

A survey study to investigate food handler's knowledge, attitudes and behaviour towards food safety and food practices in restaurants in Liverpool

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ABSTRACT

Food establishments are on the rise in the United Kingdom, producing a wide variety of cuisine to cater for a variety of tastes in a global market. However, a significant proportion of the population will experience a foodborne illness at some point in their lives, and in 2018 alone there were estimated to be 2.4 million food borne illness related cases in the UK [1] with a resulting 180 deaths per year. Whilst Local Authorities monitor and inspect these establishments periodically, the importance of those who work within food business cannot be underestimated. As such the aim of this research study was to explore food handlers' knowledge, attitudes, and behaviour towards food safety and food handling practices in restaurants within Liverpool. Using both convenience and snowball sampling, the research employed a quantitative online questionnaire to gather data from the target population of food handlers. The responses from 52 participants were then analysed using a combination of Microsoft Excel and SPSS version 28. The results of the study reveal that food handlers in Liverpool food businesses have a generally satisfactory level of food safety knowledge; their attitudes expressed demonstrated a strong positive approach and they engage in safe behaviour. However, the results show some areas of concern: knowledge surrounding harmful pathogens was lacking; behaviour in relation to the use of mobile phones in the kitchen and attitudes towards attending work whilst unwell. Therefore whilst the overall knowledge, attitude and behaviours of food handlers appears acceptable that does not mean they do not pose risk to customers. Whilst all participants had received training, this did not always translate into improved food handling knowledge, attitudes or behaviours. Training, therefore, must be tailored to reflect the needs to the individual with the understanding that knowledge, attitudes and behaviours are linked.

Key words: Food safety, foodborne illness, food handler, knowledge, attitude, practices

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INTRODUCTION

Food-borne illnesses are a substantial burden to public health and the nation's economy [2]. A large majority of the population will experience a foodborne illness at some point in their lives, and in 2018 alone there were estimated to be 2.4 million food-borne illness-related cases in the UK [1] with a resulting 180 deaths per year caused by foodborne illnesses from 11 pathogens [3]. The WHO regards *Salmonella*, *Campylobacter*, and *E. coli* among the most common foodborne pathogens that affect millions of people annually, sometimes with severe and fatal outcomes [4]. This signifies the importance of making sure food is not contaminated with potentially harmful bacteria, viruses, toxins, parasites, and chemicals. Food contamination has far-reaching effects beyond direct health consequences and has significant economic impacts on society through direct healthcare costs and indirect costs such as lost productivity. The cost of food-borne illness is estimated at around €1.14 billion each year, including the impact of illness on individual well-being, loss of earnings, and the cost of hospital admission [5].

Food has the potential to become contaminated at any point during its production, distribution, and preparation, and the primary responsibility lies with food producers. However, a large proportion of food-borne illness incidents are caused by food improperly prepared in food establishments and not all food handlers understand the roles they must play when it comes to protecting the health of the wider community [4]. There are many opportunities for food contamination to take place during the preparation process before the food reaches the consumer. Contamination of food can be compounded by people's limited knowledge of food safety practices, potentially increasing the risk of food-borne illnesses. A large proportion of food poisoning is attributed to food served in restaurants and is completely preventable. Reasons for its occurrence include: negligence, ignorance, failure to implement good hygiene practices, and in the case of commercial food premises poor management. Food businesses are responsible for ensuring that their food is safe under food regulations. It is also recognised that some food handlers do not always apply these practices, despite being aware of them, and the reasons why the kitchen can become a risky place are complex [6]. Inappropriate handling practices can cause food contamination and food-borne illness consequently, impairing the health of the consumer [6]. Research by Griffith and Redmond [7] report that food safety is not just a microbiological problem but that it also has a major behavioural component. The top three factors resulting in foodborne illness outbreaks are: poor personal hygiene, cross-contamination, and time/temperature control. All are directly related to food-handler error [8].

Food businesses are legally obliged under food regulations to ensure that their practices minimise the risk of harm to the consumer. They must comply with food safety legislation to manage food hygiene and food standards to ensure food is safe to eat. The Food Standards Agency (FSA) [9] reported that inspections by both Environmental Health in the public sector and audit reports in the private sector of food businesses have identified significant degrees of non-compliance with either statutory requirements or industry codes of practice. Whereas some non-compliance may only affect food quality, other areas may have a major impact on food safety. A more recent survey conducted by the FSA found that 45% of consumers in England reported that the safety of food served by UK restaurants and takeaways was a concern to them [5].

However, this has not stalled the industry. Spending on restaurants, cafes, and similar food outlets in the United Kingdom on the rise: in 2019, consumer spending reached approximately €114 billion [10]. In recent years local authorities have seen a decline in resources (staff, money, time) that aid the delivery of food safety controls. According to the FSA, between 2012 – 2018 spending on food hygiene controls fell by 19% from €142 million to €114 million [5]. This relates to staff reduction, at a time when demand for their services is increasing.

Purpose of the study

While numerous research has identified the importance of food handling practices [8], it is generally considered that good overall levels of knowledge of food safety will lead to beneficial behavioural changes involving food practice [11]. Bandura [12] suggests that several constructs underlie the process of human learning and behavioural change, and one such variable known as “Outcome Expectations” is the judgement of the likely consequences a behaviour will produce. In relation to food safety the importance of these expectations may also be a driver.

However, concerns expressed by Griffith and Clayton [13] suggested that other factors, including staff attitudes can limit or prevent improvements in staff practices. The effective application of such knowledge with regards to influencing attitudes and behaviours are essential in ensuring the consistent production of safe food in restaurant operations.

This research aims to explicitly look at the knowledge, attitudes, and behaviours (KAB) of restaurant food handlers in Liverpool to understand and identify any limitations and inadequacies. KAB is an important theoretical model of health education, which asserts that behaviour change is affected by knowledge and attitude [14]. Understanding the knowledge, attitudes, and behaviours of food handlers are important for identifying where the risks to consumers' health is coming from and how it may be possible to prioritise actions in order to develop more efficient training methods in food safety.

METHODS

Study Design

The research adopted a quantitative methodology approach using a survey design. Quantitative research has the advantage of determining how common a phenomenon is, can detect associations between measured variables and make generalisations [15]. Quantitative data also allows for knowledge, attitudes, and behaviours to be quantified and the results can be generalised from the sample population to a larger population.

Questionnaires

A descriptive survey design was the chosen method of data collection for this study. Descriptive surveys can be used to gather demographic, attitudinal and behavioural information [16] which is concerned with summarizing and describing data [17]. This fitted in well with the aim of the study as it was also important to gather participants' behavioural information with the other elements.

The questionnaire was constructed specifically for this research and consisted of 4 distinct sections: demographic information, food safety knowledge; food safety attitudes and food safety behaviours.

The demographic information section captured information such as the age, gender and role of the participants. The food safety knowledge section of the questionnaire included 15 questions, each consisting of 4 possible options (one option was correct and the other 3 incorrect) and participants could select one option. The food safety attitudes section of the questionnaire consisted of 10 statements and participants indicated their strength of agreement with each statement using a Likert scale. Similarly, the food safety behaviours section of the questionnaire also consisted of 10 statements, with participants indicated their strength of agreement with each statement using a Likert scale. The questionnaire was piloted with 3 food handlers before going live to participants and some minor amendments were made to the questionnaire to ensure greater clarity. Those participants who took part in the piloting were not included in the final sample for data analysis.

Sampling Process

Different types of data collection methods were reviewed before deciding upon a combination of strategies known as convenience and snowball sampling.

According to Denscombe [18] convenience sampling is a type of nonprobability sampling strategy that allows the researcher to gather information from participants that are easily accessible and when there are time and cost limitations in collecting feedback. Snowball sampling was also used to encourage respondents to refer the survey on to other potential participants - in theory the sample then snowballs in the process of accumulation as each located subject suggests other subjects [19]. Each person that completed the survey was asked to nominate some other person who they felt would be relevant for the purposes of the study. This technique is effective for building up a reasonably sized sample, especially when used as part of a small-scale research project [18]. The target population was food handlers, aged 18 years and over, and currently working within the hospitality sector in Liverpool was chosen.

Data Collection

As this research was undertaken as part of the BSc (Hons) Environmental Health degree programme, prior to collection of any data, ethical approval was obtained from Liverpool John Moores University. Whilst the secondary researcher is a qualified Environmental Health practitioner and is currently programme leader for the degree programme, the primary researcher has a background within the food industry and has worked extensively in the hospitality sector within Liverpool. Therefore using existing contacts within the hospitality industry to act as gatekeepers, a link to the questionnaire was circulated to the employees of four different food businesses. Participants could then access the link to the questionnaire, which enabled them to complete it online. The questionnaire was available in October 2021 for two weeks, and initially the researchers received forty responses. As previously stated, all participants were asked to forward the link on to any other food handlers and so a further twelve participants took part in the survey, as a result of this snowball sampling. In all there were 52 participants in the research. The design of the questionnaire did not allow the researcher to determine which responses were from convenience sampling compared to snowball sampling.

Data Analysis

Descriptive data from the questionnaires was analysed using Microsoft Excel. In order to undertake a statistical analysis of the data, SPSS was used to perform a chi squared test, which explore the relationship between variables. In these tests, a p value was generated and if the p value was less than 0.05, it was held that the relationship between the variables was statically significant.

RESULTS

Demographic data

In total 52 participants were recruited to the research. The majority of respondents were male 71% (n=37) with female (n=13) and 4% (n=2) preferring not to say.

In terms of age distribution, 25 – 34 years olds represent the largest percentage with 50% (n=26). The second largest age group was the 35 – 44-year-olds with 21% (n=11); the third largest age group was the 18 – 24 year olds with 17% (n=9) and fourth age group was 45 – 54 year olds with 10% (n=5) and finally the last group was 55 year olds at 2% (n=1).

For participants, 44% (n=23) are employed in chef de partie roles, 21% (n=11) are managers in food handling businesses, 11% (n=6) are currently in head chef roles, 11% (n=6) are sous chefs, 6% (n=3) work as prep chefs and 6% (n=3) are kitchen porters.

Figure 1 shows the years of experience gained by the participants, with over half (55%, n=34) having over 10 years' experience within the industry.

Figure 1: Participants Years of experience as a food handler

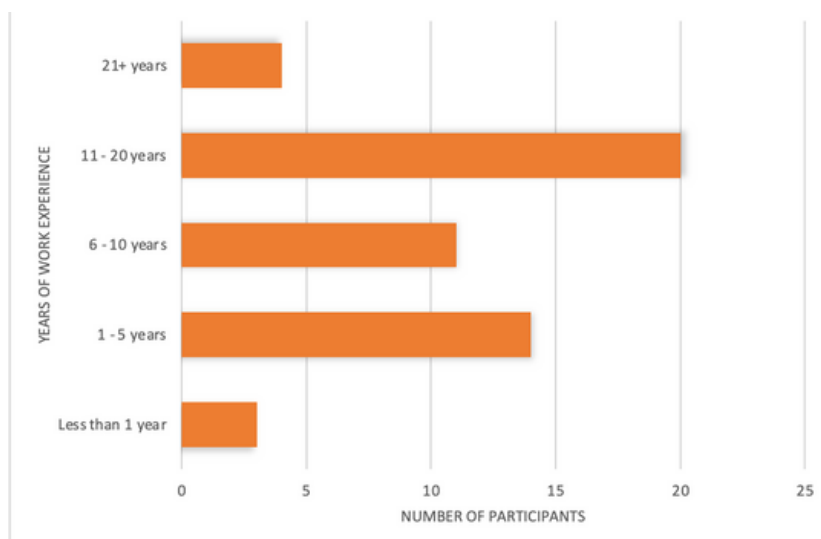
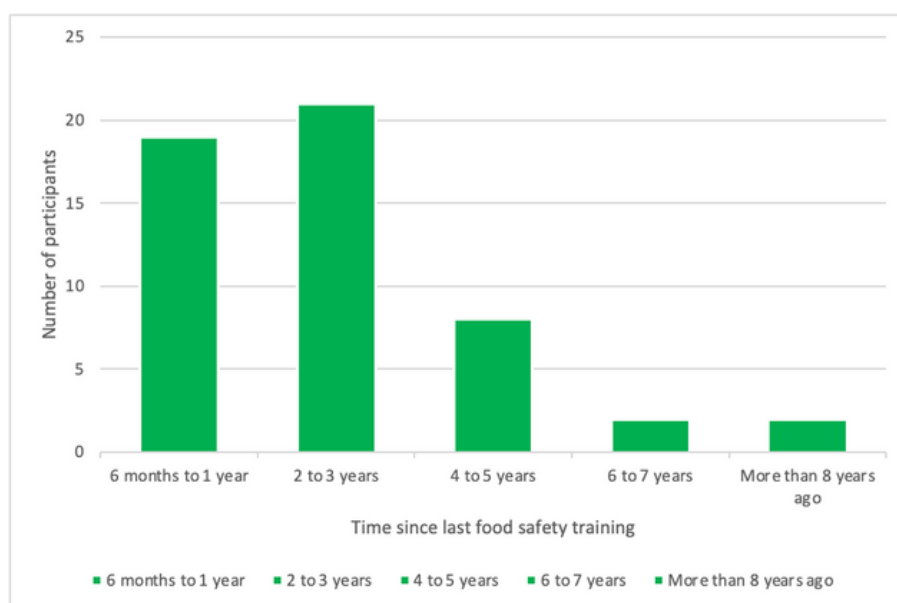


Figure 2 shows the most recent training experience the participants have gained. This training was provided in house by each of the food business involved and consisted of short online courses for employees to complete

Figure 2: Time since participants' last food safety training



Participants Food Safety Knowledge

Table 1 below shows participants responses to a range of food safety knowledge questions. For each question the participant was asked to select one answer from a number of possible responses, with only one of the responses being correct. The table shows the percentage of participants who answered each question correctly (total number of respondents n=52)

Table 1: Participants responses to food safety knowledge questions

Question asked	Correct response %	Incorrect response %
Food contaminated with food poisoning bacteria would most likely?	47%	53%
In which of these will bacteria multiply fastest?	94%	6%
What is the best method of controlling bacterial growth on food?	33%	67%
Which one of these statements about bacteria is true?	81%	19%
Which pathogenic bacteria is most commonly associated with chicken and eggs?	97%	3%
Food poisoning bacteria will multiply readily between what temperatures?	100%	0%
Food regulations require that you cool hot food ready for refrigeration within how long?	65%	35%
In the UK, food businesses must inform you under food law if they use any of the ___ allergens as ingredients in the food and drink they provide.	84%	16%
The temperature in your freezer should be?	92%	8%
Which of the following is not a high-risk food?	85%	15%
A refrigerator has 3 shelves; on which shelf do you think raw meat should be placed?	97%	3%
At what temperature should food be hot-held for service?	75%	25%
The best way to wash your hands is by using?	92%	8%
At work, the best way to dry your hands after washing is?	90%	10%
Food should not be left at room temperature for more than?	89%	11%

The average score achieved by participants was 78%, with no participant achieving 100%. The highest individual mark was 93% achieved by 5 respondents and the lowest individual mark was 53% achieved by 2 respondents.

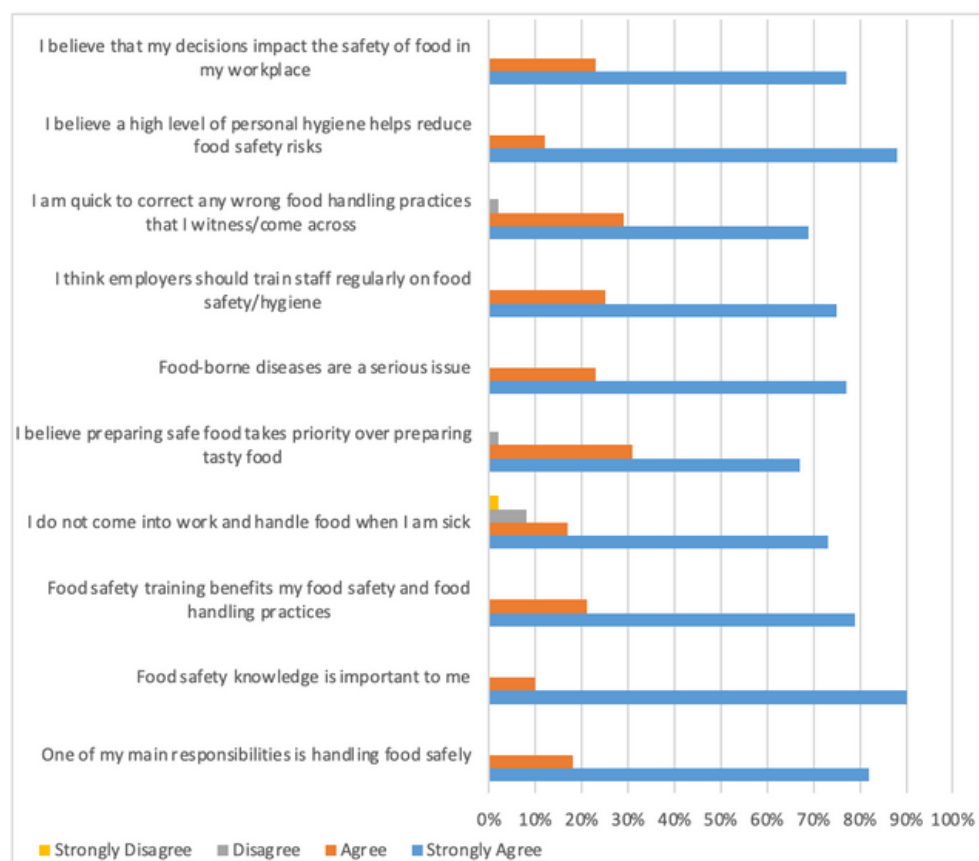
Food handlers have the ability to reduce food poisoning by either preventing the growth or survival of bacteria or by preventing contamination of foods. The findings from this study show that, based on the sample that took part in the questionnaire, the overall food safety knowledge of food handlers was found to be good. However overall knowledge of bacteria was found to be poor, with 67% unable to correctly identify the best method of controlling bacterial growth on food. Over half 53% of food handlers did not know that food poisoning can be caused by food that looked, smelt, and tasted normal. This mirrors findings by Walker et al [20] that clearly revealed “food handlers did not understand that organoleptic assessment of food was insufficient to identify food contaminated by pathogenic bacteria and therefore they were relying on incorrect physical attributes for food safety control”. Thirty-five of the respondents were also unaware of the importance of time/temperature control required when cooling cooked foods ready for refrigeration. Previous studies support these findings, and emphasize that a lack of knowledge from exists from food handlers around time-temperature control of foods [21] [22]. According to the WHO, time and temperature abuse by food handlers is one of the main reasons for causing foodborne outbreaks [23].

It is a possibility that the lack of continuous or recent training and food safety reinforcement may have contributed to the lack of food hygiene knowledge concerning a number of key questions. When individual knowledge scores were analysed, this produced an average score of 78% (calculated by looking at the average score achieved for each participant). This can be considered satisfactory if compared with the level 1 Basic Food Hygiene Certificate that has a twenty-question multiply-choice test and carries a 75% pass mark. The importance of satisfactory food knowledge is expressed by Bas et al [24] “the significant presence of knowledge is a motivation for adequate practices and justify the necessity of training. Knowledge allows the handler to modify its practice since he has motivation to change his behaviour”. However, concerns expressed [13] suggests that “it is unwise to automatically assume that improved knowledge will lead to behavioural changes involving improved practice, and also suggested that other factors, including staff attitudes can limit or prevent improvements in staff practices”.

Participants Food safety attitudes

The attitudes of participants towards food safety is illustrated in figure 3, in which participants were asked to indicate the extent to which they agreed with each statement.

Figure 3: Participants food safety attitudes.



Additional statistical analysis was undertaken to compare the level of participant's knowledge with their attitudes. Only the relationship between the variables: knowledge score and attitude statement, 'I do not come into work and handle food when I am sick' was proven to be statistically significant, with a p-value of 0.041 (where $p < 0.05$ is statistically significant)

Food handler attitude is a critical factor that can affect food safety behaviour and practices leading to foodborne illnesses. Zanin explains that, "attitude can be seen as the main link between knowledge and practices; food handlers demonstrating a positive attitude are more likely to translate them into safe practices" [24]. Therefore, it may be appropriate to say that a food handler demonstrating a negative attitude may practice risky behaviour. The findings from this study show that respondents demonstrated significantly positive results for food safety attitudes. However, there was a more varied response to the statement, 'I do not come into work and handle food when I am sick', with 8% disagreeing and 2% strongly disagreeing. Although this percentage is low it is still concerning that 10% of food handlers felt it was acceptable for them to work in food preparation areas while sick. A statistical analysis revealed that the level of participant's knowledge was related to this attitude, with those scoring lowest on the knowledge scale, more likely to attend work when ill. This can be viewed as a significant given that an infected food handler has been described as a contributing factor in 12% of outbreaks in England and Wales [25]. FSA best practice recommends food handlers displaying symptoms of illness should be excluded from the business until such time as evidence to the contrary is received, removing the potential risk of contamination of food [9].

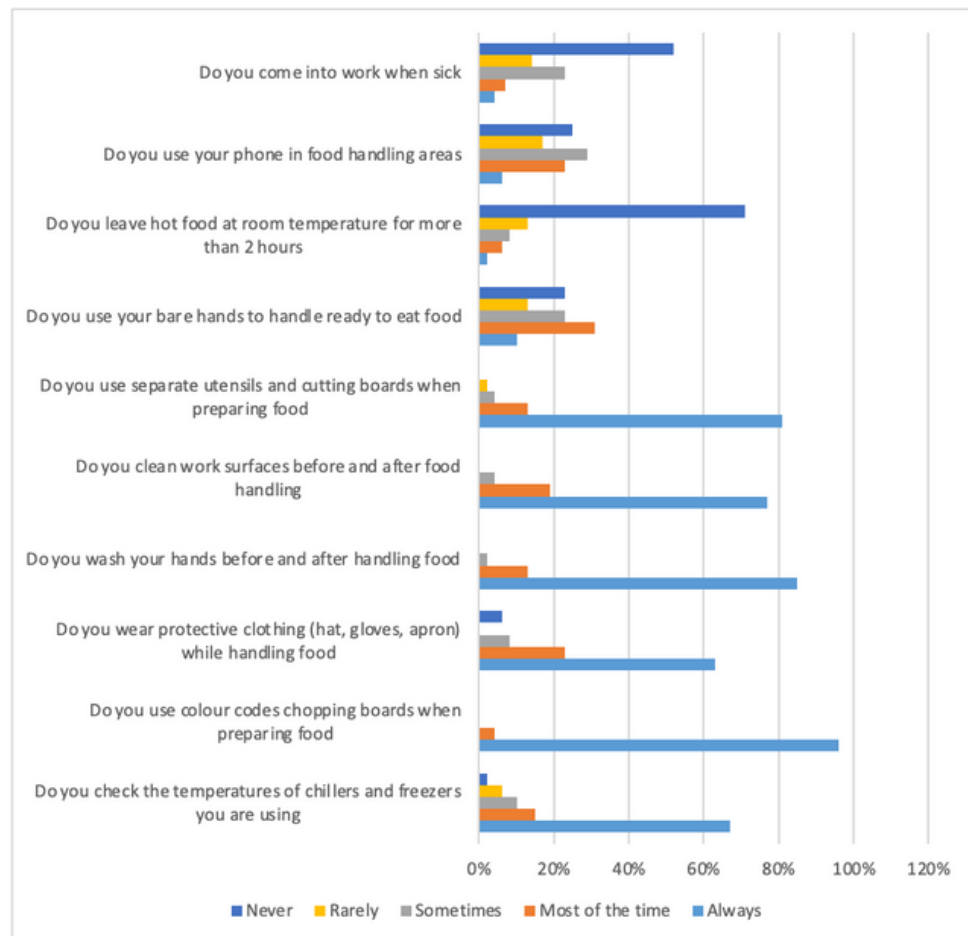
These findings are lower than those published by Al-Kandari et al [23] who evaluated the knowledge, attitudes and practices of 402 food handlers in Kuwait restaurants and had 24.4% of respondents who did not strongly agree that food handlers should not come to work when sick. This concept is sometimes termed as presenteeism, which is used to describe the phenomenon of working through illness and injury. This was not a surprising result to uncover for the researcher as social and financial pressures in the workplace can influence people's behaviours. Hospitality employees not in senior roles are often paid on an hourly basis and the impact that being sick can have on an individual's income often drives them to work even when sick, regardless of the consequences. Dewe, Keefe and Small [26] propose there may be a number of issues that can prevent staff absence, including attitudes of managers and work colleagues, sickness presenteeism may be more likely where staff replacements are hard to find. The Sainsbury Centre for Mental Health come this with research that suggests "the larger effect and mental ill-health is particularly likely to be manifest in the form of presenteeism rather than absenteeism" [27]

Further results gathered suggested that 77%, 75%, and 82% of the respondents strongly agreed with the following statements respectively: their decisions impact the safety of food in the workplace, that employers should provide regular training on food safety/hygiene and one of their main responsibilities is handling food safety. All of which demonstrate positive attitudes towards food safety practices but it would be wise to inject a note of caution at this point. Research [28] indicates that food handlers believe that they are less likely to cause food borne illness compared to their peers, perhaps giving a false level of their perceived skills and knowledge. So even with a positive attitude it is critical that effective training, strong knowledge foundation, awareness and implementation of good food handling practices is applied. According to Ko [29] "Positive attitudes are a necessary factor for the transformation of knowledge into appropriate practices by food handlers, being a mediator between knowledge and practices".

Participant's behaviours towards food safety practices

The Participant's behaviours towards food safety practices is illustrated in figure 4, in which participants were asked to indicate the extent to which they agreed with each statement.

Figure 4: Participant's behaviours towards food safety practices



The responses to the food safety practices questions were then divided into 2 groups – a group which indicated behaviour that posed a risk to food safety (risky behaviour) and group which indicated behaviour that would maintain food safety (safe behaviour).

The safe behaviour group was comprised of those responses to questions 1-4, which were never and rarely and for questions 5-10, which were always and most of the time.

The risky behaviour group was comprised of those responses to questions 1-4, which were sometimes, most of the time and always and for questions 5-10, which were never, rarely and sometimes. For each question these responses were added together provide an overall indication of each behaviour.

Table 2 shows the results of the food safety practices questions divided into safe and risky behaviour, with overall 78% of the answers given displayed safe behaviour towards food safety practices. While 22% of respondents' answers demonstrates risky behaviour towards food safety practices

Table 2 – Food safety behaviours divided into Safe and Risky behaviour.

Food Safety Practices	Risky (%)	Safe (%)
Do you come into work when sick?	34%	66%
Do you use your phone in food handling areas?	58%	42%
Do you leave hot food at room temperature for more than 2 hours?	16%	84%
Do you use your bare hands to handle ready to eat food?	59%	46%
Do you use separate utensils and cutting boards when preparing food?	6%	94%
Do you clean work surfaces before and after handling food?	4%	96%
Do you wash your hands before and after handling food?	2%	98%
Do you wear protective clothing (hat, gloves, apron) while handling food?	14%	86%
Do you use colour coded chopping boards when preparing food?	0%	100%
Do you check the temperature of chillers and freezers you are using?	18%	82%

Table 3 summarises the relationship between the knowledge scores and all ten variable behaviour questions. The table shows no significant relationships between knowledge and the majority of the behaviour variables, generating no statistical significance except for the question, 'Do you use separate utensils and cutting boards when preparing food?' with a p-value of 0.03 (where $p < 0.05$ is statistically significant).

Table 3: Statistical analysis for the relationship between participant knowledge scores and behaviour

Food Safety Practices	Significance
Do you come into work when sick?	0.727
Do you use your phone in food handling areas?	0.491
Do you leave hot food at room temperature for more than 2 hours?	0.401
Do you use your bare hands to handle ready to eat food?	0.615
Do you use separate utensils and cutting boards when preparing food?	0.03
Do you clean work surfaces before and after handling food?	0.067
Do you wash your hands before and after handling food?	0.357
Do you wear protective clothing (hat, gloves, apron) while handling food?	0.665
Do you use colour coded chopping boards when preparing food?	n/a
Do you check the temperature of chillers and freezers you are using?	0.222

When assessing the overall behaviour of participants their overall scores were categorized into protective and risky behaviours. Up to 58% of respondents demonstrated risky behaviour by using their phones in food preparation areas. In addition, 59% of them handle ready to eat foods with their bare hands while working. Only one relationship provided a statistically significant result, which was between knowledge score and behaviour question, 'do you use separate utensils and cutting boards when preparing food?' which generated a value of $p=0.03$. This shows that participants' knowledge translates into safety behavioural practices regarding cross contamination. For the majority of food safety behaviours, the results were not statistically significant as the p-value was greater than $p>0.05$. In this study it translates to there being no significant relationship between respondents' knowledge and their protective behaviours towards food safety. This mirrors findings by Bas et al [30] who found that good food safety knowledge does not necessarily result in good handling practices. Although a study conducted by Abdul-Mutalib et al [31] which evaluated the knowledge, attitudes and practices of 64 food handlers working in restaurants in Malaysia found evidence to suggest good knowledge led to good practice. It has been suggested that knowledge is the main precursor to behavioural change and over the years much of the existing training, particularly formal training is designed using the knowledge, attitudes and practices (KAP) model [25]. Rennie [32] argues that this model is flawed, and that, "too little emphasis is placed on changing individuals' beliefs and attitudes and that the model fails to take into account cultural, social and environmental issues". Although training may bring about an increase in food safety knowledge this does not always translate in a positive change in food handling behaviour

CONCLUSION

In conclusion, the results of this study show participating food handlers' knowledge, attitudes and behaviour levels to be satisfactory. This appears to be in line with the findings of Ahmed et al [33], who similarly established that food handlers had a good attitude to food safety and practices. Therefore, if we applied these results to the wider population of food handlers across Liverpool, consumers should be fairly safe when eating out. Even though this is the case certain aspects of participants' food safety knowledge are limited and require improvement, particularly relating to foodborne pathogens. The consequences of poor food safety knowledge in areas such as these could increase the risk associated with food borne illnesses.

The knowledge, attitude and behaviours of food handlers cannot be viewed as separate entities that can be tackled or addressed in specific ways but are interconnected. Each variable is interlinked, each affecting the other. What is clear is that no one method or tactic can be used to drive all three towards perfect food safety practices.

These findings support previous research that suggests whilst food safety and hygiene training should always be encouraged it does not always translate into improved food handling attitudes or behaviours. There is also the argument put forth by Clayton et al [25] that food safety and hygiene training will only be effective if the systems and resources are in place to encourage food handlers to implement good practice.

Individuals learn and adapt in different ways and so any effective training must be tailored towards the needs to the individual. It is also the case that many people enter the hospitality and food industry without formal training, so the value of in-house training cannot be underestimated. The effectiveness of such training is very much dependent on the attitudes of managers and senior staff members and the culture of an organisation. Indeed Griffith et al [34] see the development of a food safety culture, where employees see the responsibility for ensuring food safety is shared equally is key to ensuring food safety. A continuous and varied training approach can prove to be most beneficial in these circumstances. Positivity is key to driving food safety forward, but food handlers must also be made fully aware of the consequences of risky behaviour.

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