

Geophagy: uses and perceptions of women of childbearing age in Tshwane District, Gauteng Province – a qualitative study

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ABSTRACT

Background Geophagy is a common practice among women of childbearing age across the globe associated with detrimental health effects.

Objective The study aimed at ascertaining the views and uses of geophagy among women of childbearing age in Tshwane District, Gauteng Province.

Methods An exploratory qualitative study was conducted among women of childbearing age consulting the reproductive healthcare units in Tshwane District. Focus group discussions and in-depth interviews were conducted in the public healthcare facilities.

Results The study findings indicate that women of childbearing age lack proper understanding of the dangers associated with the practice of geophagy. Many participants perceived geophagy as a practice that is socially acceptable and harmless, that is mostly practised by pregnant women. It was further revealed that geophagy is practised by people who have iron deficiency anaemia and those who are addicted to feed their cravings.

Conclusion A conclusion has been made that the practice of geophagy is accelerated by addiction and cravings, pregnancy, social acceptability and accessibility, boredom, fun and entertainment. Influence from family members and peer pressure play a significant role when it comes to the practice of geophagy.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ The practice of geophagy is common in African countries, particularly among women of childbearing age, precisely pregnant women irrespective of their education status, employment status, marital status, ethnicity, religious and cultural beliefs.

WHAT THIS STUDY ADDS

⇒ A pregnant woman who practises geophagy is more prone to giving birth to low birthweight babies, experience delayed labour, shortness of breath, severe constipation and precontamination of the fetus as compared with a pregnant woman who does not practice geophagy.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ Geophagic women of childbearing age lack awareness, when it comes to the toxic substances contained in clay soil and some lack proper knowledge of how to respond to their physiological needs such as iron deficiency, which triggers them to practise geophagy. Therefore, policy-makers must prioritise geophagy health education as part of maternity package.

INTRODUCTION

Geophagy is defined as a type of pica that makes one to crave for non-nutritious food and earthy materials such as rocks, soil, dirt, clay, chalk and kaolin by women of childbearing age especially pregnant women.^{1–5}

Geophagy is a pre-existing practice that was passed on from one generation to the next, particularly in African countries.^{6–9} Geophagy is regarded as a medical condition and cultural practice that is also common and widespread among women of childbearing age in South Africa, Gauteng Province where the study was conducted to explore their perceptions and uses.^{4 6 10–12}

The prevalence of geophagy among women of childbearing age remains unknown globally, at national and local levels because geophagy is not regarded as a priority public health concern by health institutes and governments.^{13 14} The research studies conducted on geophagy as far as women of childbearing age are involved are minimum, particularly in South Africa, although the practice is expanding.¹⁵ There is a serious under-reporting of geophagy resulting from different reasons.¹⁶ Public healthcare workers hardly ask women of childbearing about geophagy behaviour when they come for antenatal and family planning services.¹⁶ Women of childbearing age often feel ashamed or



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fear to share with clinicians about their use of clay soil and geophagy practice entirely.^{4 5 16 17}

Women of childbearing age have reported various negative health outcomes pertaining to the practice of geophagy.^{2 18–21} The biological and chemical composition of clay soil that is ingested by women of childbearing age often leads to the detrimental health conditions due to their level of toxicity.^{2 20 22 23} If geophagy continues to be neglected as a major public health concern in the reproductive health services, maternal and child mortality rates targets set by sustainable development goals for 2030 will not be achieved.

Geophagy is a known and common practice across different countries globally.^{3 4 17 19 24} The practice is known to be more eminent among women of childbearing age, of different age groups, ethnicities and social statuses.^{3 4 9 17 25 26} Public health programmes and education programmes aimed at addressing geophagy to create awareness should be prioritised to prevent various health outcomes such as precontamination of fetus during pregnancy, death and other complications that are experienced by women of childbearing age that are linked to geophagy practice.

A gap has been identified that women of childbearing age who practise geophagy lack proper knowledge and understanding of the dangers associated with the practice of geophagy practice.^{6 12 20 24 27} It was further revealed that not much has been done to prevent women of childbearing age to practise geophagy, particularly because this is a practice that is socially accepted by many countries and populations. The consequences of the practice of geophagy among women of childbearing age are not clearly understood; hence, this study has explored the views and uses of women of childbearing age regarding geophagy in Tshwane District, Gauteng Province.

METHODS

Study area

The study was conducted in Tshwane District located in Gauteng Province. Tshwane has population estimation of 3.4million²⁸ excluding undocumented immigrants. Tshwane is the administrative capital city of South Africa, and Gauteng is known as the economic hub. Healthcare facilities located in Tshwane District areas such as Mamelodi, Ga-Rankuwa, Phelandaba, Mabopane, Soshanguve, Pretoria CBD and Hammanskraal were targeted to form part of the study settings, because street vendors selling clay soil are usually spotted in these locations, as compared with the suburb areas. Tshwane District comprise black Africans, whites and mixed race. The most common used languages in Tshwane District include Setswana, Sepedi, Isizulu, Xitsonga and Tshivenda. Tshwane District is also dominated by men, women, youth, children and elderly people from different cultures and traditions and had a large population of women of childbearing age who also practice geophagy.

Study design, population and sample selection

An exploratory qualitative study was conducted to explore the uses and perspectives of geophagy among women of childbearing age in Tshwane District, Gauteng Province. Women of childbearing age who were above 18 years, both pregnant and non-pregnant women who were accessing reproductive healthcare services in the public healthcare facilities of Tshwane District, Gauteng Province were included in the study as participants. Purposive sampling technique was followed to sample women of childbearing age and pregnant women in the study. The researcher scheduled an appointment with facility managers, and unit managers in the antenatal care and family planning units to recruit women of reproductive age who were consulting. The purpose of the study, significance, aim, objectives and information leaflets was discussed in detail with the potential participants during recruitment. Participants who agreed to form part of the study were requested to sign written informed consent forms.

Sample size and sampling technique

Purposive sampling method was used to sample women of reproductive age who were consulting in the antenatal care and family planning units of Tshwane District, Gauteng Province to be included in the study. This was the best suited sampling technique to identify potential participants that possess similar characteristics. The sample size was determined by data saturation, which is a stage where participants are no longer giving new information. The researcher conducted 15 in-depth interviews and 7 focus group discussions and reached a sample size of n=99. The rationale for conducting both focus group discussions and in-depth interviews was to make provision for the participants to take part in the study following the approach that is suitable for them considering the busyness of the antenatal care units.

Data collection

Data collection commenced post receiving ethics approval. Permission to conduct the study was sought from Department of Health, healthcare facility managers and unit managers in the antenatal care and family planning units. Participants were requested to sign informed consent before taking part in the study. The research was conducted using an adapted interview guide (refer to online supplemental material 1 and 2) that consists of open-ended questions and a recording device. In-depth interviews and focus group discussions were conducted with women of childbearing age to explore their uses and perspectives towards the practice of geophagy. Private rooms to conduct both face-to-face in-depth interviews and focus group discussions for women of childbearing age were requested from facility managers in the healthcare facilities of Tshwane District, Gauteng Province. An interview guide adapted from published literature by Geramian *et al*²⁹ was used during in-depth interviews and focus group discussions with women of childbearing age.

The interview guide was written in English for women of childbearing age and questions were asked in English during interviews. To accommodate participants who do not understand English, an interview guide was also translated into native languages such as Setswana, Sepedi, IsiZulu, Tshivenda and Xitsonga as main languages spoken often in Tshwane District, and questions were asked in English and translated to the native languages where necessary during the interviews. Participants were also allowed to answer questions in their preferred language of choice which were translated back to English. Data collection took 3 months between September and December 2023. Each session took approximately 45–60 min for in-depth interviews, and 60 min to 1 hour 30 min for focus group discussions.

Data analysis

An audio recording device was used to record and store data during the interviews. A computer device was used to record and store data from the generated transcripts. Qualitative data collected during in-depth interviews and focus group discussions were processed and analysed using NVivo software V.14. Data were analysed by the researcher, the cosupervisor and statistician as the cocoder. The transcripts were edited, cleaned and exported to NVivo software V.14 to identify and arrange codes. Thematic content analysis steps were followed to analyse qualitative data to produce a codebook.³⁰ The researcher familiarised herself with data by repeatedly reading the transcripts to identify the possible codes, categorical data, ordinal data and patterns. The researcher then generated codes and merged similar topics and reviewed codes to developed themes and subthemes to produce coherent, concise, non-repetitive and logical data. The new themes were reviewed and added, which were used to present the findings of this study. Descriptive statistics were used to describe sociodemographics data of women of childbearing age in Tshwane District, Gauteng Province. The final report was taken for professional language editing and proofreading (see online supplemental material 3).

Trustworthiness

As this was a qualitative study, trustworthiness was necessary to ensure dependability, transferability, conformability and credibility of the research findings.³¹ The researcher kept track of field notes for all phases of the study to ensure dependability. Credibility was ensured through recording and transcribe verbatim when conducting both in-depth interviews and focus group discussions to ensure accuracy of data collected from all study participants. A thick description of the methodology and procedures was employed in this study, to allow application of the same methodology in a different settings and populations to ensure transferability. Conformability was achieved through auditing to ensure coherence of themes so that the results will reflect true perceptions of the participant.

Table 1 Sociodemographics information

Variable	Frequency	Percentages
Women of childbearing age		
Pregnant	76	77
Non-pregnant	23	23
Age		
18–19	4	4
20–29	44	44
30–39	42	42
40–49	5	5
50–59	4	4
Marital status		
Single	79	80
Married	18	18
Divorced	1	1
Widow	1	1
Education status		
Primary education	11	11
Secondary education	67	68
College education	13	13
Tertiary education	8	8
Employment status		
Employed	30	30
Unemployed	69	70

RESULTS

Findings from qualitative data

Sociodemographics characteristics of women of childbearing age

The sample size consisted of n=99 women of childbearing age, 76 were pregnant women and 23 were non-pregnant women of childbearing age who were consulting in the antenatal care services and family planning units, respectively. Their ages ranged from 20 to 41 with an average of 29 years for pregnant women, and 19–58 years with an average of 35 for non-pregnant women, respectively. 80% of the pregnant women were single, and 20% of the pregnant women were married. 13% of non-pregnant women were married, and 4% of the women of childbearing age were both divorced and widows. 78% of the non-pregnant women were single. 52% of the non-pregnant women were employed, followed by 48% of unemployed non-pregnant women. 24% of pregnant women were employed and 76% were unemployed. Among the pregnant women, 66% possessed secondary education, followed by 5% that had tertiary education, 14% had college and another 14% had primary education. On the non-pregnant women, 74% had secondary education, 4% had college education and 13% had tertiary education.

Table 1 shows the sociodemographic characteristics of the women of childbearing age as our study participants.

The perceptions and uses of women of childbearing age regarding geophagy in Tshwane District, Gauteng

Table 2 Main themes and subthemes

Main themes	Subtheme
Perceived addiction and cravings	Feeding addition and cravings
	Pregnancy cravings
	Iron deficiency
	Rain smell triggers cravings of clay soil
Ingestion triggered by pregnancy	Pregnant women eat clay soil to management morning sicknesses and nausea
	Pregnancy triggers people to eat strange things
Consumption influenced by family member and peer pressure	Keeping a company of soil consumers
	Influence from family member or friend
	Soil-eating practice is learnt and inherited from peers
Ingestion due to lack of proper knowledge and understanding of the dangers of geophagy	Misinformation about the dangers of soil-eating practice
	Misconceptions regarding the benefits of geophagy
	People eat soil for fun and entertainment
Geophagy used for fun and entertainment	People eat clay soil to pass time when bored
	People eat clay soil to due to its earth-like smell, taste, crunchiness, muddy, sticky, cleanness and its effect after consumption
	Cultural practice that is socially acceptable
Geophagy accelerated by social acceptability and accessibility	Clay soil can easily be accessed from open markets and street vendors

Province are demonstrated in table 2 for main themes and subthemes.

The major themes that emerged from the qualitative data analysis and the verbatim quotations

Perceived addiction and cravings

This theme covers the perceptions of women of child-bearing age regarding the practice of geophagy and people who practise geophagy. Women of childbearing age hold the perceptions that addiction and cravings for clay soil are the major reasons for the practice of geophagy among women of childbearing age. Therefore, women of childbearing age believe that people practise soil ingestion to feed their addiction and cravings for clay soil. This theme also refers to the intentional continuous use and ingestion of clay soil on daily basis non-stop. Such views are expressed as follows:

- I used to eat soil in the morning, during the day and at night. I would carry small portion of clay soil everywhere I go, funerals, workplace, and other events such as parties and weddings of the family. I know cravings are bad at times, so when I see those who eat soil, I just understand it is their time for daily dose to feed the cravings. Soil eating is addictive; you end up eating in public spaces when you are deep in the practise (P10).
- Pregnancy can make you eat anything...so I guess the cravings developed because of pregnancy (P38).
- Clay soil is addictive like drugs and cigarette, you can never taste once and stop, it becomes a norm, unless you did not enjoy the taste. People are motivated by their cravings and addiction to continue eating clay soil. You are unable to

start your day properly without eating soil. As soon as I finish brushing my teeth in the morning, I quickly rush to eat my clay soil. The feeling is different before you eat soil, you will be less active and not properly strong to start with any house chore. I eat soil mina anytime of the day at any frequency as long as I crave it, then I do eat it. I chow my clay soil and then I drink a lot of water afterwards (P43).

Influence from family member and peer pressure

- This theme emerged from the views of participants that they learnt geophagy from peers demonstrating the influence of peer pressure. This theme refers to the influence of peer pressure which causes people to want to explore and learn new things such as soil eating to fit in or out of curiosity. Peer pressure from close friends was reported to be one of the perceived causes of geophagy among women of childbearing age in Tshwane District. This theme also refers to the introduction and recruitment that family members do to hook others into geophagy practice. It explains how family were introduced by their own family in the practice by means of practicing geophagy in their presence, recruiting them to have a taste and by means of sending them to purchase the clay soil on their behalf where they usually get tempted to try the soil. Women of childbearing age claimed that geophagy is a practice that is usually inherited and learnt from friends because keeping a company of soil consumers makes one to be vulnerable to want to explore the practice. Such views are expressed as follows:
- I got hooked into eating this thing (clay soil) by a friend, till today I have never stopped (P14).

Most women eat clay soil when they are in groups which impact on the influence on others who do not eat clay soil. When you are sitting in a group, it is difficult for you not to want to try that clay soil (P30).

People eat soil because of peer pressure from the company of people they live with. It could be friends, family, and relatives around them who practise soil eating and therefore influence them to want to try clay soil out (P5).

I started eating soil because my aunt was also sending me to go buy clay soil for her (P10).

My sister introduced me clay soil eating (P67).

Ingestion due to lack of proper knowledge and understanding of the dangers of geophagy

Women of childbearing age expressed their views that lack of proper knowledge and understanding, and misinformation are the leading causes of geophagy among consumers. This theme also indicated the misconceptions and myths that people have regarding geophagy, and inadequate information on the dangers of soil eating practice as well as the potential health risks. Participants indicated that they often misinterpret their psychological, physiological and nutritional needs in their bodies. Women of childbearing age revealed that people who practise clay soil ingestion perceive this as a method to supplement the required minerals, vitamins and nutrients in their bodies. Participants expressed views that people eat clay soil for wrong reasons, perceived benefits and beliefs emerging from false information. Such views are expressed as follows:

What comes to my mind is that they do not have knowledge of the dangers of soil eating practise hence they eat it even when it has many dangers (P6).

I think these women are not well informed and they need people to educate them about the danger of soil eating. They are misinformed and ignorant people who lack proper knowledge. There is no normal human being who can eat clay soil, these are people who do not understand that they are putting their lives in dangers, clay soil is addictive, therefore they are turning themselves into small addicts like nyaope because they constantly eat clay soil which weakens their immune system and damage their bodies. (P16).

Ingestion triggered by pregnancy

Participants viewed geophagy as an indication that a woman is pregnant which is followed by the huge cravings for strange things such as dirt and clay soil. The increased desire for consuming earthly materials was linked to pregnancy. Such views are expressed as follows:

Most pregnant women as well eat soil because when you are pregnant, there is nothing stopping you from eating what you want (P4).

You can survive not eating soil when you are not pregnant, but as soon as you are pregnant the urge to eat soil becomes high, us pregnant women experience different feelings,

cravings, moods swings when pregnant...hence we end up eating dirt (P41)

Whenever I see someone eating soil, I assume they might be pregnant...to me it is like a confirmation of pregnancy (P38).

I do eat soil as well, especially in the first three months of my pregnancy. I will be craving it too much. But after pregnancy I stop (P35).

Geophagy used for fun and entertainment

The theme indicated that some of the people who practise geophagy, started it as a fun thing to do when they are bored to entertain themselves. This theme also indicates that people engage in risky behaviours such as geophagy when they have nothing to do. Other participants have revealed that eating soil was a hype at some point and a trend for people to consume clay soil especially in townships, where people were influencing and recruiting each other to try clay soil particularly when sitting in groups idling. The views are expressed as follows:

I eat clay soil; I enjoy eating clay soil. I do it to reduce boredom, I eat soil to entertain myself, and I eat clay soil for fun (P12).

They eat clay soil for fun, entertainment and to somehow escape boredom (P36).

My perception is that people who are eating soil are enjoying, they consume soil to satisfy their desire. When I see people eating soil, I have no issue with them because I also eat soil myself and I know it is delicious/scrumptious. I fully understand why they eat clay soil. It is our snack (P12).

Geophagy accelerated by social acceptability and accessibility

This theme refers to the social acceptance and accessibility of clay soil by communities. Participants hold views that geophagy is commonly practised due to social acceptability and accessibility. Geophagists find it easy to buy clay soil from street vendors, stations and open markets which was perceived as one of the contributing factors to the increase in geophagy among women of childbearing age. Participants indicated that soil eating is a historically recognised cultural and social practice in different regions and ethnic groups mostly among women of childbearing age particularly pregnant women. Geophagy is perceived as an ancient cultural belief that is regarded as good for health, where consumers eat clay soil for protection and strengthening of pregnancy, and to also soothe gastrointestinal problems. The views of the participants regarding the social acceptability and accessibility are expressed as follows:

Yes, clay soil is socially acceptable hence people are able to form groups that eat soil, I saw a public page on social media (facebook) where people eat clay soil and sell openly... it is something that people are not ashamed of practising (P45).

Yes, we eat clay soil everywhere, it is something not to be ashamed of. Sometimes, me and my friends we sit as a group and buy different ones, and share amongst ourselves (P43).

I eat soil that is sold at the station/markets.... however, when I am stranded and desperate, I opt to eat the one in the yard, I would dig a hole and eat it when I do not have means to get clay soil (P17).

DISCUSSION

This study has explored the uses and perceptions of geophagy among women of childbearing age in Tshwane District, Gauteng Province. The women of childbearing age who participated in this study perceived addiction and cravings, lack of proper knowledge and understanding of dangers associated with geophagy, boredom, fun and entertainment, pregnancy, influence from family members and peer pressure, and social acceptability and accessibility to be some of the causes, reasons, motivations and uses of geophagy among women of childbearing age. Studies found that curbing morning sicknesses, nausea, mineral deficiency, satisfying cravings and life-sustaining beliefs are some of the reasons for clay soil ingestion among women of childbearing age.^{4 15 19 20 32–34}

Women of childbearing age who took part in this study expressed their views that people practise geophagy due to iron deficiency, addiction and cravings. Similar studies also confirm that women of childbearing age practise geophagy due to iron deficiency to feed their addiction and cravings.^{4 5 16 25 35–37} The cravings of clay soil, related earthly materials and strange food items during pregnancy are mostly caused by iron deficiency and imbalanced hormones, respectively. Women of childbearing age practise geophagy to supplement their need for iron. The smell of rain triggers various people to start craving and ingesting clay soil continuously, leading to addiction.

Geophagy is perceived as a sign or confirmation of pregnancy by women of childbearing age who participated in this study. Numerous studies conducted across countries also confirm that most women practised geophagy when pregnant.^{4 9 13 15–17 19 20 25 38} Participants have indicated that they associate geophagy with pregnancy. Some participants indicated that they use clay soil during pregnancy to soothe morning sicknesses and nausea. Similar studies found that most women of childbearing age practise geophagy when they experience morning sicknesses and nausea during gestation period.^{4 19 32 39 40}

Influence from family members and peer pressure were also perceived by participants to be some of the major motivations behind the use of clay soil through the practice of geophagy. Most women of childbearing age who took part in this study indicated that they started consuming clay soil after been recruited by or introduced by their close relatives, friends and family members; meanwhile, others were given a small portion of clay soil to try it by their peers. Geophagy was perceived by participants as a practice that is mostly learnt and passed

on by closely related people and loved ones. A similar study also found that the practice of geophagy among geophagists originated from a friend, sister and mother, although some learnt the practice of geophagy on their own.¹⁹ Keeping a company of clay soil consumers makes one to be vulnerable to want to explore the practice. The curiosity to want to taste clay soil due to fear of missing out on what others are feeling is what has also led many to practise geophagy.

Lack of proper knowledge and understanding regarding the dangers associated with the practice of geophagy are some of the causes and reasons facilitating the practice of geophagy among women of childbearing age as perceived by participants. Some participants indicated that they were not aware that soil-eating practice is harmful to their health because of the toxic chemical constituents that are contained in clay soil. They further revealed that they perceive geophagy as a harmless practice that offers many great benefits, with no repercussions. Studies found that most geophagic women of childbearing age do not understand the dangers of practising geophagy, as well as the potential health risks associated with the practice of geophagy.^{2 6 19 20 24 41 42} The misinformation and misconceptions that the participants have regarding the benefits of geophagy are strongly recognised as a major concern.

Some participants perceived geophagy among women of childbearing age as a habit that people indulge in because of boredom, fun and entertainment. A study conducted in Limpopo found that geophagic women crave soil due to boredom, pregnancy, after every meal, on seeing it and when feeling weak.⁴ When people are bored and idling, they tend to engage in risky behaviours such as geophagic practice to pass time, for fun and entertainment. Other participants have expressed the view that they prefer eating clay soil as compared with other types of soil due to its perceived taste, smell, crunchiness, stickiness, muddiness, cleanness and its effect after consumption. On the contrary, a study conducted in Limpopo found that clay soil was the least preferred and consumed type of soil by geophagic women of childbearing age.⁴ Similarly, studies reported that kaolin is the most consumed geophagic material among women.^{19 43} These variations may be caused by lack of accessibility of clay soil in specific geophagic locations.

Participants revealed that they practise geophagy as a traditional and cultural custom that is socially acceptable; however, some participants indicated that they get tempted to purchase clay soil on seeing it in the open markets, street vendors, taxi ranks and spaza shops because of easy accessibility. Studies confirm that geophagy is a common cultural practice that is socially acceptable by many people across nations.^{4 15 19 32} Social acceptability and easy accessibility of clay soil add to the high number of people who practise geophagy. The level of acceptability for geophagy practice among communities makes it difficult for consumers to see it as a dangerous practice that needs to be condemned. Furthermore, for as long

as clay soil is still easily accessible to consumers in public spaces, it will be difficult to curb the practice of geophagy.

The practice of geophagy among women of childbearing age remains a major public health problem that requires serious consideration by the government. Despite the available interventions aimed at curbing the practice of geophagy among women of childbearing age, such as administration of iron supplements and folic acid, studies have discovered poor adherence and uptake of iron supplements and folic acid among women of childbearing age across countries citing challenges such as nasty taste, nausea, vomiting and weight gain as some of their reasons for defaulting.^{44–47} Some of the limitations of this study included the setting type and participants selection, since conducting a study in the healthcare facilities has the potential to hinder some participants from sharing their views freely and openly, out of fear of the healthcare workers. This study included only women of childbearing age who were consulting in the family planning units and antenatal care units, without any consideration for all women of childbearing age. Some of the study participants were above the age of 50 years, although we confirmed with them their ability to conceive a child, we are speculating that some were perhaps consulting due to reproductive health problems encountered postreproductive age; since participation was free and voluntary, they participated due to fear of missing out and excitement.

Conclusions

It is concluded that the practice of geophagy is accelerated by addiction and cravings, pregnancy, social acceptability and accessibility, boredom, fun and entertainment. Influence from family members and peer pressure play a significant role when it comes to the practice of geophagy. Lack of proper knowledge and understanding regarding the dangers of geophagy are some of the reasons behind the use of clay soil. Most women of childbearing age use geophagy as method of soothing nausea and morning sicknesses during pregnancy.

Recommendations

Geophagy must be included in the school's curriculum and maternity package to facilitate geophagy health education and promotion. Support groups and rehabilitation centres for people who practise geophagy must be established. Geophagy public health surveillance system must be established. Further research needs to be conducted to understand the aetiologies, toxic elements and health effects of geophagy phenomenon.

Limitations and strengths of the study

The study was conducted in the healthcare facilities which serves as a study limitation, as some of the participants might have not shared the views freely due to the nature of the setting in fear of healthcare workers.

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Patient consent for publication Not applicable.

Ethics approval Ethics approval was obtained from Sefako Makgatho Health Sciences University Research Ethics Committee (SMUREC/H/290/2023:PG) refer to online supplemental material 4. Permission to conduct the study in the public healthcare facilities was requested from the National Health Research database committee (Tshwane Research Committee), senior managers of the healthcare facilities, and unit managers in the antenatal care and family planning units of Tshwane District, Gauteng Province. Research ethical principles such as privacy, confidentiality, informed consent, protection of personal information, and voluntary participation were observed in this study.

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