (2). Diabetes knowledge is very poor among both types of diabetes especially among those classed as illiterate and the female sample. Based on the above findings two different programmes of diabetes education would be recommended. The first programme of education would focus primarily on those with inadequate levels of knowledge about diabetes, particularly people with long duration diabetes. The second programme would be for both healthcare professionals and people with diabetes, which would consider the psychological factors that are involved in the process of diabetes management. Qualitative research is also needed to more fully understand the problem of non-adherence to the health advice.

References

1. ADA. Implications of the Diabetes Control and Complications Trial Diabetes Care. 2002;25(Suppl 1):S25-S7.
2. DCCT. The Effect of Intensive Treatment of Diabetes on the Development and Progression of Long-Term Complications in Insulin-Dependent Diabetes Mellitus. New England Journal of Medicine. 1993;329(14):977-86.
3. IDF. International Diabetes Federation: Diabetes Atlas: IDF; 2003. Available from: http://www.idf.org/sites/default/files/IDF_Diabetes_Atlas_2ndEd.pdf.
4. Whiting DR, Guariguata L, Weil C, Shaw J. IDF diabetes atlas: global estimates of the prevalence of diabe-

tes for 2011 and 2030. Diabetes Res Clin Pract. 2011; 94(3):311-21. Epub 2011/11/15.

5. Beshyah SA. Non-Communicable Diseases and Diabetes Care Guidelines: Epidemiology And Call For Collective Action. February, 6th 2010, Dat Elmad Conference Hall Complex, Tripoli, Libya. Ibnosina Journal of Medicine and Biomedical Sciences. 2010;2: 142-8.

6. Toljamo M, Hentinen M. Adherence to self-care and glycaemic control among people with insulin-dependent diabetes mellitus. Journal of advanced nursing. 2001;34(6):780-6.

7. Roglic G. The Burden of Mortality Attributable to Diabetes: Realistic estimates for the year 2000. Diabetes care. 2005;28.

8. Collins MM, Bradley CP, O'Sullivan T, Perry IJ. Self-care coping strategies in people with diabetes: a qualitative exploratory study. BMC endocrine disorders. 2009;9(1):6.

9. Dunbar-Jacob J, Mortimer-Stephens MK. Treatment adherence in chronic disease. Journal of Clinical Epidemiology. 2001;54(12, Supplement 1):S57-S60.

10. WHO. Adherence to long-term therapies: evidence for action. Geneva: World Health Organization; 2003.

11. Brannon L, Feist J. Health psychology: An introduction to behavior and health. USA: Wadsworth Publishing Company; 2000.

12. Fitzgerald JT, Funnell MM, Hess GE, Barr PA, Anderson RM, Hiss RG, et al. The reliability and validity of a brief diabetes knowledge test. Diabetes Care. 1998;21(5):706-10.

13. Al-Adsani aMS, Moussa Maa, Al-Jasem LI, Abdella Na, Al-Hamad NM. The level and determinants of diabetes knowledge in Kuwaiti adults with type 2 diabetes. Diabetes & metabolism. 2009;35:121-8.

14. Van der Ven NCW, Weinger K, Yi J, Pouwer F, Adèr H, van der Ploeg HM, et al. The Confidence in Diabetes Self-Care Scale. Diabetes Care. 2003;26(3):713-8.

15. Sacks DB. Translating hemoglobin A1c into average blood glucose: implications for clinical chemistry. Clinical chemistry. 2008;54(11):1756-8.

16. Cramer JA. A systematic review of adherence with medications for diabetes. Diabetes Care. 2004;27(5):1218-24.

17. Bandura A. Self-efficacy mechanism in human agency. American Psychologist. 1982;37(2):122.

18. Colleran KM, Starr B, Burge MR. Putting Diabetes to the Test Analyzing glycemic control based on patients' diabetes knowledge. Diabetes Care. 2003;26(7):2220-1.

19. McPherson ML, Smith SW, Powers A, Zuckerman IH. Association between diabetes patients' knowledge about medications and their blood glucose control. Research in Social and Administrative Pharmacy. 2008;4(1):37-45.

20. Roaeid R, Kablan A. Profile of diabetes health care at Benghazi Diabetes Centre, Libyan Arab Jamahiriya. Eastern Mediterranean health journal= La revue de santé de la Méditerranée orientale= al-Majallah al-ṣiḥḥīyah li-sharq al-mutawassiṭ. 2007;13(1):168.

21. Heisler M, Piette JD, Spencer M, Kieffer E, Vijan S. The relationship between knowledge of recent HbA1c values and diabetes care understanding and self-management. Diabetes Care. 2005;28(4):816-22.

22. Simmons D. Personal Barriers to Diabetes Care: Is It Me, Them, or Us?: Preface. Diabetes Spectrum. 2001;14(1):10-2.

23. Habib SS, Aslam M. Risk factors, knowledge and health status in diabetic patients. Saudi medical journal. 2003;24:1219-24.

24. Murata GH, Shah JH, Adam KD, Wendel CS, Bokhari SU, Solvas Pa, et al. Factors affecting diabetes knowledge in Type 2 diabetic veterans. Diabetologia. 2003;46:1170-8.

25. Sircar AR, Sircar S, Sircar J, Misra S. Patients' concepts and attitudes about diabetes. Journal of diabetes and its complications. 2009;24:398-403.

26. Wang CY, Fenske MM. Self-care of adults with non-insulin-dependent diabetes mellitus: influence of family and friends. The Diabetes Educator. 1996;22(5):465-70.

27. Williams K, Bond M. The roles of self-efficacy, outcome expectancies and social support in the self-care behaviours of diabetics. Psychology, Health & Medicine. 2002;7(2):127-41.

28. Griva K, Myers LB, Newman S. Illness perceptions and self efficacy beliefs in adolescents and young adults with insulin dependent diabetes mellitus. Psychology and Health. 2000;15:733-50.

29. Johnston-Brooks CH, Lewis Ma, Garg S. Self-efficacy impacts self-care and HbA1c in young adults with Type I diabetes. Psychosomatic medicine. 2002;64:43-51.

30. Kadiki O, Roaed R. Epidemiological and clinical patterns of diabetes mellitus in Benghazi, Libyan Arab Jamahiriya. Eastern Mediterranean health journal 1999;5(1):6.

BEHAVIORAL, NUTRITION, EDUCATION, AND EXERCISE

Poster Session Abstracts
BEHAVIORAL, NUTRITION, EDUCATION, AND EXERCISE

51-P
Obesity, Diabetes and Depression in Arab Women
Abdullah Al-Ozairi[1], Etab Taghadom[2], Ebaa Al-Ozairi[2]
[1]Toronto, ON, Canada, [2]Kuwait City, Kuwait

Introduction:
In women, depression has been found to be strongly associated with co-morbid type 2 diabetes and obesity in the Western population. This is thought to be related to poorer self care, and poorer glycemic control. This study aimed to examine the relationships between these variables and identify predictors of depression in a female Arab Kuwaiti, type 2 diabetes outpatient population.

Methods:
500 female patients with type 2 diabetes and 69% of whom were clinically obese were recruited consecutively through an outpatient clinic in Kuwait. Current depression was defined as having a score of >10 on the nine item Patient Health Questionnaire. Weight, height, waist circumference were measured and BMI calculated. Demographic and clinical data were recorded. Univariate and multivariate analyses were conducted.

Results:
In univariate analysis, higher rates of depression were significantly correlated with abdominal obesity (r=0.5, p<0.01) but not BMI (p = 0.4). Abdominal obesity and depression were significantly associated with less exercise (r=-0.3, p=.013; r=-0.4, p<0.01) and depression was associated with less blood glucose testing (r=-0.4, p<0.03). Younger age (<45) was significantly associated with depression (r=-0.4; p=0.015). Multivariate analysis to predict depression scores were not significant and explained little of the variance.

Conclusions:
Interventions that support Arabic women with obesity and co-morbid depression to achieve lifestyle modification are required. Further research is needed to elucidate the at risk characteristics in the female Arab population as they vary significantly from the Western Population.

52-P
Obesity and Foot Care in an Arab Population with Diabetes
Ebaa Al-Ozairi[1], Abdullah Al-ozairi[2], Etab Taghadom[2], Debbie Cooke[3]
[1]Kuwait City, Kuwait, [2]Toronto, ON, Canada, [3]London, UK

Introduction:
When depression is co-morbid with type 2 diabetes and obesity, this is related to poorer glycemic control, decreased physical activity and poor self-care. However, there is a paucity of data on diabetic foot care in context of co-morbid depression and obesity. This study aimed to examine the relationships between these variables and identify predictors of depression in an Arab Kuwaiti, type 2 diabetes outpatient population.

Methods:
400 patients with type 2 diabetes, 64% of whom were clinically obese, were recruited consecutively through an outpatient clinic in Kuwait. Questionnaires to assess depression (PHQ9) and diabetes self-care behaviours (SDSCA) were completed. Demographic and clinical data were recorded. Univariate and multivariate analyses were conducted.

Results:
In univariate analysis, higher rates of depression, as assessed by PHQ9, were significantly correlated with larger waist circumference (r=0.2, p<0.01) but not with BMI. Larger waist circumference was significantly associated with less self-reported exercise (r=-0.15, p=.013). Greater BMI was associated with less engagement with foot self-care (r=-0.1, p=0.05). Higher levels of depression were significantly associated with lower levels of self-reported exercise (r=-0.2, p<0.01) and less blood glucose testing (r=-0.1, p<0.05). Multivariate analysis to predict depression scores were not significant and explained little of the variance.

Conclusions:
Interventions that support people with diabetes to achieve better foot care and are tailored to account for co-morbid depression and obesity are required. Further research is needed to assess the relevance of the World Health Organisation (WHO) BMI classification for Arab populations.

53-P
Nutrition Knowledge and Psychosocial Adjustments to Diabetes Self-Care among Emirati Adults with Type 2: Preliminary Results of the "Skills for Change Program"
H. Ali, L. Baynouna, H. Abdel Baki, C. Platat, W. Ibrahim, H. Habib, N. Nagelkerke
Al Ain, UAE

Background:
Despite the high prevalence of diabetes and its complications in the United Arab Emirates (UAE), research on nutrition knowledge and psychosocial adjustment to diabetes self-care among Emirati adults with type 2 diabetes is limited.

Objective:
To assess baseline nutrition knowledge levels and psychosocial adjustments to diabetes self-care among Emirati adults with type 2 diabetes attending community-based healthcare centers in Al Ain.

Methods:
Preliminary analyses were conducted with baseline data from the "Skills for Change" intervention program, a randomized controlled intervention trial evaluating the impact of diabetes education program for Emirati adults (aged 20-70y) with type 2 diabetes. 292 participants were recruited from the 7 Ambulatory Health Services clinics in Al Ain. Data on nutrition knowledge and psychosocial adjustment to diabetes self-care based on social cognitive theory constructs (self-efficacy, outcome expectancy, and social support) were collected from October 2011 to May 2012. Recruitment and data collection are still on-going (target sample 400).

Results:
The mean age (SD) of the participants was 53.69 (9.4). Eighty-four percent of the participants were managed with oral hypoglycemic agents. 56.8% of the respondents reported testing their blood glucose levels at home with 63.7% of them indicating that they change their meal timing and/or content based on their blood glucose levels. More than half (69.2%) of the participants did not visit a dietitian for nutrition counseling within the past 6 months and only 43.2% of them reported following a special meal plan for diabetes management. With regard to the adjustment to diabetes self-care, 61.5% reported that they feel confident in their ability to keep weight under control while 72.3% felt that their families and friends support them and/or help them to take care of their diabetes.
The mean (SE) for the total nutrition knowledge score was 5.30 (3.1) (maximum possible score =14). Mean knowledge scores of dietary sources of carbohydrate, dietary fiber, and cholesterol were 2.9, 1.5, and 0.87, respectively (maximum score= 8, 5, and 1, respectively). In terms of knowledge related to effects of certain foods commonly consumed in UAE on blood glucose levels, 63.4% of the respondents correctly identified pasta has the potential to increase blood glucose levels compared to only 32.5% for "ragag bread."

Conclusions:
Emirati adults with type 2 diabetes have limited nutrition knowledge. Therefore, there is a need to increase referral to dietitians for nutrition counseling.

This project is supported by Sheikh Hamdan Bin Rashid Al Maktoum Award for Medical Sciences, MRG/04/09-10.

54-P
Diabetes Knowledge and Practice in Malaysian and United Arab Emirates Diabetic Patients
Hala J. Mahdi[1], Yahaya Hassan[1], Noorizan A. Aziz[1], Hadeer Akram[1], Feras J. Jirjees[2], Abdeulmula R. Abduelkarem[3]
[1]Penang, Malaysia, [2]Sharjah, UAE, [3]Ajman, UAE

Aim:
The aim of the study was to investigate and compare the current levels of the knowledge, attitude and the practice of people with diabetes in Malaysia and the United Arab Emirates.

Method:
A cross-sectional prospective study was conducted with a total of 403 people with diabetes in Malaysia [202 patients from Endocrinology Out-Clinics at Penang Hospital] and the UAE [201 patients from Endocrinology and Diabetes Center in Abu-Dhabi] secondary care sector. A validated questionnaire and a specific data collection form were used.

Results:
The data showed significant differences at the levels of the Knowledge, Attitude and the Practices between Malaysian and the UAE respondents with (P <0.001), while the good attitude was missing amongst the UAE respondents.

Conclusion:
Malaysians were showed higher level of knowledge and attitude toward diabetes and also had better practice in managing their disease than the UAE patients. None of the UAE respondents were categorized under the good attitude, while many of Malaysian respondents were had, and scored good attitude.

Implications:
It is recommended to improve our health educational programs by establishing a specific links between different countries forward utilize and sharing the experiences of the other countries.

55-P
Knowledge of and Adherence to Health Advice among Adults with Diabetes in Libya
Walid M. Elkharam[1], Rose Khatri[1], Akhtar H. Wallymahmed[1], Tawfeg Elhisadi[2], Linda Mason[1], Ivan Gee[1], Daz Greenop[1]
[1]Liverpool, UK, [2]Benghazi, Libya

Background:
It is important that individuals with diabetes adhere to health care advice to prevent or minimize acute and long-term complications. Non-adherence to medical and health care advice is a common problem, though reasons for non-adherence can differ across different groups and societies as well as between individuals. However, there has been little research in this area in the MENA countries and particularly in Libya.

Objective:
The primary aim of this study is to examine diabetes knowledge among people with both type 1 and type 2 diabetes in Libya and explore any other factors that enhance adherence to treatment and management of the condition.

289

Methods:

A cross-sectional survey design was used to collect data from adults with type 1 or type 2 diabetes who have been diagnosed for 12 months or more, in Benghazi Diabetes Center, which is one of the oldest and largest diabetes registries in Libya, a total of 855 participants were asked to fill in two questionnaires; the Michigan Diabetes Knowledge Test to investigate the level of diabetes knowledge (Fitzgerald et al., 1998) and the Confidence in diabetes Self-care Scale to assess self-efficacy (Weinger et al., 2000). For the purpose of the study descriptive statistics and inferential statistical tests were conducted.

Results:

Diabetes knowledge is very poor especially among females and those classed as illiterate within the sample. The Mean HbA$_{1c}$ of 9.39 was higher than the recommended levels by ADA (2002) & DCCT (1993). Three variables namely duration of illness, age of participants and self-efficacy significantly predicted levels of HBA$_{1c}$.

Conclusion:

Based on the above findings two different programmes of diabetes education would be recommended. The first programme of education would focus primarily on those with inadequate levels of knowledge about diabetes, particularly older people and people with long duration diabetes. The second programme would be for both healthcare professionals and people with diabetes, which would consider the psychological factors that are involved in the process of diabetes management. Qualitative research is also needed to more fully understand the problem of non-adherence to the health advice.

56-P

Impact of Family-Based Health Education Program on Knowledge Attitudes and Practices among Patients with Type 2 Diabetes Mellitus in Ismailia-Egypt

Mohamed S. Nasrallah, Soliman H. Elkamash, Mohamed E. Shoair, Sobhy A. Sobhy
Ismailia, Egypt

Background:

Diabetes is a family disease which is absolutely unique, there is no chronic diseases for which much of daily management responsibility rests with patient and their families.

Objectives:

The study aimed at assessing the knowledge, altitudes and practices of types 2 diabetic patients after implementation of family based-health education program.

Methods:

The present study is an experimental study conducted during the period from March to September 2006 on (150) diabetic patients [75 cases and 75 control]' at Abukhaleifa family medicine center and Elshaheed Khaiery family health unit. A questionnaire was designed including; (socio demographic characters) and [Diabetes knowledge test (DKT), Diabetes attitude scale (DAS) and Summary of self care activity measure (SDSCA)] before and after implementation of family based health education program (Education while attending family member in 6 time sessions).

Results:

No significant difference between groups regarding total Knowledge score after program implementation. Regarding attitude there is decrease--ve attitude category in intervention group from 87.1% to 57.4% in comparison to control group which decreased from 79.4 to 57.4% and that was significant. There is significant difference between the two groups regarding practice as total unsatisfactory practice score decreased from 98.6% to 34.3% in intervention group in comparison control group which decreased from 92.6% to 67.5%.

Conclusion:

Family based health education program is an effective modality to change attitude and improve practices towards self care behavior, family is not unidimensional (supportive vs. non-supportive), the multiple dimensions provide multiple target for intervention tailored to patient needs.

57-P

Impact of Family-Based Health Education Program on Compliance, Control and Obesity among Patients with Type 2 Diabetes Mellitus in Ismailia

Mohamed S. Nasrallah, Soliman H. Elkamash, Mohamed E. Shoair, Sobhy A. Sobhy
Ismailia, Egypt

Background:

Compliance to diabetic regimen and metabolic control are related to family interaction as family members are often asked to share in responsibility for the implementation of regimen requirement and family routines can be disrupted by the diabetes self care regimen.

Objectives:

This study aimed at assessing the compliance, diabetes control and obesity state among type 2 diabetes mellitus after implementation of family based health education program.

Methods:

The present study is an experimental study conducted during the period from March to December 2006 on (150) diabetic patients (75 cases & 75 control)' at Abukhaleifa family medicine center and El Shaheed Khaiery family health unit. A questionnaire was designed including (sociodemographic characters) and (Compliance checklist, measurement of Glycosylated hemoglobin, and Body mass index) before and after family based health education program (patient education while attending family member in 6 time sessions)

Results:

Regarding compliance there is significant difference between the two groups after program as poor compliance category state decreased from 74.3% to 30% in intervention group in

comparison to 66.2% and 54.4% in control group. Regarding HBA1c: Poor control changes from 75% to 32.9% in intervention group compared to 67.6% and 6.5% in control group and it was significant. BMI: there is no significant difference between the two groups after the program regarding obesity state.

Conclusion:

Family based health education program is an effective modality to increase compliance and brings diabetes control but has no effect on obesity state.

58-P

Evaluation of Preconception Care Knowledge among Saudi Women with Diabetes Mellitus

Madanat Amal Yacoub, Shesha Eman Adulrahman
Riyadh, Saudi Arabia

Background:

As the prevalence of diabetes mellitus (DM) continues to rise worldwide including Saudi Arabia, more women of child bearing age will be affected by DM. Consequently DM related poor pregnancy outcomes are expected to rise. Preconception care of DM plays a major role in reducing maternal and fetal risks. Therefore it is important from both a scientific and a public health perspective, to evaluate the level of preconception care knowledge among Saudi women, to plan strategies to improve pregnancy outcomes.

Objective:

To explore the level of preconception care knowledge, the rate of preconception counseling, and the rate of unplanned pregnancies among Saudi diabetic women.

Research Design and Methods:

The study was performed at the Diabetes Care Center, Prince Salman Hospital (MOH) in Riyadh-KSA from March to May 2012 on a sample of 355 female patients with DM. After obtaining an informed consent, patients were interviewed by a trained team. The study questionnaire contained variables about diabetes duration, treatment, comorbidities, preconception care counseling provision, maternal and fetal risks knowledge, opinion about the safety of contraceptive use in diabetes, and the number of unplanned pregnancies. The level of preconception care knowledge was evaluated using a modified Likert scale.

Results:

Age ranged between 18-49 years, (mean_SD 38.91 ± 7.87); all were Saudi nationality residing in Riyadh KSA. 273 (76.9%) were married, 56.6% had only elementary school education. Mean_SD age at onset of DM: 31.68 ± 9.31years. Mean_SD duration of DM was 7.15 ± 6.19 years. 37.5% were on diet and metformin, 16.1% on combined oral hypoglycemic agents, 24.8% on insulin, and 19.7% on combined insulin and oral hypoglycemic agents. 104 (29.3%) and 101 (28.45%) received antihypertensive and lipid-lowering treatment respectively. 5.1% had hypothyroidism. 152 (42.82%) patients had absent or limited level of preconception care knowledge, (18.3%) had moderate, while (16.62%) had extensive level of preconception care knowledge and only (22.26%) had excellent level. Only 104 (29.3%) received preconception counseling after the diagnosis of DM, while 251 (70.7%) did not. Despite the fact that some patients received preconception counseling, 250 (80.4%) never discussed preconception matters with their doctors, and 188 patients (52.96%) regard the use of contraceptive methods as unsafe in DM. Of 184 (58.22%) patients who conceived after the diagnosis of DM, all pregnancies (100%) were unplanned.

Conclusions:

The study demonstrates inadequate level of preconception care knowledge among Saudi diabetic patients, and a low rate of preconception counseling. Results also suggest that the existing programs are inefficient. There is an urgent need for the development, implementation and monitoring of structured preconception counseling program to improve pregnancy outcomes for Saudi diabetic patients.

59-P

Therapeutic Education is the Real Challenge to Prevent Metformin-Associated Lactic Acidosis (MALA)!

Mohamed-Faouzi Safraou
Paris, France

Introduction:

No doubt today that therapeutic education for Diabetes patients is a real challenge to improve care and to prevent or manage without delay the potential side effects of pharmacologic treatment. The example of Metformin is a good illustration. More than 50 years after its introducing in 1957 (1996 in USA), metformin is used today in more than 90 countries. It is the most efficient, safe and costless anti-hyperglycemic agent in the treatment of type 2 diabetes Mellitus. Its principal risk remains Metformin-Associated lactic Acidosis (MALA), subject of controversies as reported in a recent Cochrane database review in 2010.

Patients and Methods:

This is a retrospective personal series of all cases of MALA diagnosed in an 8 year-period in an Emergency department admitting 16000 patients yearly. Serum lactic acid over than 5 mmol/L at admission (normal value < 2 mmol/l) in a context of metabolic acidosis is the key of the diagnosis.

Results:

In this 8 year-period, 4 cases of MALA are diagnosed. The incidence is 3 for 100000 patients admitted in Emergency. The indication of the metformin was not relevant in 1 case (mitochondrial disease) and subject of discussion in 2 others (with chronic alcoholism in one case and chronic use of Anti-Inflammatory Drugs in the other). The case 4 treated with 3000 mg

Knowledge of and adherence to health advice among adults with diabetes in Libya

Walid M. Elkharam[1], Rose Khatri[1], Akhtar H. Wallymahmed[1], Tawfeg Elhisadi[2], Linda. Mason[1], Ivan Gee[1], Daz Greenop[1]

[1]Liverpool, UK, [2]Derna, Libya

Abstract

Adherence to the health care advice is essential to prevent or minimize acute and long term conditions. Non-adherence to medical advice among people with diabetes is a common problem in every community. This study examined the diabetes knowledge (DKT), self-efficacy (CIDS) and other factors that enhance adherence to treatment and management of the condition in Libya. The study found that Diabetes knowledge is very poor among both types of diabetes and three variables namely duration of illness, age of participants and self efficacy significantly predicted levels of HbA_{1c}

Background:

It is important that individuals with diabetes adhere to health care advice to prevent or minimize acute and long-term complications (Toljamo& Hentinen, 2001). Aadherence improves glycaemic control (HbA_{1c}). Non-adherence to medical advice among people with diabetes is common and is a multi-determined dilemma caused by different factors (Brannon & Feist, 2000; WHO, 2001). However, there has been little research in this area in the MENA countries and particularly in Libya.

Trust Me, I'm a Doctor

Objectives

a) To examine the levels of diabetes knowledge among adults with diabetes in Libya.
b) To investigate the levels of adherence (as measured by HbA1c) to health advice with regards to diabetes management.
c) To examine the factors which facilitate and enhance adherence to health care advice.
d) To examine the relationship between self-efficacy and diabetes management

Methods

Research Design

A cross-sectional sampling survey design was used to collect data from adults with diabetes type 1 or type 2 who have been diagnosed for 12 months or more. Participants were asked to fill in two questionnaires in Benghazi Diabetes Centres, which is one of the oldest and largest diabetes registries in Libya.

Participants

A total of 855 participants (92 Type1 and 763 with Type2 diabetes) took part in the study. They were recruited whilst at the Diabetes Centre for routine appointment. 446 of participants were female and 409 were male. The age of participants range from 18-96 yrs Mean (Sd): 51.9 (13.17)

Materials: two questionnaires were used to collect data from all the participants these are:

Michigan Diabetes Knowledge Test (DKT)

The DTK questionnaire of the University of Michigan Diabetes Research and Training Centre was designed to investigate the level of diabetes knowledge. It comprises of 23 items which include 14 items as a general test of management diabetes and 9 items for insulin use (Fitzgerald, Funnell, Hess, Barr, Anderson & Hiss, 1998). Following measurement of diabetes knowledge, the sample divided into three groups based on their response of knowledge of diabetes. The range of the knowledge score was categorized in three different ways: as all 23 items, as general knowledge 14 items and as 9 for items related to the insulin use.

The range of score according to the level of knowledge

Level	DKT 23 items	DKT 14 items general knowledge	DKT 9 items related to insulin use
Poor knowledge	<11	<7	<5
Average knowledge	11-17	7-11	5-7
Good knowledge	>17	>11	>7

Al-Adsani et al. (2009)

The Confidence in Diabetes Self-Care Scale (CIDS)

The brief CIDS Scale is a self report questionnaire to assess self-efficacy; it was designed for type one diabetes (Weinger, Ven, Yi & Snoek, 2000). It comprises 20 items to test patient's possibilities and capacities with diabetes management which include performing activities to the treatment, self observation and control general health condition and self regulation to improve the conditions.

E-mail address: W.M.Elkharam @2009.ljmu.ac.uk (W.M.Elkharam)

In addition data on the most recent HbA_{1c} value (within the last three months prior to data collection) were extracted from the case-notes.

Ethical approval was obtained from LJMU ethics committee and the health authorities in Libya.

Results

Diabetes Knowledge Test (DKT 23,14,9)

DKT 23 ■ DKT 14 ■ DKT 9

Level of HbA_{1c}
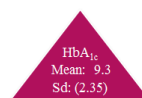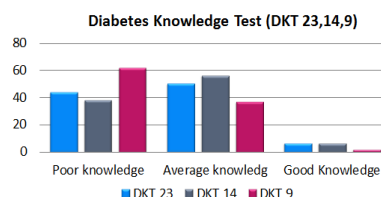
HbA_{1c}
Mean: 9.3
Sd: (2.35)

HbA_{1c} Level	No. (%)
Good (< 7 %)	106 (14.2 %)
Acceptable (7-8%)	181 (21.3 %)
Poor (>8 %)	540 (63.2%)

Factors are predicted HbA_{1c} levels

Predictor variables	Standardized Coefficients Beta	t	P
Age	-0.098	-.2.455	0.014
Duration of DM	0.116	2.914	0.004
DKT 23	-0.063	-1.758	0.079
Self efficacy	-0.232	-6.490	0.001

The model accounted for 6.6% of the variance (Adjusted R^2 = 0.066)
(F = 11.58, p < 0.01)

Conclusion

Diabetes knowledge is very poor especially among females and those classed as illiterate within the sample. The Mean HbA_{1c} of 9.39 was higher than the recommended levels by ADA (2002) & DCCT (1993). Three variables namely duration of illness, age of participants and self-efficacy significantly predicted levels of HbA_{1c}. Based on the above findings two different programmes of diabetes education would be recommended. The first programme of education would focus primarily on those with inadequate levels of knowledge about diabetes, particularly older people and people with long duration diabetes. The second programme would be for both healthcare professionals and people with diabetes, which would consider the psychological factors that are involved in the process of diabetes management. Qualitative research is also needed to more fully understand the problem of non-adherence to the health advice.

Reference

ADA. (2002). Implications of the Diabetes Control and Complications Trial *Diabetes Care, 25*(Suppl 1), S25-S27.
Al-Adsani, a. M. S., Moussa, M. a. a., Al-Jasem, L. I., Abdella, N. a., & Al-Hamad, N. M. (2009). The level and determinants of diabetes knowledge in Kuwaiti adults with type 2 diabetes. *Diabetes & metabolism, 35*, 121-128. doi: 10.1016/j.diabet.2008.09.005
Brannon, L., & Feist, J. (2000). *Health psychology: An introduction to behavior and health*. USA: Wadsworth Publishing Company.
DCCT. (1993). The Effect of Intensive Treatment of Diabetes on the Development and Progression of Long-Term Complications in Insulin-Dependent Diabetes Mellitus. *New England Journal of Medicine, 329*(14), 977-986. doi: doi:10.1056/NEJM199309303291401
Fitzgerald, J. T., Funnell, M. M., Hess, G. E., Barr, P. A., Anderson, R. M., Hiss, R. G., & Davis, W. K. (1998). The reliability and validity of a brief diabetes knowledge test. *Diabetes Care, 21*(5), 706-710.
Toljamo, M., & Hentinen, M. (2001). Adherence to self-care and glycaemic control among people with insulin-dependent diabetes mellitus. *Journal of advanced nursing, 34*(6), 780-786. doi: 10.1046/j.1365-2648.2001.01808.x
Weinger, K., Butler, H. a., Welch, G. W., & La Greca, A. M. (2005). Measuring diabetes self-care: a psychometric analysis of the Self-Care Inventory-Revised with adults. *Diabetes care, 28*, 1346-1352.
WHO. (2001). Adherence to long-term therapies: policy for action *World Health Organization* (pp.29). Geneva: World Health Organization.

Abstract for poster presentation. Vitae NW Hub: University of Manchester. Postgraduate Researchers in Science Medicine Conference, (2012)

Abstracts
Poster presentations

P17
The effectiveness of hydrotherapy in the management of Rheumatoid Arthritis (RA):
AL-QUBAEISSY, K., FATOYE, F., YOHANNES, A., GOODWIN, P.C.
Keywords: Rheumatoid Arthritis, Hydrotherapy, Aquatic physiotherapy, Aqua therapy,

Background and Aims Hydrotherapy is often used in the treatment of Rheumatoid Arthritis (RA); however there has been limited evaluation of its effectiveness1. The principle aims of hydrotherapy (aquatic physiotherapy) in RA are to improve functional ability and quality of life2, 3, 4. This type of treatment is popular in many patients with painful neurological or musculoskeletal conditions5. The aim of this systematic review is to evaluate the effectiveness of hydrotherapy in the management of RA.
Method: AMED, CINAHL, The Cochrane Library, EMBASE, MEDLINE, Pub Med, Science Direct, and Web of Science were searched between 1987, and May 2011. Keywords used were: rheumatoid arthritis, hydrotherapy, aquatic physiotherapy, aqua therapy and water therapy Searches were supplemented with hand searches of selected journals. Randomised controlled trials were assessed for methodological quality using the Physiotherapy Evidence Database (PEDro) Scale6from which a best evidence synthesis was derived to determine the strength of evidence for hydrotherapy in RA management.
Then (Finding and CONCLUSION)

P19
Knowledge of and adherence to health advice among adults with diabetes in Libya
Walid Elkharam, Dr. Tawfeg Elhisadi, Dr. Linda Mason& Dr. Wallymahmed Akhtar
Keywords: Adherence, Diabetes, Health advice, Libya

The aim of this study:
is to examine the current diabetes knowledge among people with diabetes in Libya and explore any factors including self-efficacy that enhance adherence to treatment and management of the condition.
Design: This is a cross-sectional survey design using questionnaire.
Sample:
855 participants (92 Type1 and 763 with Type2 diabetes) took part in the study. They were recruited whilst at the Diabetes Centre for routine appointment.
Tools:
The following scales were used:
• Michigan Diabetes Knowledge Test (DKT), to measure diabetes knowledge
• The Confidence in Diabetes Self-Care Scale (CIDS) to measure self-efficacy
• HbA1c value
The results:
The Mean HbA1c of 9.39 was higher than the recommended levels by ADA (2002) & DCCT (1993). Three variables namely duration of illness, age of participants and self efficacy significantly predicted levels of HBA1c. Diabetes knowledge is very poor among especially among those classed as illiterate and female sample.

P20
Does administering a Parent Reported Outcome Measure during Improve Self-efficacy in carers of children with cystic fibrosis?
Tulsi P Patel, Latifa Patel, Clare Dixon, Claire Glasscoe, Kevin W Southern
Keywords: Cystic fibrosis, self-efficacy, parent reported outcome measure

INTRODUCTION
The 'Challenges of Living with Cystic Fibrosis Questionnaire' (CLCF-Q) was developed to measure treatment burdens faced by caregivers of patients with cystic fibrosis (CF). This study aims to identify whether its' use has any effect on the self-efficacy of the carer, measured by the 'Cystic Fibrosis Self-Efficacy Questionnaire' (CFSE-Q). Higher scores indicate a better self-efficacy.
METHODS
Participants are randomly allocated to group 1 (intervention- CLCF-Q) or group 2 (control). All participants complete the CFSE-Q at the beginning and end of the study.
RESULTS
There was no difference in change in self-efficacy scores between Group 1(n=16) and 2(n=20). (Median(IQR) change in score 1(-1.75 to 3.75) versus -0.50(-4 to 2); U=112.5, p=0.13).
DISCUSSION
Even though the change in self-efficacy score was not significant, a higher proportion of carers in Group 1 had improved their scores than those in Group 2. Administering the CLCF-Q may have a role in improving self-efficacy.

292

Knowledge of and adherence to health advice among adults with diabetes in Libya

Walid M. Elkharam 1,*, Tawfeg. Elhisadi 2, Linda. Mason 3, Akhtar H. Wallymahmed 1-3
Faculty of Health & Applied Social Sciences, Liverpool John Moores University
Liverpool, United Kingdom

E-mail address: W.M.Elkharam @2009.ljmu.ac.uk (W.M.Elkharam)

Abstract

Adherence to the health care advice is essential to prevent or minimize acute and long term conditions. Non-adherence to medical advice among people with diabetes is a common problem in every community. This study examined the diabetes knowledge (DKT), self-efficacy (CIDS) and other factors that enhance adherence to treatment and management of the condition in Libya. The study found that Diabetes knowledge is very poor among both types of diabetes and three variables namely duration of illness, age of participants and self efficacy significantly predicted levels of HBA_{1c}.

Background

it is estimated that the number of people with diabetes worldwide about 285 million in 2010 and will increase to 438 million in 2030 (IDF, 2009). It is important that the individual with diabetes adheres to health care advice to prevent or minimize acute and long-term complications (e.g. retinopathy, neuropathy, nephropathy and cardiovascular disease (Toljamo& Hentinen, 2001). Diabetes complications impact considerably on the person's quality of life and the health economy in general. Diabetes is considered one of the top five leading in most high- income countries (Roglic et al., 2005). High levels of non-adherence to diabetes treatment have been reported (Dunbar-Jacob & Mortimer-Stephens, 2001; WHO, 2003). Non-adherence to medical advice among people with diabetes is common and is a multi-determined dilemma caused by different factors which include patient knowledge, attitude and belief about their illness, self-efficacy duration and complexity of the regimen (Brannon & Feist, 2000; WHO, 2001).

Objectives of the study:

a) To examine the levels of diabetes knowledge among adults with diabetes in Libya.
b) To investigate the levels of adherence (as measured by HbA1c) to health advice with regards to diabetes management.
c) To examine the factors which facilitate and enhance adherence to health care advice.
d) To examine the relationship between self-efficacy and diabetes management.

Methods

Research Design
A cross-sectional sampling survey design was used to collect data from adults with diabetes type 1 or type 2 who have been diagnosed for 12 months or more. Participants were asked to fill in two questionnaires in Benghazi Diabetes Centres, which is one of the oldest and largest diabetes registries in Libya.

Participants
A total of 855 participants (92 Type1 and 763 with Type2 diabetes) took part in the study. They were recruited whilst at the Diabetes Centre for routine appointment. 446 of participants were female and 409 were male. The age of participants range from 18-96 yrs Mean (Sd): 51.9 (13.17)

Materials:
Two questionnaires were used to collect data from all the participants these are:

Michigan Diabetes Knowledge Test (DKT), Fitzgerald et al. (1998)

The DTK questionnaire of the University of Michigan Diabetes Research and Training Centre was designed to investigate the level of diabetes knowledge. It comprises of 23 items which include 14 items as a general test of management diabetes and 9 items for insulin use (Fitzgerald, Funnell, Hess, Barr, Anderson & Hiss, 1998). Following measurement of diabetes knowledge, the sample divided into three groups based on their response of knowledge of diabetes. The range of the knowledge score was categorized in three different ways: as all 23 items, as general knowledge 14 items and as 9 for items related to the insulin use.

The range of score according to the level of knowledge

| Level	DKT 23 items	DKT 14 items general knowledge	DKT 9 items related to insulin use
Poor knowledge	<11	<7	<5
Average knowledge	11-17	7-11	5-7
Good knowledge	> 17	> 11	> 7

The Confidence in Diabetes Self-Care Scale adapted from Weinger et al. (2000)

The brief CIDS Scale is a self report questionnaire to assess self-efficacy; it was designed for type one diabetes (Weinger, Ven, Yi & Snoek, 2000). It comprises 20 items to test patient's possibilities and capacities with diabetes management which include performing activities to the treatment, self observation and control general health condition and self regulation to improve the conditions. The CIDS scale has been shown to be reliable and valid (Nicole et al., 2003). Because the participants in the present study had both type 1 or type 2 diabetes the original questionnaire was modified to 21 items to cover questions related to type 2.

In addition data on the most recent HbA_{1c} value (within the last three months prior to data collection) were extracted from the case- notes.

Ethical approval was obtained from LJMU ethics committee and the health authorities in Libya.

Results

Diabetes Knowledge Test (DKT 23,14,9)
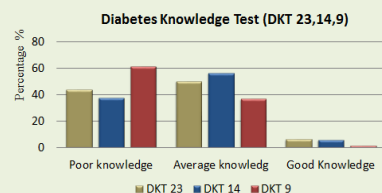
Level of HbA_{1c}

HbA_{1c} Level	No. (%)
Good (< 7 %)	106 (14.2 %)
Acceptable (7-8%)	181 (21.3 %)
Poor (>8 %)	540 (63.2%)

HbA_{1c} Mean (Sd): 9.3 (2.35)

The relationship between DKT 23 and education level

Groups	Knowledge 23, Mean (Sd)	F	P
Illiterate	9.95 (4.37)	17.14	0.001
Primary/Intermediate	11.61 (4.04)		
Secondary/Diploma	12.50 (3.69)		
Uni. Degree	11.32 (4.13)		

The Tukey test (with p< 0.05) suggest that those who were classified as being illiterate were different from the other 3 groups having lower levels of knowledge about diabetes

Factors are predicted HbA_{1c} levels

Predictor variables	Standardized Coefficients Beta	t	P
Age	-0.098	- 2.455	0.014
Duration of DM	0.116	2.914	0.004
DKT 23	-0.063	-1.758	0.079
Self efficacy	-0.232	-6.490	0.001

The model accounted for 6.6% of the variance (Adjusted R^2 = 0.066) (F = 11.58, p < 0.01)

Conclusions and Discussion

The Mean HbA_{1c} of 9.39 was higher than the recommended levels by ADA (2002) & DCCT (1993). Three variables namely duration of illness, age and self efficacy significantly predicted HbA_{1c} levels. Diabetes knowledge is very poor among both types of diabetes especially among those classed as illiterate and female sample. The Knowledge test was able to identify subgroups with limited level of knowledge, indicating that special education programmes need to be considered for these groups.