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Experiences of geophagy during pregnancy among African migrant women in London: Implications for public health interventions[☆]

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ABSTRACT

This study explored African migrant women's clay ingestion experiences during pregnancy against a backdrop of health risks warnings in order, to inform public health interventions by the UK Food Standards Agency and Public Health England, now known as the UK Health Security Agency. An interpretative phenomenological approach (IPA) was utilized, and data were collected with a total of 30 participants through individual in-depth interviews and one focus group discussion. Findings showed clay ingestion is a fluid and widely accepted cultural practice among African communities with most participants having been socialized into ingestion during childhood, through family influences and current social networks in their adulthood. Vomiting, nausea, spitting, appetite challenges, and cravings were cited as the main reasons for clay ingestion during pregnancy. With strong claims regarding its effectiveness, clay was ingested every day by most participants, and at times in large quantities despite the potential health risks. This calls for innovative and culturally sensitive public health interventions starting with the inclusion of clay ingestion health risk messages in maternal health nutrition information within antenatal settings. This can be done as part of multilevel interventions informed by life course approaches, which also consider community health messages and an enabling regulatory policy framework focusing on clay sold for human ingestion.

1. Introduction and background

Clay ingestion (CI) also known as geophagy among pregnant women in various parts of the world is a major public health concern which requires attention. Against a backdrop of the Sustainable Development Goals (SDGs), with Goal 3 aiming to ensure healthy lives and promote the well-being of all, a critical understanding of clay ingestion among pregnant women should be prioritized. There are health issues that arise from this practice as scientific evidence suggests that some clay ingested by pregnant women can be toxic to the human body due to the presence of high levels of lead and arsenic among other metals which can potentially lead to low birth weight (LBW) in children, impaired intra-uterine growth, impaired neurodevelopment, and intestinal blockages (Al-Rmalli, Jenkins, Watts, & Haris, 2010; Frazzoli et al., 2016; Gundacker et al., 2017; Nyanza et al., 2014; Reeuwijk et al., 2013). Lower levels of exposure to lead potentially affect brain development with implications for Intelligence Quotient (IQ) and attention span reduction,

antisocial behavior as well as reduced educational attainment (World Health Organisation (WHO), 2021). For instance, a study in Bangladesh indicated that early pregnancy exposure to arsenic through drinking contaminated water was associated with LBW (Huyck et al., 2007). In 2020, nearly 20 million (14.7%) of all newborns globally suffered from LBW (United Nations Children's Fund (UNICEF), 2023). LBW is associated with death during the first month of life and babies who live beyond this are at higher risk of lower IQ and stunted growth as well as obesity and diabetes later in life (Christian, Black & et al, 2013; Gu et al., 2017; Jornayvaz et al., 2016). While middle- and low-income countries are most affected, high income countries such as the United Kingdom have evidence of high rates of LBW (UNICEF, 2023) with people from Black ethnic groups having the highest infant mortality rates for LBW babies, followed by those from Asian ethnic groups (Office of National Statistics (ONS), 2021). Women from Black ethnic groups in the UK are known to experience poor maternal health outcomes (ONS, 2021), and against this backdrop, contributing risk factors such as CI deserve attention.

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Clay Ingestion is also known to expose pregnant women to the risk of parasitic infections through ingesting contaminated clay which is a major transmission route for helminths such as *Trichuris trichiura*, *Ascaris lumbricoides* and *Toxocara* (Getachew et al., 2021; [Ulaganeethi et al., 2023](#)). Additional health risks include excessive tooth corrosion and dental enamel wear ([Ekosse et al., 2017](#)) as well as anemia ([Nchito et al., 2004](#)) with severe implications for pregnant women in some cases ([Moyana, 2018](#)).

However, rooted in cultural beliefs, CI during pregnancy is widely practiced in Africa ([Diko & Diko, 2013](#); [Frazzoli et al., 2016](#); [Gundacker et al., 2017](#); [Henry & Cring, 2013](#); [Kelle et al., 2022](#); [Madziva & Chinouya, 2020](#); [Nabuuma, 2021](#); [Njiru et al., 2011](#); [Nyanza et al., 2014](#); [Reeuwijk et al., 2013](#)), some parts of South Asia ([Davies, 2023](#); [Getachew et al., 2021](#); [Ulaganeethi et al., 2023](#)) and Latin America ([Njiru et al., 2011](#)). There is evidence of CI among African Migrant women and Asian women in Western contexts ([Abrahams et al., 2006](#); [Al-Rmalli et al., 2010](#); [Madziva & Chinouya, 2023](#); [Medical University of Vienna, 2016](#); [Reeuwijk et al., 2013](#)) sales. Against a backdrop of potential health risks, the UK Food Standard Agency (FSA) issued several warnings against CI among pregnant and breastfeeding women as well as restrictions on clay sales ([FSA, 2022](#)). Public Health England (PHE), now known as the UK Health Security Agency (UKHSA) also notified public health practitioners to dissuade women from CI ([PHE, 2013](#)).

Despite these top-down initiatives pregnant women in London, continue to ingest clay with a recent study indicating that restrictions have pushed the practice underground. This has resulted to selling of clay under the counter in some shops and markets ([Madziva & Chinouya, 2023](#)). This has potentially left women ingesting toxic clay with little chance of guidance from authorities and conversations about risks. This suggests that the top-down approach has limited impact. Complex cultural frameworks from countries of origin are known to influence women's health behaviours during pregnancy ([Benza & Liamputtong, 2014](#); [Madziva & Chinouya, 2020](#)). This has implications for how they engage with the host country's antenatal care services. Understanding women's lived experiences as they navigate a pregnancy informed by their cultural framework on CI is crucial in informing public health practitioners' engagement with women in clinical encounters as well as outside those encounters. It has been argued that by understanding the lived experiences of those whom they serve, practitioners can be more aware of their perspectives as well as "their biases and unconscious perpetuation of inequalities between them and communities" ([Getera & Singh, 2020](#): para: 15). On this note, the view of CI as a dangerous practice ([PHE, 2016](#)) needs balancing with an awareness of alternative perspectives as informed by women's experiences. This can be a starting point for the development of culturally sensitive interventions as public health practitioners recognize and act on the significance of those lived experiences. The CI evidence base is skewed by scientific evidence pointing to the potential dangers; a basis which informs the top-down approach. The dearth of practicing women's voices has partly contributed to this top-down approach as well as its limited impact. Hence, incorporating African migrant women's lived experiences in the CI knowledge base is crucial in remedying this. It is anticipated that an awareness of women's lived experiences including the importance placed upon CI will encourage sensitivity to women's cultural heritage as well as influence public health practitioners' perceptions in a way which reduces biases and increases the likelihood of appropriate interventions being developed. In this case, Public health practitioners can improve the acceptance of CI interventions by women when they have a better understanding of the women's lived experiences ([Beames et al., 2021](#)). The development of appropriate interventions would go some way in improving maternal health outcomes for pregnant women and their unborn babies. In addition, this study also forms the basis for further research, particularly in terms of understanding the prevalence of this practice among pregnant women in England which is presently unknown.

2. Methodology

Interpretative Phenomenology Analysis (IPA) was employed in this study due to its suitability to address questions regarding women's experiences relating to CI during pregnancy. IPA aims to uncover the meaning and key structures of participants' lived experiences with a phenomenon, in this case, CI as well as the contextual forces that shape it ([Bynum & Varpio, 2018](#), p. 252). This methodology enabled the study to fully accommodate participants' lived experiences as informed by their backgrounds and cultural heritage. While smaller samples are mostly used with Interpretative Phenomenological Analysis (IPA) with [Creswell \(1998\)](#) suggesting five to 25; 'there is no right answer to the question of the sample size' as this depends on many factors ([Smith et al., 2021](#), p. 46). A larger sample size afforded the study with breadth which is often sacrificed in small samples by depth ([Smith et al., 2021](#)). This enabled coverage of different African nationalities. With research methods training at the doctoral level and a combined research experience of over 25 years as well as being academics, researchers were well equipped to conduct the study. Two black African community mobilizers were trained to recruit participants using the set criteria as explained in the ensuing section. It was important for recruiters to be 'insiders' of the African community to build trust and rapport with potential participants. The researchers then contacted recruited participants at agreed times as arranged by the community mobilizers for briefing about the study. This allowed participants to ask questions about the study before agreeing to participate at another agreed time slot of their choice.

2.1. Sampling and recruitment

Recruitment utilized a combination of purposive, snowballing, and quota sampling. Snowballing works well in recruiting a hard-to-reach group ([Ritchie et al., 2013](#)). Snowballing was useful in sampling since CI by women is a hidden practice, that women are not willing to share with everyone. Given the risk of ending up with participants from the same country of origin with snowballing, quota sampling was introduced to improve the sampling pool diversity. Due to COVID-19 restrictions, participants were initially approached remotely through community networks via emails and telephone calls by community mobilizers. The study was conducted from May 2020–August 2020.

Participants' countries of origin were as follows: Zimbabwe, Uganda, Cameroon, South Africa, Ghana, Republic of Congo, Nigeria, Congo Brazzaville, and Guinea Bissau. With a median of 2.5 children, participants' age ranged from 29 to 45 years old. Most participants worked in the Health Care Sector as Nurses, Social Workers, Health Care Support Workers and Health Care Assistants as well as in the financial sector. This resonates with the UK context where black and minority workers dominate the health care sector. While 4.2% of England's population identifies as of Black heritage ([ONS, 2021a](#)), 48% of health and social care workers in London are from black and minority groups ([The Health Foundation, 2020](#)).

Participants were 'purposively' selected to 'represent' the following criteria.

- Self-identifying as black African;
- Over eighteen years old;
- Living in a London borough; and,
- Having experienced CI during pregnancy in England in the last ten years.

2.2. Study context and ethical considerations

The study was conducted in London with participants drawn from London boroughs as presented in [Fig. 1](#) below.

The study was granted ethical approval (ID-016) by the London Metropolitan University Ethics Review Committee. In line with ethical requirements, all participants were briefed on the aims of the study,



Fig. 1. Greater London Authority.

issues of consent, confidentiality, voluntary participation, and the right to withdraw from the study anytime. Informed written consent was obtained from participants and to ensure confidentiality, all participants were anonymized.

2.3. Data collection and analysis

Using an interview schedule, semi-structured in-depth interviews were utilized to gain in-depth insights into participants' lived experiences as told in their language (Carter & Henderson, 2007). The FGD enabled the collection of data generated between participants (Finch & Lewis, 2004) thereby eliciting data relating to both shared and unique lived experiences. Participants of the FDG were drawn from those who had been individually interviewed. The rationale for this was to clarify issues emerging from the interviews and this worked well. Each in depth interview lasted approximately forty to 60 min, while the FGD lasted 1 h and 45 min. All interviews were conducted in English and recorded, transcribed and manuscripts were printed for IPA. The manuscripts were read while listening to corresponding audio files to ensure accuracy.

Data analysis followed the four-stage process outlined by Willig (2008). This involved; familiarizing with the text, and identifying themes, clustering themes based on their connectedness with each other and producing a summary table with all themes, and matching quotes, and integration of cases enabling the tracing back of individual scripts. To arrive at the themes, Moustakas (1994) and Creswell, 2013 processes were followed where the transcripts were first read and reread. This led to the development of a list of significant statements" as a foundation for understanding the phenomenon of CI (Creswell, 2013). Lastly the significant statements were then grouped into "larger units of information to form themes" (Creswell, 2013, p. 193).

3. Findings

Thirty participants took part in the study. While thirty-nine participants were initially approached to take part in the study, data saturation was reached with thirty participants, hence once there was no new information being generated no further interviews were conducted (Saunders et al., 2018). Due to COVID-19 restrictions, data was collected

remotely via direct telephone calls as well as the WhatsApp's app depending on participant's choice. At that time Children were being home-schooled and some participants had their young children in the background during data collection. While this was in some cases disrupted by children crying; we exercised patience while prioritizing the need for parents to attend to them. This led to rescheduling at times more than once.

Women CI experiences emerged into 2 broad themes as follows: a) What 'our' community says about CI during pregnancy b) Experiences of CI during pregnancy: childhood socialization and pregnancy onset as a trigger followed by clay type preference and reasons for ingestion, frequency and 'quantity'. Emerging themes were partially informed by the interview and FGD schedules. Participants identities were anonymized and the letter 'P' was used to represent the participant followed by an assigned number.

3.1. What our community says

In a bid to better understand community perceptions of CI during pregnancy, participants detailed their views of what they perceived as the views of their communities regarding CI during pregnancy. A mother who describes CI as an acceptable well-known practice in her culture explained it this way:

"In terms of people eating clay, in my culture when you are pregnant, it's like clay is supposed to help you with pregnancy. I would say it's a known thing, I know it's an accepted thing, for instance if I went somewhere and I am craving for it ... they will bend over hills to find me some ... It's not taboo" (P11 Ugandan mother)

Far from being viewed as a tabooed practice, the community was perceived supportive of CI. Another mother who spoke about CI 'back home' being a tradition put it this way:

"In general, its normal especially back home. I don't know here they don't seem to know much about it, but I am sure other African ladies like me will tell you it's normal. Only a few pregnancies that don't do that ... it was there even before we were even born, it's like our tradition". (P26 Zimbabwean Mother)

A Ghanaian mother who ingested clay through three pregnancies explained it as acceptable as well as mandatory with perceived benefits as follows:

“It’s acceptable. It’s something pregnant women have to eat. It’s acceptable in our community ... its very good because to me it gives a bit of iron, it gives me energy, it’s like it prevents me from vomiting because when I am pregnant, I vomit a lot. I think for African people its normal because for all my three children, I have been eating it” (P29 Ghanaian mother)

While acknowledging challenges in accessing clay in the UK in comparison to ‘back home’, another mother described CI as normal to the extent that it is often perceived as the first sign of pregnancy as follows:

“I think in our community ... it’s something which is very normal; It’s unfortunate that here in the UK, we don’t find it easily and sometimes when we get it, it will be so expensive. Back home its very normal when you see someone eating clay, then you are like, “oh yeah I think you are expecting”, it’s like something that’s expected when you are pregnant ...” (P30 Zimbabwean Mother)

A Cameroonian mother explained CI as culturally valued by pregnant women, while also alluding to the community’s varied perspectives as follows:

“[Clay] ... it’s something that people use from the community when they are pregnant, something cultural ... some people are against it, some people are for it because it’s like you grow up seeing women eating when they are pregnant ...” (P20 Cameroonian Mother)

Again, different perspectives were also noted by a Zimbabwean mother who remarked:

“Oh God there is so much that people in our community say about eating clay. Obviously, it’s not everyone who does that but most of the people who have encouraged me to eat this clay say that it acts as a mineral supplement for the pregnancy ...” (P19 Zimbabwean Mother).

Despite the lack of consensus with regards to what the community says about CI among participants; the majority pointed to the practice being normal with a cultural dimension and helpful to pregnant women in various ways.

3.2. Childhood socialization and social networks

When participants were asked when and how they had started CI, childhood socialization appeared to have played a key role in introducing most women to the practice from female relatives. A South African mother explained it this way:

“I saw my grandmother eating it and she would roast it like you roast peanuts and when she did that it was even more nicer as it just brought the flavor out of the clay ... I was 11, 12 ... that’s when I started having that kind of experience of eating it. And as I got older, I stopped until I became pregnant” (P14 South African Mother)

Another mother who learnt from observing her pregnant mother noted:

“A long time ago may be in grade 6 [Approximately 11 years] ... my mother would eat it when she was pregnant ... when she was eating, I was eating as well then I stopped when she had stopped, when she had given birth” (P4 Zimbabwean Mother)

For some, being sent by family members to fetch clay introduced them to their first tasting experience as explained below:

“I was very young because my aunt used to eat a lot of clay and anytime, she sent me to get some, I would take some and eat it ...” (P16 Ghanaian Mother)

For some, CI however started with pregnancy and a mother who

didn’t initially think highly of CI noted:

“When I was younger, I was not interested in it (clay). I would say haa rubbish thing, rubbish but when I am pregnant it’s like something is driving me to have it, you feel you want to have it” (P12 Congolese Mother)

Whilst pregnancy triggered cravings, for some it was recommended by family and friends to mitigate vomiting related to pregnancy as one reflected:

“I started when I was vomiting, and people were proposing different things to me. It prevented me from being dehydrated, from vomiting”. (P29 Ghanaian Mother)

Among those who had ingested clay during childhood and then stopped as they transitioned into adulthood, perceived socio-cultural norms, the expectation to ingest clay when pregnant appeared to have played a key role in the resumption of the practice. One mother explained it this way:

“I thought if you’re pregnant you have to eat clay. But I ate clay when I was younger but ... I hadn’t eaten clay for ages, until I became pregnant. I was like nope; you can’t be pregnant without eating clay. In Africa a lot of women ate clay, some would say they ate it for spitting, for this, for that, but for me it’s like you have to eat clay if you’re pregnant because I just associated it with pregnancy” (P22 Cameroonian Mother)

3.3. Clay preference: processed and unprocessed

In their clay ingestion experiences participants expressed clay type preferences with variations from countries of origin emerging as well as distinctions between processed and unprocessed clay as explained by a Cameroonian mother:

“It depends ... there is clay from Ghana, ...Congo. I don’t like the clay from Congo because it is man made. The clay that we use in Cameroon come from the mountains. They may remove some sediments like sand, but it is still in natural form. But the clay that they sell from Ghana and Congo ... I don’t trust it, it is man made, they shape it themselves and I don’t know if the hands are cleaned” (P20 Cameroonian Mother)

Preference for unprocessed clay was also highlighted by another Cameroonian mother, while pointing to salted clay from Congo as noted below:

“The one that comes from Congo is a bit salty, and that’s different from the one in Cameroon which is just raw clay ... The salty one is not the one I really like, but because I had no option, I had to buy that one” (P28 Cameroonian Mother)

Comparisons were also drawn as follows:

“The way they (Ghanaians) do theirs is not the same as ours. I don’t know whether they ground it, they put it in water and add some salt. They try to make it a bit artificial. But our own is natural. The way they get it [from original source], is the way we eat it, we don’t do anything to it ... but theirs comes in some kind of shape. Very small like fingers. Finger size. The size of the thumb” (P13 Cameroonian Mother)

Preference for natural clay often described as “plain” was high among participants as another mother explained simply:

Plain, Plain is the best. (P21 Ugandan Mother)

A Zimbabwean mother also echoed the same sentiments as follows:

“I trust the one I know from back home, the natural one, which is not modified, processed or anything” (P30 Zimbabwean Mother)

A mother who compared her preference to chocolate explained it this

way:

“I have seen all of them [types of clay] but in my country we eat the one that looks like a stone (Plain) ... the one mixed with salt and sugar ... Those ones I don't want to eat because I don't trust them. The one I like is appears natural like a rock ... it is really dry, cranky like chocolate. You know when you put chocolate in the fridge, and you are eating it ... you have that feeling”. (P9 Congolese Mother)

Aversion to processed clay appeared to stem from handling issues as well as the additional ingredients such salt and sugar. In addition, due to this process one could not be certain of additional ingredients. Preference however went beyond this to clay texture when being consumed as well as the color and smell. One mother put it this way:

“I like the traditional one, plain clay, no sugar, no nothing. It needs to be darker clay but quite hard not soft, hard enough to bite it. I never liked the soft one. Of course, it has to smell good. I have to smell it before I eat it. They have different smells. I would know from the smell that this one is not the one ... if you want to make it better, when you get it, put it in a foil paper and charcoal grill it” (P11 Ugandan Mother)

Some participants preferred grilled or heated clay because they believed it killed off bacteria as explained below:

“They [sellers] put it in the oven, even from the smell you can tell that it has been in the fire. You know some of the clays are quite raw and fresh ... I knew when I smelt fire that whatever bacteria there would have been dissolved or killed in the process [hence preference]” (P16 Ghanaian Mother)

However, not all participants preferred unprocessed clay. A mother who preferred processed clay put it this way:

“The one mixed with salt [preference] I tried the other one [plain] but I had to go back to the salted one because I wasn't comfortable with the other one” (P7 Nigerian Mother)

Another mother reported not having any preference as follows:

“You have two different types [of clay] there is one that's plain and the one that has a bit of salt in it. I don't mind any” (P6 Ghanaian Mother)

Preference also appeared to be informed by what worked for the individual in mitigating pregnancy related challenges being experienced as mother explains:

“The plain one [is the best]. Someone introduced me to the salty one, but I would throw up, it didn't work for me” (P29 Ghanaian Mother)

3.4. CI reasons, frequency, and 'quantity'

Participants reported reasons for CI as well as ingestion frequency, as they explained the extent to which they relied on clay in managing pregnancy-related challenges. While there was no attempt to measure the quantity of clay ingested, issues of quantity were repeatedly raised in response to the original question on the frequency of ingestion. A mother whom health professionals had encouraged to eat crackers (water biscuits) to deal with excess saliva explained it this way:

“It [clay] clears your mouth from saliva ... your mouth is always full up with saliva so clay kind of dry it out ... the taste of it made it a difference for me, like they [health professionals] suggest- eat a cracker but I prefer clay ... [otherwise] all the time I am holding a bottle to spit in, it was gross so I would rather eat the clay to dry it out” (P6 Ghanaian Mother)

When asked how often she ingested it; she responded as follows:

“I would have it every day but because sometimes you go to the shop there is none there, I would kind of economize the one I have ... though sometimes when I know that they have some there [shop] I would finish it. I would eat about three times ... it comes in some kind of shape ... the size of the thumb. But if know I'm running out then I, I'll reduce it to maybe two or one until I finish” (P6 Ghanaian Mother)

Clay molds, the size of a thumb, were consumed three times a day, subject to its availability at the local shops in London. Availability of clay appeared to dictate how often it was consumed as well as the quantity. Another mother put it this way:

“It helps me with the spitting ... when you are pregnant you get up in the night to throw up. It prevents you from throwing up as well. Instead of me sleeping with a small bowl next to my bed to be spitting in; I prefer to put the clay in my mouth through the night. So, I just leave it in my mouth and sleep with it and all night I will sleep without waking up to spit” If it wasn't that clay, I don't know (P13 Cameroonian Mother)

For this mother CI played a dual role in mitigating spitting as well as vomiting. She reported difficulties in quantifying, but alluded to ingesting a lot as follows:

“I can't even quantify it but a lot ... every day I will even eat a bowl of it” (P13 Cameroonian Mother)

While clay was ingested every day in quantities described as “a lot” and the “size of a bowl” it seemed to also lead to insatiable cravings leading to more clay ingestion. Another mother ingested for the same reasons explained it this way:

“I vomit all the time even when I brush my teeth, I have to vomit. That's why I say okay if I take clay, my vomit will stop ... that's when I start taking it. I ate too much and over and over again. I can't say how much. Sometimes I take the big piece and I finish it. A bowl in one day. I feel very bad sorry to tell you that you know” (P12 Congolese Mother)

Some mothers reported ingesting clay to boost appetite and eventually give birth to healthy babies as one mother said:

“In a day I would eat maybe half a kilogram or three quarters because remember it was helping me to boost my appetite and my mum always said it helps me to give a healthy baby, so who doesn't want a healthy baby? I religiously was taking this clay” (P19 Zimbabwean Mother)

An Ugandan mother who also credited CI with quelling vomiting and boosting her appetite and described clay as a food supplement taken first thing in the morning and before going to bed put it this way:

“Early in the morning before going to do anything you take it [CI] and then in the evening before going to sleep. It stopped the vomiting and ... appetite increased. I would say it's something like a food supplement in pregnancy ... Before that I was constantly sick, vomiting. It does boost your appetite of eating. It cleans your stomach as well”. (P21 Ugandan Mother)

The morning and evening ritual was also highlighted by another mother who slept with clay under her pillow for easy access. She explained it this way:

“When I was pregnant, I would take it first thing in the morning to prepare myself for the day, and then before I go to bed so I can sleep. Because with some people you'll find them with stuff like chocolates or sweets under the pillow. Me, I used to have clay under my pillow” (P18 Zimbabwean Mother)

However not all participants reported ingesting clay every day and or in large quantities. One mother who perceived clay safer than taking

drugs to quell vomiting put it this way:

“To be honest, maybe like once or twice a week in very little quantity the first three months, I was feeling nauseous, I was vomiting, I couldn't go to work. And then because I was being so conscious of taking drugs, because I didn't want to put the health of my baby at risk. Any time I'm pregnant, I stay away from drugs for the first trimester. One of my relatives advised me at the time, if I could just eat a little bit of clay and it did work because after a few weeks I felt better. And I wasn't really vomiting anymore. I couldn't believe it” (P17 Nigerian Mother)

However, not all participants ingested clay due to cravings, nausea, vomiting and appetite challenges. A first-time mother reported engaging in CI in compliance with pregnancy's perceived social norms due to concerns that deviance would result in the pregnancy not going well. She explained it this way:

I never needed clay. I was eating it because I thought when you're pregnant, you eat it. People say it will stop nausea and saliva in your mouth. I never had saliva, I never had nausea ... but I was eating it. It's like an acquired taste. Do you enjoy it? I don't know. I just know that while you're pregnant you eat clay. It's not a matter of enjoyment. It's a necessity. If you don't do that your pregnancy won't be nice or it won't go well. Maybe something will happen to you ... all the time I had to eat it ... literally every day (P22 Cameroonian Mother)

The reported CI “all the time” and “everyday” denotes a strong belief that not doing so would result in a negative pregnancy outcome.

4. Discussion

This study aimed to explore African migrant women's CI experiences in a bid to understand the importance and experiences of CI during pregnancy, inform public health interventions as well as increase the likelihood of acceptance of those interventions by women who practice geophagy.

4.1. CI: a widely accepted cultural practice

As a starting point to making sense of and understanding women's lived experiences, it was pivotal to gain insight into community perspectives of CI. Findings point to CI as well-known and normal practice with some participants describing it as ‘culture’ and ‘tradition’ with family and community members going out of their way to enable the practice. This resonates with a large body of evidence which shows that CI is widely accepted and viewed as a cultural practice in many African countries (Davies, 2023; Diko & Diko, 2013; Frazzoli et al., 2016; Gundacker et al., 2017; Henry & Cring, 2013; Kelle et al., 2022; Madziva & Chinouya, 2020; Nabuuma, 2021; Njiru et al., 2011; Nyanza et al., 2014; Reeuwijk et al., 2013). For example, a neonatal study involving 12713 mothers at a hospital in Uganda revealed that 80 % of them had ingested clay during pregnancy (Kalanzi, et al., 2013) while a more recent study reported 45% of CI among 307 women attending antenatal care (Nakiyemba et al., 2021). Among participants, CI was perceived synonymous with pregnancy which concurs with the literature (Shinondo & Mwikuma, 2008). While there was an acknowledgment that CI during pregnancy is not well known in this Western context, the underlying assumption was that other African women are well versed in the practice. However, despite this widespread acceptance, it was noted that some people in the community disagreed with it.

4.2. Childhood socialization and the role of social networks

Most participants' experiences of CI started during childhood through observing women such as their mothers, aunts, and grandparents engaging in the practice. Some reported having their first tasting

experience after being sent to fetch it. Clay Ingestion childhood experiences indicate that it's not practiced by pregnant women only, which resonates with other evidence from elsewhere (Diko & Diko, 2013). A quantitative study of 378 pregnant women in Kenya indicated that 65% of them had ingested clay as young girls (Luoba et al., 2004). Similarly, a study among Zambian school children showed that 79% of those who ingested clay had more relatives who did so than those who didn't engage in the practice (Nchito et al., 2004) However, in this study participants who engaged in the practice during childhood reported stopping as they transitioned to adulthood; only to re-engage due to pregnancy. The socialization of children into CI points to the family as a powerful source of social influence as the first agent of socialization. Participants who had not engaged in CI during childhood; reported that friends and family were instrumental in recommending it as they struggled with pregnancy related nausea and vomiting inter alia. On this note, interventions should go beyond individual pregnant women. The role of family and friends as well as the community alludes to the presence of active social networks which should not be ignored in interventions.

4.3. Clay preferences & safety beliefs

Findings indicate that clay ingested comes in different forms; processed and unprocessed. Most participants preferred unprocessed clay which was often described as ‘natural’ or ‘plain’ as highlighted elsewhere (Diko & Diko, 2013). Clay preferences were informed by one's country of origin with differences noted; for example, some clay from Ghana and Congo was reportedly salted and molded into finger like shapes while some clay from countries such as Zimbabwe, Cameroon, South Africa, and Uganda was ingested in its original unprocessed state; albeit in some stances grilled or baked. While ingestion was done directly as though ingesting sweets or chocolate, in some cases, it was mixed with water and herbs and taken as a drink. However, clay described as ‘natural’ by some participants had been subjected to heating -grilled or roasted to improve the taste as well as kill off bacteria; a process well described by Henry and Cring (2013). Elsewhere this clay is described as processed (Diko & Diko, 2013). In this study, the perception of baked or grilled clay as ‘natural’ was juxtaposed with molded clay mixed with either salt and sugar which was perceived ‘artificial’, ‘men made’ and ‘processed’ which also resonates with findings by Henry and Cring (2013).

Some participants considered unprocessed clay safe and risk free while hygiene concerns were raised with regards to processed clay. Whether clay was processed or not; texture and smell were also deemed important; hence not just any clay was ingested in line with other findings (Diko & Diko, 2013). However, perceptions of processed clay and unprocessed clay as unsafe and safe respectively, point to limited risk awareness. Evidence suggests that roasting or clay baking improves its smell and taste as well as kills off helminths to ward off parasitic infections. This is reflected in a study by Shinondo and Mwikuma (2008) which concluded that due to moisture being a pre-requisite for ova such as *Ascaris lumbricoides*, and *Trichuris trichiura* to survive and embryonate, no helminth infections were attributed to CI among pregnant women. While this may be the case, there remains a large body of evidence derived from large scale quantitative studies showing that CI is linked to helminth infections during pregnancy with incidents of infection at 20% (Getachew et al., 2021), 51 % (Gebrehiwet et al., 2019) and 71% (Feleke & Jember, 2018) respectively. Differences in evidence can be attributed to personal hygiene in relation to clay handling, clay source, type, and how it is ingested as dried and or exposed to heating. Furthermore, while heated and dried clay (which participants in this study considered unprocessed and safe) maybe free from ova; it may contain toxic elements such as lead and arsenic inter alia, hence the need to increase women's knowledge and risk awareness.

Some participants reported preferring processed clay; salted clay and this poses additional concerns. While salt intake assessment is generally

fraught with difficulties, high dietary salt intake is a major risk factor for developing high blood pressure among other cardiovascular diseases (WHO, 2020). Salt intake across sub Saharan Africa is above WHO's recommended intake of a maximum of 2 g per day which potentially underpins the high burden of blood pressure in the region (Oyebode et al., 2016).

In the UK, Black people of African heritage are three to four times more likely to have high blood pressure when compared to Caucasian counterparts (Action on Salt, 2010). High blood pressure is associated with several pregnancy complications such as pre-eclampsia, stillbirth, fetal growth restriction and preterm birth (Webster et al., 2019). While there are many contributing factors to high blood pressure, salt intake in the context of CI has not been a subject of scientific inquiry. As with all clays, salted clay is not treated as a food product; hence the salt content is not monitored thereby potentially leaving women ingesting unknown quantities of salt, in addition to the usual dietary intake which is likely above recommendation. Clay ingestion studies have mainly focused on testing clay for helminth infections and elements for toxicity (Al-Rmalli et al., 2010; Getachew et al., 2021; Kortei et al., 2019; Reeuwijk et al., 2013; Ulaganeethi et al., 2023) bar additional ingredients. On this note, research is required to assess ingredients in clay such as salt to ascertain the health implications thereof.

4.4. CI reasons, frequency and 'quantities'

Most participants reported ingesting clay 'religiously', 'every day', 'three times a day', 'all the time', 'like food', 'over and over again' as well as 'morning and evening' bar one who ingested twice a week. Similarly, a study of 340 pregnant women, who attended six antenatal clinics in Geita District, Tanzania found that 50% ingested clay with 65% ingesting it two to three times a day while 20 (13%) ingested more than three times a day (Nyanza et al., 2014). In this study, the language used by some participants such as 'too much', 'can't quantify', 'can't say how much' 'the size of bowl' 'half a kilogram to three-quarters' pointed to ingestion of sizable quantities. However, in some instances, clay the size of two fingers per day was ingested which indicated a lower amount. Other studies have pointed to ingestion of 100–400 g per day (Medical University of Vienna, 2016); 5–219 g (Huebl et al., 2016). No clay ingestion quantities in Europe were identified for comparisons. Additional experiences reported by participants included ingesting clay first thing in the morning to prepare for the day and last thing at night; carrying clay to work for ingestion during break times as one does with a snack; sleeping with clay in the mouth to avoid waking up to spit; sleeping with clay under the pillow for easy access. The availability or non-availability of clay from various sources appeared to influence how much was ingested; thus, when scarce; it was ingested sparingly due to concerns of running out. On this note, while it is impossible to ascertain the levels of exposure to associated risks; it can be postulated that CI frequency, amount ingested daily, and clay source, potentially pose varying levels of risks to the women and their unborn babies.

Most women (twenty four of the thirty participants) in the study, cited quelling nausea, vomiting, and spitting as well as increasing appetite as the reasons for CI which resonates with other findings (Nakiyemba et al., 2021; Njiru et al., 2011; Nwafor, 2008; Nyanza et al., 2014) with strong beliefs and claims of effectiveness as highlighted elsewhere (Wilson, 2003). The claim to providing relief is backed by scientific evidence which indicates that most clay ingested contain smectite and kaolin clays which are used in modern medicine to tackle nausea and gastrointestinal upsets including diarrhea (Droy-Lefaix & Tateo, 2006; Young, 2007). For example, Young (2007) cites the case of smectite clay which is now pharmaceutically branded after clinical trials showed it can effectively reduce the severity of diarrhea.

The findings showed concerns regarding the side effects of medication to tackle nausea and vomiting during the first trimester which influenced some women's decision to ingest clay. This was underpinned by the belief that clay is safe because ancestors, including their own

mothers had ingested it for generations without negative pregnancy outcomes. While caution regarding taking medication during pregnancy is important and warranted; a study by Tefera and et al. (2020) among 423 pregnant women in Ethiopia indicated that 70% of them thought all drugs were harmful if taken during pregnancy. This alluded to an exaggerated risk belief. Given the evidence pointing to the potential health risks associated with CI, the assumption that it is safer than medicine is simplistic. However, there is evidence that some clay minerals can provide relief. Therefore it is necessary to critically assess clay from different sources to identify if any can be certified safe for human ingestion in its natural state, benefits and side effects included. Clay Ingestion has survived for generations, and such scientific studies can contribute towards provision of a safer line of continuation. However, prior to this, risk awareness interventions are pivotal.

Cravings were cited by five of the participants as a reason for CI; a phenomenon well reported in a Tanzanian study (Nyaruhucha, 2009). However, cravings were additionally reported as side effects of ingesting clay to tackle nausea and vomiting. Such cravings seemed to develop over time consequently leading to more clay being ingested. Elsewhere these cravings are likened to cravings for cigarettes and alcohol (Young, 2010). Societal expectation as well as the belief that CI 'is good for the baby' and 'quickens delivery' were also cited as reasons by some participants which resonates with findings from South Africa (Nwafor, 2008) and Kenya (Geissler et al., 1999). However, there is no scientific evidence to support these claims.

In between tackling nausea, vomiting, spitting, increasing appetite, satiating cravings, and fulfilling societal expectations, some participants cited mineral supplementation. While this may be true in some instances, it's equally fraught. For example, a study which showed that CI in pregnant women provided 14% of the required dietary iron also indicated a strong negative association between CI and low haemoglobin and ferritin status (Geissler et al., 1999). Similarly, a study by Kortei et al. (2019) found that clay sourced from the Volta Region in Ghana and sold for ingestion contained potassium, iron, calcium, and zinc which are essential nutrients; but lead, arsenic and mercury were also detected. Hence, where relevant nutrients may exist; they may coexist with toxic elements which are associated with varying risks including anemia. The association of CI and iron deficiency has been attributed to impaired iron absorption after CI (Nchito et al., 2004). Njiru et al. (2011) list several mechanisms through which this may happen; notably the presence of lead and zinc competing with iron uptake; mercury and aluminum interfering with the production of red blood cells as well as tough clay materials damaging intestinal lining thereby inhibiting the absorption of iron (Young, 2007). As noted earlier, anemia is a risk factor for LBW, preterm delivery (Allen, 2000) and still birth as identified in Eastern Sudan (Ali & Adam, 2011).

5. Recommendations

There is no doubt that good nutrition for expectant women is one of the key ingredients for positive pregnancy outcomes. In recognition of this, the World Health Assembly maternal and infant Nutrition Action Plan aims to reduce anemia during pregnancy (Target 2) and LBW newborns (Target 3). However, despite CI's link to anemia and LBW, the action plan does not address CI. Guidelines generally focus on iron supplementation and deworming to control anemia during pregnancy (Davies, 2023). Furthermore, in African countries, where CI is most prevalent, Davies (2023) points out in an extensive review that there is no evidence of its inclusion in any local or national maternal health education guidance including uniform recommendations in any of the countries. While the normalization of CI in these countries probably underpins this neglect; in Western contexts where CI is viewed as dangerous; a lack of nuanced understanding of the practice by public health agencies such as UK Health Security Agency has contributed to reactive halfhearted measures. While clay is not a certified food product, the fact that it is ingested as such calls for its inclusion in maternal health

nutrition interventions, particularly those which seek to either encourage or discourage particular dietary intakes.

In the absence of clay certified safe for human ingestion, there is need for interventions which do not only spell out the potential health risks but engage in a balanced dialogue as to why CI as a cultural practice needs “deep revising and assessment” (Frazzoli et al., 2016, p. 1465). Industrial revolution activities such as mining and pollution inter alia have negatively impacted on the environment, consequently contaminating some clay. This can be used as a starting point for a balanced dialogue regarding the potential health risks not just with women but also with relevant communities. As Frazzoli et al. (2016: 1469) further argue, the concept ‘sustainable’ should explicitly include the needs of future generations with regards to “unimpaired potential for growth, development and health: mother to child transgenerational diet ...”. On this note; tackling CI among pregnant women should not be divorced from Goal 3 of the SDGs which aims to ensure healthy lives and promote well-being for all at all ages by 2030 particularly Target 3.1 (reduction of the global maternal mortality ratio to less than 70 per 100,000 live births); Target 3.2 (deaths prevention of newborns and children under 5 years of age and Target 3.9 (reduction of mortality and illnesses from hazardous chemicals including soil pollution and contamination). The inclusion of CI during pregnancy in the wider maternal health targets can contribute to their attainment because a good life begins in the womb. Concerted efforts in the form of international, national, and local collaborations in both research and interventions are required. This highlights the need for multiple level interventions informed by the Socio Ecological Model which identifies various interlinked levels of influence (Scholmerich & Kawachi, 2015) on women’s CI behaviour during pregnancy. This includes health messages interventions which could assist in promoting adherence to public health advice in terms of refraining from ingesting clay during pregnancy amongst at-risk communities (Tanna et al., 2021). As argued elsewhere by Madziva and Chinouya (2023), other than individual characteristics and social networks; the community level and policy levels of influence (local, national, and global) are pivotal in tackling CI. In the UK, the larger context of this study, the Food Standards Agency and UK Health Security Agency can play a key role in the formulation of appropriate policy frameworks with regards to toxic clay sold for human ingestion. On this note, the inclusion of communities in the formulation of interventions can go some way in ensuring their acceptance and effectiveness. Considering these inter-related complexities, interventions should be developed and tailored with the community of interest, while taking into account cultural sensitivity.

6. Contributions made

Whilst expounding on CI as a cultural practice that African women engage in to address pregnancy related challenges, this paper also affords insight into hidden experiences that are scarcely understood and researched in western contexts. Unravelling these hidden experiences is critically important in informing public health interventions given the reported risk that the practice potentially causes to women and their children’s health. Furthermore, the paper outlines and presents potential methodological approaches in researching hidden practices.

7. Limitations

One of the limitations of this study is that the women interviewed may not be representative of the experiences of all migrant African clay ingesting women during pregnancy in London. Despite this limitation, this study provides us with in-depth insight into the CI experiences of women during pregnancy in a context where little is known about such experiences, particularly by public health professionals. Most importantly, these findings suggest that there is a need to raise awareness regarding the potential health risks through multilevel interventions that target all levels of influence.

8. Conclusion

This study aimed to explore African migrant women’s CI experiences in a bid to inform public health interventions as well as increase the likelihood of acceptance of those interventions. Findings showed that CI is a widely accepted cultural practice among African communities with many participants having been socialized into CI as children through family influences as well as social networks as adults. During pregnancy vomiting, nausea, spitting and appetite challenges, as well as cravings were cited as the main reasons for ingestion. With strong claims regarding its effectiveness in quelling nausea, vomiting, and spitting along with boosting appetite, clay was ingested every day by most participants. On this note, there is a need for further research into clay from different sources to comprehensively assess if any clay is safe for human ingestion, particularly during pregnancy. Furthermore, research is required to assess the ingredients of processed clay, particularly salt levels and the health implications thereof as well as the prevalence of CI in Western contexts such as the UK as this is unknown. The pervading belief that clay is safe because ancestors ingested it for generations without evidence of harm points to a lack of relevant knowledge and risk awareness; hence the need for innovative and culturally sensitive interventions. Given the role of nutrition in pregnancy, the inclusion of clay ingestion health risk messages in maternal health nutrition information could be a starting point in the context of multilevel interventions which target all levels of influence on women’s CI behaviour up to the policy level. However, for this to be effective, affected communities should be at the helm. This calls for more funding for research and interventions.

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CRedit authorship contribution statement

Cathrine Madziva: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Writing – original draft, Writing – review & editing. **Martha Judith Chinouya:** Data curation, Formal analysis, Investigation, Methodology, Writing – review & editing. **Kezia Njoroge:** Methodology, Writing – review & editing, Formal analysis, Investigation.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.ssmqr.2024.100431>.

References

- Abrahams, P., Follansbee, M., Hunt, A., Smith, B., & Wragg, J. (2006). Iron nutrition and possible lead toxicity: An appraisal of geophagy undertaken by pregnant women of UK. *Applied Geochemistry*, 21, 98–108. <https://doi.org/10.1016/j.apgeochem.2005.09.015>
- Action on Salt. (2010). *Salt and black people of African descent*. Available at: London: Wolfson Institute of Preventive Medicine, Queen Mary, University of London <https://www.actiononsalt.org.uk/salthhealth/ethnic/blackafrican/#:~:text=The%20majority%20of%20salt%20consumed,intake%20comes%20from%20processed%20foods.> (Accessed 7 September 2023).
- Al-Rmalli, S. W., Jenkins, R. O., Watts, M. J., & Haris, P. I. (2010). Risk of human exposure to arsenic and other toxic elements from geophagy: Trace element analysis of baked clay using inductively coupled plasma mass spectrometry. *Environmental Health*, 9(79), 1–8. <https://doi.org/10.1186/1476-069X-9-79>

- Ali, A. A. A., & Adam, I. (2011). Anemia and stillbirth in kassala hospital, eastern Sudan. *Journal of Tropical Pediatrics*, 57(1), 62–64. <https://doi.org/10.1093/tropej/fmq029>
- Allen, L. H. (2000). Anemia and iron deficiency: Effects on pregnancy outcome. *American Journal of Clinical Nutrition*, 71(5 Suppl), 1280S–1284S. <https://doi.org/10.1093/ajcn/71.5.1280s>
- Beames, J. R., et al. (2021). A new normal: Integrating lived experience into scientific data syntheses. *Frontiers in Psychiatry*, 12(763005), 1–4. <https://doi.org/10.3389/fpsy.2021.763005>
- Benza, S., & Liamputtong, P. (2014). Pregnancy, childbirth and motherhood: A metasynthesis of the lived experiences of immigrant women. *Midwifery*, 30(6), 575–584. <https://doi.org/10.1016/j.midw.2014.03.005>
- Bynum, W., & Varpio, L. (2018). When I say ... hermeneutic phenomenology. *Medical Education*, 52(3), 252–253. <https://doi.org/10.1111/medu.13414>
- Carter, S., & Henderson, L. (2007). Approaches to qualitative data collection in social science. In A. Bowling, & S. Ebrahim (Eds.), *Handbook of health research methods: Investigation, measurement and analysis* (pp. 215–229). Maidenhead: Open University Press.
- Christian, P., Black, R. E., et al. (2013). Risk of childhood undernutrition related to small-for-gestational age and preterm birth in low- and middle-income countries. *International Journal of Epidemiology*, 42, 1340–1355.
- Creswell, J. W. (1998). *Qualitative inquiry and research design: Choosing among five traditions*. Thousand Oaks, CA: Sage Publications.
- Creswell, J. W. (2013). In *Qualitative Inquiry and research design choosing among five approaches* (3rd ed.). Thousand Oaks, CA: Sage Publications.
- Davies, T. C. (2023). Current status of research and gaps in knowledge of geophagic practices in Africa. *Frontiers in Nutrition*, 9(1084589), 1–14. <https://doi.org/10.3389/fnut.2022.1084589>
- Diko, C. N., & Diko, M. L. (2013). Geophagia among female adolescents as a culturally driven practice. *Indilinga: African Journal of Indigenous Knowledge Systems*, 12, 242–251.
- Droy-Lefaix, M. T., & Tateo, F. (2006). Chapter 11.6 clays and clay minerals as drugs. *Development in Clay Science*, 1, 743–752. [https://doi.org/10.1016/S1572-4352\(05\)01025-1](https://doi.org/10.1016/S1572-4352(05)01025-1)
- Ekosse, G.-I. E., Ngole-Jeme, V. M., & Diko, M. L. (2017). Environmental geochemistry of geophagic materials from free state province in South Africa. *Open Geosciences*, 9, 114–125. <https://doi.org/10.1515/geo-2017-0009>
- Feleke, B. E., & Jember, T. H. (2018). Prevalence of helminth infections and determinant factors among pregnant women in mecha district, northwest Ethiopia: A cross sectional study. *BMC Infectious Diseases*, 18(373). <https://doi.org/10.1186/s12879-018-3291-6>
- Finch, H., & Lewis, J. (2004). Focus groups. In J. Ritchie, & J. Lewis (Eds.), *Qualitative research practice: A guide for social science students and researchers* (pp. 170–198). London: Sage.
- Food standard Agency. (2022). *Importing food supplements and health foods*. Retrieved from <https://www.food.gov.uk/business-guidance/importing-food-supplement-s-and-health-foods#:~:text=We%20advise%20people%2C%20especially%20pregnant,considered%20unfit%20for%20human%20consumption>. (Accessed 8 August 2022).
- Frazzoli, C., Pouokam, G. B., Mantovani, A., & Orisakwe, O. E. (2016). Health risks from lost awareness of cultural behaviours rooted in traditional medicine: An insight in geophagy and mineral intake. *Science of the Total Environment*, 566–567, 1465–1471. <https://doi.org/10.1016/j.scitotenv.2016.06.028>
- Gebrehiwet, M. G., Medhaniye, A. A., & Alema, H. B. (2019). Prevalence and associated factors of soil transmitted helminthes among pregnant women attending antenatal care in Maytebri primary hospital, North Ethiopia. *BMC Research Notes*, 12(644), 1–6.
- Geissler, P. W., Prince, R. J., Levene, M., Poda, C., Beckerleg, S. E., Mutemi, W., et al. (1999). Perceptions of Soil eating and anemia among pregnant women on the Kenyan Coast. *Social Science & Medicine*, 48(8), 1069–1079. [https://doi.org/10.1016/S0277-9536\(98\)00409-2](https://doi.org/10.1016/S0277-9536(98)00409-2)
- Getachew, M., Yeshigeta, R., Tiruneh, A., Alemu, Y., Dereje, E., & Mekonnen, Z. (2021). Soil-Transmitted helminth infections and geophagia among pregnant women in jimma town health institutions, southwest Ethiopia. *Ethiopian Journal of Health Sciences*, 31(5), 1033–1042. <https://doi.org/10.4314/ejhs.v31i5.16>
- Getera, G., & Singh, S. (2020). *Reflecting on lived experiences in mental health*. Retrieved from <https://www.linkedin.com/pulse/reflecting-lived-experiences-mental-health-shuranjeet-singh/>. (Accessed 22 March 2023).
- Gu, H., Wang, L., Liu, L., et al. (2017). A gradient relationship between low birth weight and IQ: A meta-analysis. *Scientific Reports*, 7(18035), 1–13. <https://doi.org/10.1038/s41598-017-18234-9>
- Gundacker, C., Kutalek, R., Glaunach, R., Deweis, C., Hengstschläger, M., & Prinz, A. (2017). Geophagy during pregnancy: Is there a health risk for infants? *Environmental Research*, 156, 145–147. <https://doi.org/10.1016/j.envres.2017.03.028>
- Henry, J. M., & Cring, D. (2013). Geophagy: An anthropological perspective. In E. C. Brevik, & L. C. Burgess (Eds.), *Soils and human health* (pp. 179–198). Boca Raton, FL: CRC Press Taylor & Francis Group. <https://doi.org/10.1201/b13683-12>
- Huebl, L., Leick, S., Guettl, L., Akello, G., & Kutalek, R. (2016). Geophagy in northern Uganda: Perspectives from consumers and clinicians. *The American Journal of Tropical Medicine and Hygiene*, 95(6), 1440–1449. <https://doi.org/10.4269/ajtmh.15-0579>
- Huyck, K. L., Kile, M. L., Mahiuddin, G., Quamruzzaman, Q., Rahman, M., Breton, C. V., Dobson, C. B., Frelich, J., Hoffman, E., Yousuf, J., Afroz, S., Islam, S., & Christiani, D. C. (2007). Maternal exposure associated with low birth weight in Bangladesh. *Journal of Occupational and Environmental Medicine*, 49(10), 1097–1104. <https://doi.org/10.1097/JOM.0b013e3181566ba0>
- Jornayvaz, F. R., Vollenweider, P., Bochud, M., Mooser, V., Waeber, G., & Marques-Vidal, P. (2016). Low birth weight leads to obesity, diabetes and increased leptin levels in adults: The CoLaus study. *Cardiovascular Diabetology*, 15(73), 1–10. <https://doi.org/10.1186/s12933-016-0389-2>
- Kalanzi, E., Mengiste, A., & Katamba, A. (2013). Incidence of cleft deformities among neonates in mulago national referral hospital, Uganda. *East and Central African Journal of Surgery*, 18(1), 78–83.
- Kelle, H. I., Ogoko, E. C., Nduka, J. K., Udeozo, P. I., & Ubani, M. C. (2022). Health risk assessment of heavy metal exposures through edible clay from South-eastern and south-southern Nigeria. *The Pacific Journal of Science and Technology*, 23(1), 113–123.
- Kortei, N. K., et al. (2019). Elemental minerals and microbial compositions as well as knowledge and perceptions regarding kaolin (clay) consumption by pregnant women in the Ho municipality of Ghana. *Pan African Medical Journal*, 34(113), 1–17. <https://doi.org/10.11604/pamj.2019.34.113.17394>
- Luoba, A. I., Geissler, P. W., Estambale, B., Ouma, J. H., Magnussen, P., Alusala, D., Ayah, R., Mwaniki, D., & Friis, H. (2004). Geophagy among pregnant and lactating women in bondo district, western Kenya. *Transactions of the Royal Society of Tropical Medicine and Hygiene*, 98(12), 734–741. <https://doi.org/10.1016/j.trstmh.2004.01.009>
- Madziva, C., & Chinouya, M. J. (2020). Clay ingestion during pregnancy among black african women in a north London borough: Understanding cultural meanings, integrating indigenous and biomedical knowledge systems. *Frontiers in Sociology*, 5(20). <https://doi.org/10.3389/fsoc.2020.00020>
- Madziva, C., & Chinouya, M. J. (2023). African migrant women acquisition of clay for ingestion during pregnancy in London: a call for action. *Public Health*, 223, 110–116. <https://doi.org/10.1016/j.puhe.2023.07.021>
- Medical University of Vienna. (2016). *Geophagy: Soil-eating' as an addictive behavior*. Retrieved from <https://www.sciencedaily.com/releases/2016/12/161205085943.htm>. (Accessed 21 February 2023).
- Moustakas, C. (1994). *Phenomenological research methods*. Thousand Oaks: Sage.
- Moyana, M. (2018). *Addicted-to-eating-soil-may-have-dangerous-deficiency*. Retrieved from <https://www.news24.com/life/wellness/body/condition-centres/anaemia/new-s/pregnant-women-addicted-to-eating-soil-may-have-dangerous-deficiency-20181206>. (Accessed 4 May 2023).
- Nabuuma, J. (2021). *Health risks associated with heavy metal exposure in geophagic products (Emumbwa) consumed during pregnancy*. Kyambogo University. Retrieved from <https://kyuspace.kyu.ac.ug/bitstream/handle/20.500.12504/375/JUSTINE%20NABUUMA%20GMFT%202021.pdf?sequence=1&isAllowed=y>. (Accessed 3 January 2022).
- Nakiyemba, O., Obore, S., Musaba, M., Wandabwa, J., & Kiondo, P. (2021). Covariates of Pica among pregnant women attending antenatal care at kawempe hospital, kampala, Uganda: A cross-sectional study. *American Society of Tropical Medicine and Hygiene*, 105(4), 909–914. <https://doi.org/10.4269/ajtmh.21-0028>
- Nchito, M., Geissler, P. W., Mubila, L., Friis, H., & Olsen, A. (2004). Effects of iron and mult micronutrient supplementation on geophagy: A two-by-two factorial study among Zambian school children in lusaka get access arrow. *Transactions of The Royal Society of Tropical Medicine and Hygiene*, 98(4), 218–227. [https://doi.org/10.1016/S0035-9203\(03\)00045-2](https://doi.org/10.1016/S0035-9203(03)00045-2)
- Njiru, H., Elchalal, U., & Paltiel, O. (2011). Geophagy during pregnancy in Africa: A literature review. *Obstetrical & Gynecological Survey Journal*, 66(7), 452–459. <https://doi.org/10.1097/OGX.0b013e318232a034>
- Nwafor, A. O. (2008). *Reasons pregnant women who attend antenatal care in Mecklenburg Hospital eat soil. PhD dissertation. Limpopo. University of Limpopo (Medunsa Campus)*.
- Nyanza, E. C., Joseph, M., Premji, S. S., Thomas, D. S., & Mannion, C. (2014). Geophagy practices and the content of chemical elements in the soil eaten by pregnant women in artisanal and small scale gold mining communities in Tanzania. *BMS Pregnancy Child Birth*, 14(144). <https://doi.org/10.1186/1471-2393-14-144>
- Nyaruhucha, C. N. (2009). Food cravings, aversions and pica among pregnant women in Dar es Salaam, Tanzania. *Tanzania Journal of Health Research*, 11(1), 29–34.
- Office for National Statistics. (2021). *Births and infant mortality by ethnicity in England and wales: 2007 to 2019. Live births, stillbirths, infant deaths by ethnicity of the baby occurring annually in England and wales*. Retrieved from <https://www.ons.gov.uk/peoplepopulationandcommunity/healthandsocialcare/childhealth/articles/birthsandinfantmortalitybyethnicityinenglandandwales/2007to2019>. (Accessed 15 February 2023).
- Office for National Statistics. (2021a). *Ethnic group, England and Wales: Census 2021 - the ethnic groups of usual residents and household ethnic composition in England and Wales*. Census 2021 data. Retrieved from <https://www.ons.gov.uk/peoplepopulationandcommunity/culturalidentity/ethnicity/bulletins/ethnicgroupenglandandwales/census2021>. (Accessed 6 March 2024).
- Oyebode, O., Oti, S., Chen, Y. F.1, & Lilford, R. J. (2016). 1Salt intakes in sub-saharan Africa: A systematic review and meta-regression. *Population Health Metrics*, 14(1), 1–14. <https://doi.org/10.1186/s12963-015-0068-7>
- Public Health England. (2013). *Health risks of eating chalks and clays*. London: Retrieved from <https://webarchive.nationalarchives.gov.uk/20140722150327/>. (Accessed 1 September 2017) http://www.hpa.org.uk/webc/HPAwebFile/HPAweb_C/1317139340150
- Public Health England. (2016). *Chemical hazards and chemicals report. Issue 26* Retrieved from https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/522065/CHaP_Report_26_V2.pdf. (Accessed 15 February 2023).
- Reeuwijk, N. M., Talidda, A., Malisch, R., Kotz, A., Tritscher, A., Fiedler, H., et al. (2013). Dioxins (polychlorinated dibenzo-p-dioxins and polychlorinated dibenzo-furans) in

- traditional clay products used during pregnancy. *Chemosphere*, 90, 1678–1685. <https://doi.org/10.1016/j.chemosphere.2012.09.064>
- Saunders, B., Sim, J., Kingstone, T., Baker, S., Waterfield, J., Bartlam, B., Burroughs, H., & Jinks, C. (2018). Saturation in qualitative research: Exploring its conceptualization and operationalization. *Quality and Quantity*, 52(4), 1893–1907. <https://doi.org/10.1007/s11135-017-0574-8>
- Scholmerich, V. L. N., & Kawachi, I. (2015). Translating the socio-ecological perspective into multilevel interventions: Gaps between theory and practice. *Health Education & Behavior*, 43(1), 17–20. <https://doi.org/10.1177/1090198115605309>
- Shinondo, C. J., & Mwikuma, G. (2008). Geophagy as A risk factor for helminth infections in pregnant women in Lusaka, Zambia. *Medical Journal of Zambia*, 35(2), 48.
- Smith, J. A., Flowers, P., & Larkin, M. (2021). *Interpretative phenomenological analysis: Theory, method and research*. London: Sage.
- Tanna, N. K., Alexander, E. C., Lee, C., Lakhanpaul, M., Papat, R. M., Almeida-Meza, P., ... Blair, M. (2021). Interventions to improve vitamin D status in at-risk ethnic groups during pregnancy and early childhood: A systematic review. *Public Health Nutrition*, 24(11), 3498–3519. <https://doi.org/10.1017/S1368980021000756>
- Tefera, et al. (2020). Beliefs and risk awareness on medications among pregnant women attending the antenatal care unit in Ethiopia university hospital. Overestimating the risks is another dread. *Frontiers in Public Health*, 8(28). <https://doi.org/10.3389/fpubh.2020.00028>
- The Health Foundation. (2020). *Black and minority ethnic workers make up a disproportionately large share of key worker sectors in London*. Retrieved from <https://www.health.org.uk/black-and-minority-ethnic-workers-make-up-a-disproportionately-large-share-of-key-worker-sectors-in#:~:text=In%20London%2C%20workers%20from%20an,health%20and%20social%20care%20sector>. (Accessed 6 March 2024).
- Ulaganeethi, R., Saya, G. K., Rajkumari, N., Kumar, S. S., Ganapathy, K., & Dorairajan, G. (2023). Soil-Transmitted helminth infections among antenatal women in primary care settings in southern India: Prevalence, associated factors and effect of anti-helminthic treatment. *Tropical Medicine and Infectious Diseases*, 8(48). <https://doi.org/10.3390/tropicalmed8010048>
- UNICEF. (2023). *A good start in life begins in the womb*. Retrieved from <https://data.unicef.org/topic/nutrition/low-birthweight/>. (Accessed 14 August 2023).
- Webster, L. M., et al. (2019). Impact of ethnicity on adverse perinatal outcome in women with chronic hypertension: A cohort study. *Ultrasound in Obstetrics and Gynecology*, 54(1), 72–78. <https://doi.org/10.1002/uog.20132>
- WHO. (2020). *Salt reduction intake*. Retrieved from <https://www.who.int/news-room/fact-sheets/detail/salt-reduction>. (Accessed 12 September 2023).
- WHO. (2021). *Lead poisoning fact sheet*. Retrieved from <https://www.who.int/news-room/fact-sheets/detail/lead-poisoning-and-health>. (Accessed 12 October 2021).
- Willig, C. (2008). In *Introducing qualitative research in psychology. Adventures in theory and method* (2nd ed.). Berkshire: Open University Press/McGraw Hill Education.
- Wilson, M. J. (2003). Clay mineralogical and related characteristics of geophagic materials. *Journal of Chemical Ecology*, 29(7), 1525–1547. <https://doi.org/10.1023/a:1024262411676>
- Young, S. (2007). A vile habit? The potential biological consequences of geophagia, with special attention to iron. In J. MacClancy, H. MacBeth, & J. Henry (Eds.), *Consuming the inedible: Cross-disciplinary approaches* (pp. 67–69). Oxford: Berghahn Press.
- Young, S. L. (2010). Pica in pregnancy: New ideas about an old condition. *Annual Review of Nutrition*, 30, 403–422. <https://doi.org/10.1146/annurev.nutr.012809.104713>