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Geophagy in Northern Uganda: Perspectives from Consumers and Clinicians

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Abstract. The etiology and health consequences of geophagy are still poorly understood. The consumed soil, individual motives, consumption habits, and the clinical perspective of geophagy in northern Uganda were examined. A total of 50 semistructured interviews (17 pregnant, eight nonpregnant women, 10 men, and 15 health-care professionals) were conducted. Our results suggest that geophagy is not limited to pregnancy and can also be found among nonpregnant women and men. During gestation, excessive amounts of various soil types are consumed and can replace food at times. Nonpregnant women and men consume less soil and stick to one type. When pregnant, craving and alleviating gastrointestinal upset are the main motives. In men, the main reasons for geophagy were craving, hypersalivation, and natural stimulants. If soil is craved, it can show similarities to a dependency syndrome. When picked up in childhood, geophagy is more likely to be continued throughout life. The consumption habits differ and thereby vary in their possible implications on health. Our findings suggest that men should be included in further studies. Especially nurses from the antenatal care are exposed to geophagists; however, no national guidelines exist for geophagy. Further research is necessary to create guidelines to be included in medical training and practice.

INTRODUCTION

Geophagy, the practice of soil consumption, can be seen as a form of pica—the craving and ingestion of nonnutritive substances. Soil eating occurs throughout the world.[1] It is most commonly found among pregnant and lactating women in sub-Saharan Africa with the highest prevalence during pregnancy.[2] Although eating soil can also be found among children,[3–5] it is described to be a predominant female practice,[6] and rarely reported among men.[7] The prevalence of geophagy among pregnant women in Africa has been reported to range from 28% to 84%,[3,6,8–11] and it is assumed that, in Uganda, up to 50% of pregnant women are engaging in geophagy during gestation.[12] There is a wide range of reasons for underreporting of geophagy. Clinicians often do not ask patients about this behavior.[13] Pregnant women might not report it, because eating soil does not coincide with the hygiene concept associated with western medicine. Therefore, they might feel ashamed or fear chastisement from family or clinicians[13] and fear harming themselves or the fetus.[14] Furthermore, it can be seen as normal during gestation and therefore might not be seen as necessary to mention.[2]

The consumed soil is highly selected[15] and can be gathered from local sources, such as riverbanks,[16] termite mounds, house walls,[17] or can be bought at local markets in Africa, where it has often been transported over long distances.[18] A variety of different types of soil are consumed,[19] and typically the soil contains a high content of clay.[20] The soil is mostly air dried, but can also be baked, smoked, salted,[21] or mixed with herbs or water.[19] In other studies, the amount of consumed soil is reported to be between 5 g and 219 g,[6,22] and the frequency ranges from one to twenty times per day.[15]

Until now, the etiology and health consequences of soil consumption are poorly understood. Various hypotheses exist and there are conflicting studies to whether the consumption of soil may be beneficial to health or not. Several studies indicate that eating soil may have a positive effect such as alleviating gastrointestinal (GI) upset like nausea[17] and heartburn,[23] detoxifying food,[24,25] and therefore may be a protective behavior.[23] Furthermore, clay can be used as a traditional antidiarrheal pharmaceutical to treat acute gastroenteritis.[18,26] Geophagic soil can be a source for micronutrients,[23,27,28] such as for iron deficiency.[29,30] However, other studies suggest that the nutrient value of the soil is overestimated[20] and that the consumption of soil rather exacerbates micronutrient deficiencies.[27] Although studies have shown that geophagy might be a risk factor for geohelminth infection among children,[31–33] it is unlikely to be a cause for adult infestation.[21,34] In young children, eating soil might be an important unrecognized risk factor for environmental enteropathy and stunting.[35] Geophagic material might contain high levels of lead[21] and other toxins,[36–39] which might pose a severe health risk to the fetus.

So far, geophagy has received only little attention in antenatal care (ANC),[2] although especially during pregnancy, excessive amounts of soil are often consumed and may have an implication on health, both for pregnant women and the infant. Furthermore, due to migration, geophagy can be found in typical immigrant countries,[37,40] and therefore, progressively gains international importance in global public health.

In this study, we investigated geophagy among consumers (pregnant women, nonpregnant women, and men), as well as opinions of health-care professionals on the practice in northern Uganda. We were specifically interested in the individual motives of consumers, their consumption habits, and to evaluate the importance of geophagy in health care.

MATERIALS AND METHODS

Data collection. We conducted semistructured interviews with soil consumers (pregnant women, nonpregnant women, and men) and health-care professionals in northern Uganda. The interview participants had to be ≥ 18 years. Pregnant women needed to have had at least one previous pregnancy to compare their consumption habit with previous pregnancies. The interviews were conducted between June and September 2012 in northern Uganda with the main focus on

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Gulu. The district was chosen because geophagy is poorly researched there, due to the availability of infrastructure, and an academic relation with the Gulu University.

Three researchers (Lena Huebl, Stephan Leick, and Lukas Guettl) conducted the interviews. The female researcher conducted the interviews with pregnant women; the other interviews were done by male researchers. The participants were approached face-to-face and selected purposively. Furthermore, a snowballing technique was used for recruitment by all three researchers. All interview partners agreed to voluntarily take part in this study, and a written informed consent was obtained for each interview. An open-ended questionnaire, which was developed after reviewing literature on geophagy, guided through the interview.

Most pregnant women were recruited with the help of nurses while waiting for their ANC appointment at one of the local hospitals. In addition, interviews took place within the community at markets and at their homes. Participants who were neither pregnant nor health-care professionals were recruited within Gulu town and the neighboring villages. To interview male geophagists, a male vendor for Lobo agulu, who ate soil as well, was first approached at the market. He established the contact with male soil consumers. Local health-care professionals in the field of gynecology and obstetrics were recruited directly by the researcher while on their job. Most interview appointments were arranged for the same day of recruitment. The interviews at the hospital were conducted in a separate room. Besides a translator, no other persons were present at the interview.

Of the 50 interviews, 38 were in English and 12 in Acholi. Of the 17 interviews with pregnant women, nine were in English and eight in Acholi. Of the interviews with nonpregnant women and men, 14 were in English and four in Acholi. All the interviews with health-care professionals were in English. The conversation was audiotaped; the Acholi interviews were translated into English with the help of a female and a male local research assistant, and transcribed verbatim. In addition, field notes were used. On average, the interviews lasted between 30 and 90 minutes.

Data analysis. Interviews were conducted until data saturation was reached meaning that no new relevant knowledge was obtained from new participants anymore. Data were already analyzed while data collection was going on in the field. The method of grounded theory was used for data analysis.[41,42] The interviews were coded and analyzed by Lena Huebl, Stephan Leick, and Lukas Guettl. Coding was done inductively and deductively[43]: categories and codes were built on topics that appeared on the basis of the first revision of the material as well as the structure postulated by the interview guidelines. While reading the interview material, the emerging codes were applied and constantly compared. The codes were clustered and sorted into themes and subthemes, which allowed finding patterns within the data.[44] The applied codes were merged into categories and summarized by Lena Huebl, Stephan Leick, and Lukas Guettl. Six categories were defined that are also reflected in the subheading of the results: 1) types of soil consumed, 2) motivation for consumption, 3) craving or addiction, 4) implications on health, 5) clinical perspective, and 6) social (un) acceptability. To make the coding scheme and theme development more valid and reliable, it was discussed with the other researchers of the team (Ruth Kutalek and Grace Akello). Many participants' quotations are included in the results to illustrate the findings; hereby, we aim to give our research partners a strong voice. After several drafts of the manuscript with the coauthors, who conducted or were familiar with the content of the interviews, the results were finalized.

Ethics statement. This study was approved by the Institutional Review Committee of Gulu University, Faculty of Medicine (GU/IRC/03/07/12) and the Ethics Committee of the Medical University of Vienna (EK no.: 050/2012).

RESULTS

Characteristics of the interviewees. The majority of the participants belonged to the Acholi ethnic group; they came from the districts Gulu, Oyam, Kitgum, Amoro, and Pader, which all belong to northern Uganda.

Pregnant women had a mean age of 25 years (19–32) and a mean parity of 2.7 (2–5). Of 17 women, eight were in their third trimester at the time of interview. They had 9.7 (6–16) years of education and 11 of 17 women worked most commonly as a vendor or teacher. Nonpregnant women had a mean age of 27 (23–36) and 11.5 (7–13) years of education. Men had a mean age of 23 (18–29) and 10.6 (5–13) years of education. Nonpregnant women and men most likely worked as vendors or as farmers. Health-care professionals (three male, 12 female) had a mean age of 38 (24–59) and 16.8 (16–22) years of education. They were medical doctors, nurses, and midwives. The majority of them worked at the ANC unit and the gynecological ward of a local hospital.

Types of soil consumed. Usually not every type of soil is consumed, but is selected and picked carefully. In northern Uganda, a variety of soil types are available: soils from red and white termite mounds, sun-dried bricks, burnt bricks, soil from wells, from riverbanks, from swamps, and black clay from markets (*bumba*). *Bumba* (in Acholi "lobo agulu") is a type of clay, which is sourced from riverbanks and swamps and usually used for construction and pots. According to the interviewed geophagists, lobo agulu is a black clay that is burnt, soft in texture, without any big stones, and it can contain sour or bitter parts, which generate a pleasant taste, whereas *mumbwa* is a soil high in clay and mixed with herbs, that is prepared by a herbalist and seen as traditional medicine. *Mumbwa* is only available in markets in southern and central Uganda. In Gulu town, lobo agulu can be bought at three local markets ranging from 100 to 500 UGX (30–60 Eurocents) per piece. In average, a vendor has 150 customers per day and the majority buys soil worth between 200 and 500 UGX. At the markets, lobo agulu is placed right next to vegetables and kept in open baskets to stay fresh by being exposed to open air and to be easily accessible (Figure 1). Lobo agulu is consumed by men and women alike.

White and red termite mounds can be found on the outskirts of Gulu town. Their soil is dried, soft, and does not contain any sour parts. This type of soil is more likely to be consumed by women and children in rural areas due to their wide availability.

> *The soil I pick is from the anthill. That's the one I like, because it is even easier to get, because it is near my place. Any time I feel like it I just go, pick it and eat it. And this soil from the market you need to come*

FIGURE 1. Lobo agulu at a local market.

again up to here to buy, transport money, of coming from highland up to here. . . so if I get the chance like this when I am coming to the hospital then I will buy soil at the market. I will buy a little and when it gets finished I will have to return to the other soil from the anthill. (Mother in second trimester, second pregnancy)

Portions of bricks are mainly eaten during gestation. They are taken from houses that have not been plastered yet and from brick stacks in the compound that are used for construction. The soil from burnt bricks is rough and can contain stones and leaves. The unburnt or not properly burnt pieces are soft, easier to break, chew, and swallow.

The soil of the burnt brick is hard, but the smell of it is nice. But for me if I want to eat soil, I want to eat a bit of a quantitative. But that type of soil is a bit hard, although it smells good. Therefore I like the unburnt brick, because it is soft in texture. (Mother in third trimester, third pregnancy)

I pick the soil from the bricks. I pick it from any side. Anywhere, wherever I can get it such as from the compound. I also pick the soil from houses like this one. At times the houses in the villages are round and the outcast might not have been plastered. Then I pick the soil from there or from those bricks thrown in the compound or from the bricks they are still using or the ones they still want to burn. I just pick the soil from there. (Mother in third trimester, third pregnancy)

For the selection of soil smell, consistency and availability are important. The interviewed geophagists described the flavor of soil as sweet, neutral, or tasteless.

Boot [ach. tasteless] (Male, market "Kaunda Ground") and *nwege koo [ach. pleasant smell/aroma], mit [ach. good (flavor)], fott [ach. slippery (in mouth)], yom [ach. soft (in mouth)]* (Male, market "Kaunda Ground")

However, to them, every type of soil has a distinct smell, which acts as an olfactory trigger that provokes the desire for its consumption and maintenance. The aroma is released while chewing and already small pieces of soil satisfy the craving.

It's all about the smell. It smells good for me. I really feel that I'm really missing that smell. That makes me really go for it. (Female, market "Kakanyero market")

Actually the soil smells nice eh. Mhm and you can even make me not smell anything apart from it. All the time I sit I am just imagining the smell. . .hehe. (Mother in second trimester, second pregnancy)

The choice of soil can have practical reasons as well.

I like the clay from the market, because it is portable. If I am coming to the hospital like this, I can carry it in my bag and there is no dirt in my bag. Not like the one from the termite mounds. (Mother in second trimester, second pregnancy)

Pregnant women preferred bricks (seven), Lobo agulu (six), and termite mounds (four), but only two of six pregnant women, who preferred Lobo agulu, could afford it as a main source. Due to excessive amounts needed during gestation and lack of income, many pregnant women therefore preferred bricks, which are easily accessible and available for free.

It is expensive, because I find the soil (bricks) I like for free. Free. So I pick that one, but the other people need money. So it is expensive if it is to buy daily. I will not have the money to buy it. (Mother in third trimester, third pregnancy)

According to our study, 10 of 17 pregnant women eat more than one type of soil throughout their pregnancy, but typically one type per day. It is less common to change the main type of soil within gestation, rather between pregnancies due to changes in living conditions, sources of money, and introduction to other types of soil.

This time I don't want to eat the soil from the termites. This time I want to buy the soil from the market, because that one is very soft and I think it will not cause me appendicitis. This is why I prefer the soil from the market and when I get money I will go and buy it. (Mother in first trimester, second pregnancy)

Nonpregnant women and men mainly stick to the consumption of lobo agulu. The money spent on soil consumption is often included in daily expenses for account of the spending for food.

I have to remove some part of the money for food and buy the soil with it. (Female, market "Kaunda Ground")

Soil is eaten on demand and its daily-consumed quantity varies depending on the type of soil. Nonpregnant women and men reported to consume about 100 g of lobo agulu per day, but rarely exceed more than 400 g per day. During gestation, the consumption could range from 50 g to a couple hundred grams per day. The biggest diversity of quantity was

found in the consumption of bricks ranging from pieces of 2 cm in diameter to a handful three times per day and replacing food at times.

According to the interviewed geophagists, soil from lobo agulu is crushed into small pieces, which are chewed or sucked on and swallowed. The remaining small solid stones are spat out followed by drinking water. Only the inner parts of dried soil from bricks and termite mounds are consumed, because the outside is seen as dirty.

I first break the outer part and then I pick from the inner part, because sometimes I feel maybe the rain has brought some contaminated things that got stuck there on the outside. So I first peel off the soil from the outside and then I pick it from the inner parts. (Mother in third trimester, second pregnancy)

Motivation for consumption. According to interviewed health-care professionals, the main consumers of soil are pregnant women, followed by children and teenagers, but it is rarely seen in men. Health-care professionals believe that in gestation, a craving for soil is caused by hormone changes and iron deficiency.

In a mother who is pregnant, the hormones induce her to like certain things and eat certain things. So there are some mothers who like eating clay. (Midwife)

It is hormonal. It is up to the time when the pregnancy hormones begin to come down, when among those mothers the level of craving also decreases. (Nurse)

They also stated, that geophagy can be associated with GI upset, micronutrient deficiencies, human immunodeficiency virus, and mental health diseases, especially when not pregnant.

These hysteric ladies just eat soil, because they want to be seen eating it: "Don't do it, it is bad." They just need attention from someone, so they intentionally start eating. They don't hide it. They do it in public places. (Male nurse)

Yes, gastroesophageal reflux. Sometimes, people in the community believe that it acts as an antacid and it can reduce heartburn. In most cases you can see them taking the soil mixed with ashes. (Midwife)

Our interviews have shown that the first geophagy experience is often during childhood due to influence of family members and friends or due to curiosity. Habitually, the consumption of soil ceases in adolescence, but is restarted during gestation. Of 17 pregnant women, five reported to have had prior experience as young girls and gave up geophagy as teenagers.

I stopped eating soil at the age of fifteen, because I was big. I felt that I have already grown up. You know, I can't walk with my friends when I am there busy eating clay. I feel ashamed. (Mother in second trimester, second pregnancy)

Every pregnant woman has a daily routine of eating soil and retains it throughout her pregnancy, although habits might change between pregnancies. According to our results, nine of 17 pregnant women initiated geophagy during their first pregnancy as teenagers. Those women reported that geophagy is limited to times of gestation and there tends to be a pattern with the onset and cessation, starting in the second trimester and ceasing with the end of gestation and the latest with delivery. Of 17 pregnant women, two reported an onset of geophagy in their third trimester, and stated that in their current pregnancy, bigger quantities of soil are needed than in previous ones. Thirteen of 17 pregnant women abandoned geophagy at the end of gestation and the latest with delivery; the main reasons for cessation of geophagy were lack of craving (eight), lack of olfactory triggers (two), insufficient satisfaction of soil intake (two), and discouragement by family members (one).

It is only the pregnancy that causes people to eat that stuff, that Lobo. But after it, even the appetite and any liking disappears after birth. (Mother in third trimester, fourth pregnancy)

However, according to our results, four of 17 pregnant women ate soil before, during, and beyond pregnancy. They reported that a persisting craving for soil after delivery maintained the consumption beyond pregnancy, but the intensity of craving, the frequency and amount of consumed soil were less when not pregnant. According to those women, the same type of soil as in gestation was consumed or it was changed intentionally.

The clay from the market is the most favorite when I am pregnant, but when I am not pregnant then the one from the anthills is the favorite. (. . .) When I am not pregnant the feeling for soil comes in, but not so much. It only comes in when it drizzles and maybe when I look at the clay or when I find an anthill. But when I don't find it I don't even have that feeling. But in pregnancy whether there is clay or it is not there I always have that feeling for soil. (Mother in third trimester, second pregnancy)

Causes for soil consumption in geophagists were diverse: in addition to the main cause of craving (15), pregnant women reported multiple other causes such as hypersalivation (seven), natural stimulant (four), vomiting (three), boosting appetite (three), replacing food (two), and heartburn (one).

When I conceived my first baby I began feeling that edge to eat the soil and my heart could force me to even eat in the night, during the day, anytime when I got the feeling. I could just pick and eat. (Mother in third trimester, second pregnancy)

The main thing I like about this soil is that it just makes me feel comfortable, makes me feel nice and makes me enjoy my day. Even though when I am just lonely like this and I am eating the soil I feel nice and good. (Mother in first trimester, second pregnancy)

When I am pregnant I feel like eating soil all the time. I keep on eating even though I eat food. I feel as if I have not eaten anything. There is an empty stomach and I have to eat. So I have to pick soil and then eat. I feel there is something in my stomach and at least I have eaten something. (Mother in third trimester, third pregnancy)

Those women affected by hypersalivation were more likely to suffer from nausea as well, and stated that soil intake was started earlier in gestation and consumed after meals. Those women reported that morning sickness was more prevalent during their first pregnancy and soil intake could diminish involuntarily induced vomiting.

Sometimes when I need to vomit it helps me when I eat soil. At least I will not vomit every time. I will feel like vomiting, but can't. (Mother in third trimester, third pregnancy)

In nonpregnant women and men, different reasons existed for the onset of soil consumption: Only half of the interviewed nonpregnant women started geophagy independently from pregnancy by imitating a friend's habit. However, most men started due to curiosity of a friend's habit and by observing and imitating geophagy in women, because it gave them the impression that soil is something delicate. Even when it did not meet their expectations, they were still interested and continued eating soil.

After seeing those pregnant women eating it, I also began eating it. I could see like maybe the thing is sweet and I also began eating it. I went and tasted it. Because when those people have been eating it; they look like if they were eating something very, very nice. (Male, market "Kaunda Ground")

In men, the main reasons for geophagy were craving, hypersalivation, and the notion that it is a natural stimulant. They reported that craving for soil could cause hypersalivation that could only be ceased with soil consumption. In men, soil was known as a remedy for nausea and vomiting. However, it was rarely used as a self-medication for gastritis, stomach ulcers, and heartburn. Of 10 men, three reported that geophagy was recommended to them to boost their appetite, gain strength, and as a source of calcium. Nevertheless, they developed a craving for soil. Two of them stated that they would stop the habit if their primary motive for soil consumption would not exist.

I didn't find it was nice (. . .) but then I ate it and I felt gaining strength through it. (. . .) I eat it first, before I enter the ring. (. . .) I can play like six rounds, but if I do not eat it, I can only do two or three. (. . .) As long as I'm still a kick boxer, I will continue eating it. (Male, at a friend's house, Gulu Town)

(. . .) The soil has many important [effects]. It can help you holding the saliva back, it can help you holding the food, but what I'm interested in, is the appetite the soil gives me. (Male, at a friend's house, Gulu Town)

According to our interviews with geophagic women and men, the consumption of soil could be seen as a natural stimulant, and they reported that soil had a positive and euphoric effect on their mind, could ease upsetting thoughts, and relax during stressful times.

The smell makes me eat soil and sometimes, when I am overthinking something, maybe when I have some problems, I also use it. When I am eating I normally forget about the problems. (Male, market "Kaunda Ground")

Craving or addiction? Of the 35 geophagists interviewed, 25 attributed their geophagy to craving. Our findings have shown that nonpregnant women and men less likely used the term "craving" and 10 of 18 rather saw themselves as "addicted" to soil. Although only two geophagists had previous experience with cannabis and nicotine, those 10 who described themselves as "addicted" compared the intensity of craving for soil to other drugs such as nicotine (eight), alcohol (one), and cocaine (one), but soil was not seen as a drug itself.

This thing (eating soil) is like if you are addicted to smoking. (Male, market "Kaunda Ground")

(. . .) I first saw my friends taking it. That was like I have been introduced to it. It's similar, when somebody is being introduced to cocaine. You get to learn [it], then you do it." (Female, market "Kakanyero market"')

Those interviewees who described themselves as addicted to soil did not consider it as food and the consumption was not linked to satiety, but rather necessary to satisfy a specific desire for soil.

(. . .) I feel like I'm not satisfied, even though I eat food, at least I should top up with bumba. (Female, at sister's house, Gulu Town)

On the contrary, 15 of 17 pregnant women saw the longing for soil rather as a craving, which was limited to times of gestation and could replace food at times.

Yeah eating soil helped me, because even if I don't eat food I am satisfied with that clay. (Mother in third trimester, second pregnancy)

When soil is craved, smell is the main attraction and olfactory triggers are drizzling, the smell of wet soil, recently burnt bricks, chalk, and cement. The sight and mentioning of soil can provoke a craving as well.

It's the heart that yearns for it. It's not the stomach. It's from the heart! You feel, you like to do it, and the brain commands and your hands are pushed to pick it and if it is not nearby, your legs will move and look for it. It feels like, if you're yearning for something so special, something so good. As if you're going to get something so good out of it. But there is nothing so much good out of it. But you know, when you take it, you are relieved. (Female, at friend's house, Gulu Town)

Depending on the consumption habit, already a short unintended disruption could cause symptoms of withdrawal such as increased heartbeat, restlessness, dysphoria, dissatisfaction, hypersalivation, and nervousness.

If I don't take it, I feel like I'm not normal. I'm not in that [good] mood. (Male, at home, Gulu Town)

I always go and look for soil. Even if I am doing some work I have to leave and go and see at least. (Mother in third trimester, fourth pregnancy)

In nonpregnant women and men, abstinence was possible for a couple of hours (six) to a couple of days (four) and up to more than a week (eight), whereas during pregnancy, abstinence could only last minutes to hours and soil had to be consumed daily by all 17 pregnant women. Our interviews have shown that abstinence from soil could not reduce craving and that withdrawing from consumption was difficult.

You can't stop taking soil, if you're used to it. That is why I say it could be an addiction, because it's really hard to stop taking it. I have never heard of anyone, who has stopped taking soil. You can stop, maybe because it's not there. But once it's there, you will take it automatically. (Male, market "Kaunda Ground")

If soil is not available, the craving for soil can be palliated with substitutes like chalk, charcoal, dried cassava (manioc), and chewing gum, and by smelling wet soil. In addition, sour fruits like unripe mangos, sour bonbons, green vegetables, bitter tomatoes, lemons, and drinking tea are used in gestation.

But also even if the soil is the cause for pinching the stomach I cannot stop it, because my heart is still there. Maybe until one day when god will release me that is when I will leave eating soil. (Mother in third trimester, second pregnancy)

Implications on health. Our study has shown that little knowledge existed among geophagists on the implications on health of soil consumption. It was mainly based on second-hand information, rumors, and their own imagination.

I don't know anything, because I just have the feeling I want to eat soil. I will not know that I have gotten sick. That's what I am thinking. (Mother in second trimester, third pregnancy)

It was widely believed that adverse effects depended on the type of soil, its amount, its texture, and that swallowing small stones could cause appendicitis.

I always have a feeling that I may have this one effect, because in this clay there are small particulars of stones and I feel that it would give me problems in my appendix. That is one of the reasons why I try to control myself not to eat too much. That is the most serious effect that I think I will have. (Mother in third trimester, second pregnancy)

None of the interviewed geophagists was worried about suffering from worm infestation due to carefully picking only the inner parts of dry soil and eating it cautiously. Of 17 pregnant women, 12 reported to not be worried about adverse effects on the fetus, because they have eaten excessive amounts of soil in previous pregnancies and still delivered a healthy baby.

Ah I don't think I will be sick, because of eating soil, because I have even eaten now for some years in my pregnancy and I have not fallen sick. (Mother in third trimester, fourth pregnancy)

In rare cases, eating soil was seen as healthy and necessary, because it was only consumed during gestation and purchasable at the market.

The soil is for eating. It cannot make you sick. (Mother in first trimester, fifth pregnancy)

None of the interviewed men and nonpregnant women experienced adverse effects. They rather worried about loss of control over soil intake.

(. . .) I started to stop it, because for example, if I eat food, I feel like I'm not satisfied. That's why I stopped. I could not control my hunger for it. (Male, at home, Gulu Town)

On the contrary, seven of 17 pregnant women experienced adverse effects such as sore throat, cough, abdominal pain, diarrhea, and worm infestation. Those women who got sick themselves or knew someone to become sick were more concerned and reduced their soil intake or changed the type of soil.

Yeah when I think of infections like that, that is when I go for the soil from the market, because it is a little bit packed and I feel it is safer than the one from the anthills. (Mother in third trimester, second pregnancy)

I am worried, because of eating soil. As it is has already been taught to me that we are also sharing an umbilical cord. So if eating soil can bring effects on me it can also affect the baby. (Mother in third trimester, second pregnancy)

Among those pregnant women who have not gotten sick, the willingness to withdraw from soil consumption was low, because soil consumption was mostly limited to times of gestation.

If I am pregnant I eat soil until the day I deliver. That is when I stop and wait for another pregnancy. (Mother in third trimester, second pregnancy)

In men, the presence of angst-inducing rumors about adverse effects led to a reduction of soil consumption and when consumed for medical reasons, they stated to stop when healthier and cheaper alternatives are available. However, the majority of geophagists would consider giving up soil eating if proven to have implications on health.

I want to stop it, because in the long run, you will have serious problems. (Female, market "Kakanyero market")

Clinical perspectives. In northern Uganda, no uniform recommendation exists on geophagy. Some health-care institutes do not recommend geophagy and others do not inform their medical staff whether eating soil should be encouraged or not. The knowledge among health-care professionals varies widely and depends on one's own medical education and clinical experience.

[. . .] In midwifery training, when they were teaching us about the hormonal changes in pregnancy, that was when we also touched parts of soil eating, that women develop some unnatural feelings, due to hormonal changes. Some of them prefer certain things and others prefer eating soil. We were not given the details whether it is good or bad. However, they said, there are some nutrients, which can be good from the soil, [. . .] that is the positive part. On the negative part there is the risk of worm infestation. [. . .] They never told us whether we should encourage them to eat or not to eat. (Midwife)

In a clinical setting, midwives and nurses are more exposed to geophagy than doctors.

[. . .] There is one aspect you have to consider. The degree of disease is a little low. If I go to a patient, I will look at the most common symptoms and first of all the geographical location. For example, here I would look for malaria if there were a fever. Rarely would I go as deep as finding out if the patient took soil. (Doctor)

However, only four of 15 health-care professionals have had personal experience with eating soil, usually during their own pregnancy.

I ate it (soil) and I became addicted. I started when I was pregnant, [. . .] I used to enjoy it, but I discovered that it was not good. If I ate too much, I couldn't go to the toilet. So I withdrew slowly and I stopped it. (Nurse)

According to the interviews, all health-care professionals believed that geophagy has possible implications on health. They stated that those patients, who presented with GI upset, such as constipation, diarrhea, nausea, and worm infestation often had a past medical history of geophagy. Particularly, the soil from termite mounds was considered as a risk factor for diseases.

Nurses from the ANC of a local hospital assessed whether women ate soil before pregnancy or started during gestation.

We normally tell them the dangers of native medicine and why they are eating soil, [. . .]. We tell them why they are craving for it. Then we normally ask them if somebody is eating. We assess whether the person was eating before becoming pregnant or just started eating in pregnancy. (Nurse, gynecological ward)

Then the nurses advised those pregnant women to quit the consumption by teaching them about the disadvantages of geophagy, such as GI upset, worm infestation, parasites, appendicitis, and malnutrition.

We try to discourage them, but we talk from the Antenatal Care Unit here. We don't follow her up to her home. So there, she will eat what she wants. (Midwife)

Although geophagy can be part of the topics of "nutrition" and "native medicine" at the health education at the ANC, no local or national guidelines on geophagy exist in Uganda. Since the health education at the ANC depends on the knowledge and experience of nurses and midwives, it can vary widely. At the hospital level, geophagy is therefore not discussed with many pregnant women. None of the interviewed men and nonpregnant women received information about geophagy from doctors, nurses, or other health-care professionals. However, no one requested information. Half of the health-care professionals stated to have been asked for advice on geophagy while being off duty.

Social (un)acceptability of geophagy. Eating of soil was usually socially accepted and seen as a common habit in pregnant women.

Actually people think that is now how pregnant women behave. Once they are pregnant they have to eat that soil. (Mother in second trimester, second pregnancy)

Actually, here in the north, soil eating is mostly done by pregnant women only, though there are also some other people who eat it because of the smell, but it is mostly done by pregnant mothers. (Nurse)

Whether soil was consumed in public or hidden depended on the individual and their surroundings. Some pregnant interview partners were discouraged to eat soil by their mothers, because to them, it was an unhealthy habit that they did not carry out during their own pregnancies. Others had no objection with the practice, because it was limited to times of gestation. When soil was consumed beyond pregnancy, it was mostly associated with medical issues as was consumption by men. Some geophagists hid their soil consumption from nurses because the habit was known to be discouraged at the hospital.

One nurse was also pregnant and she used to eat, but the other one was discouraging us. When she is there we do not eat, but when she is not there we eat soil from the house. I hide it from her, because I like her and she loves me. So we stay like that. I had to be induced. She induced me and because of her help I delivered. But about eating soil I would hide it from her. (Mother in second trimester, third pregnancy)

DISCUSSION

This is the first qualitative study that explores the broad phenomenon of geophagy among different types of consumers (pregnant and nonpregnant women, as well as men); furthermore, it includes the perspectives of health-care workers.

Eating soil is a common and accepted practice that is not limited to pregnancy and can also be found among

nonpregnant women and men in northern Uganda. The consumption of soil among men was not considered shameful, as was reported in one other study.[17] This broad acceptance within the community led to an uninhibited conversation. Previous studies have described geophagy in men.[45–47] Our results on geophagy in men, however, differ from Golden and others where men mostly consumed soil for medicinal use and for short periods during the year. According to our results, soil was consumed over long periods and reasons for consumption were craving, hypersalivation, and the perception of geophagic soil as a natural stimulant. However, health-care professionals and the community still had the perception that men consume soil for medical reasons. The findings of Golden and others showed that the smell played a minor role and soil was consumed due to its texture. However, the smell was the main attraction according to our results.

We could show that not every type of soil is considered appropriate for consumption, which is in conformity with previous studies that the soil is highly selected,[15] and needs to have special qualities in color, odor, flavor, softness, and plasticity.[48] Additionally, the availability of the soil type is important as well. Nonpregnant women and men mainly stick to one type, lobo agulu, whereas during gestation a variety of soil types are consumed.

Our findings have shown that soil was mainly consumed to satisfy a specific craving for soil, which is in accordance to previous findings that soil is rather craved and not eaten as a last resort.[23] The craving for soil is the main factor for geophagists to pursue the consumption. The intensity of craving for soil can be compared with the one for alcohol or cigarettes, which are in accordance with previous findings.[23] Geophagists even see themselves as addicted to soil and any disruption of the consumption can cause withdrawal symptoms such as sweating and nervousness, which have been described previously.[49] According to the American Psychiatric Association, the eating of nonnutritive, nonfood substances must be developmentally inappropriate (Criterion B) and not part of a culturally supported or socially normative practice (Criterion C).[50] However, our results have shown that nonpregnant women and men did not suffer from an eating disorder, but rather from a withdrawal syndrome. Therefore, geophagy should not be seen as an eating disorder, such as pica. According to our results, soil can be consumed as a "natural stimulant" to improve the mood. This might be in conformity to previous findings that soil may be consumed as a response to psychological stress.[51] Experimental geophagy in rats contributed to a significant improvement in behavioral parameters, confirming the antistress effects of the use of natural ingredients.[52]

In contrast to previous findings,[22] soil is not consumed as traditional medicine, and not due to a lack of access to modern pharmaceuticals in northern Uganda. Earths in Uganda are high in iron, but little of this iron is bioavailable and some earths can inhibit iron absorption from foods.[12] This suggests that iron supplementation might not be the primary motive for geophagy and could even worsen iron deficiency.

Geophagy in northern Uganda is socially accepted and highly associated with pregnancy: whenever a woman of childbearing age is observed eating soil, it is immediately assumed that she is pregnant and it is even seen as diagnostic for pregnancy. Previous studies have shown that the prevalence of geophagy increases with gestational age,[6,53] and that the habit is picked up especially around the middle of the second trimester,[8] to then cease with delivery. According to our results, geophagy was mostly picked up in the second trimester and an onset in the first trimester was only described in women who suffered from hypersalivation or nausea in early pregnancy and among women who consume soil beyond pregnancy. When comparing our results to other studies on Nilotic people,[3] we found that there are similarities in the onset of soil intake, a stable soil consumption during pregnancy, and a decline of soil intake at the end of gestation. However, differences can be found in the soil types, the frequency of consumption during lactation, as well as the prevalence of soil consumption before pregnancy.

It is discussed whether geophagy can be considered a learned habit[49] or as independent from the consumption habit within a family.[54] Our results show that mostly pregnant women were the ones to consume soil within their families. Even in families where eating soil was discouraged, women still picked up the habit during pregnancy. They often started eating soil due to curiosity when observing and imitating pregnant women. Although geophagy is socially accepted, it is not limited to one culture.[55]

Geophagy is an important topic in medical care, especially in ANC. So far, no guidelines for the approach and management of geophagy exist in Uganda. Geophagy is often not discussed at the ANC, because women would have to actively ask about it (which they do not do), and it is known that nurses discourage geophagy. Although UpToDate has an entry on clinical guidelines on "pica in pregnancy" that could be modified for low-resource settings, it might not be known in northern Uganda. UpToDate might not be accessible for local nurses from the ANC because it is not an open source and requires a subscription fee and access to Internet.

Although obstruction and perforation of the colon due to soil consumption have been reported,[56,57] no case reports of appendicitis caused by geophagy exist so far. The implication for health seems to depend on the soil type and consumption habit.[58] Geophagic material can contain high levels of lead[21] and other toxins.[36–39] Especially during pregnancy, excessive amounts of soil are consumed and its ingestion could expose the fetus to high lead levels. Unbaked soil, which is commonly consumed in northern Uganda, may be microbially contaminated and cause GI upset.[21] However, geophagists were not concerned about that due to carefully selecting the soil.[34]

Limitations and strengths. We were able to recruit soil consumers from diverse backgrounds including males and nonpregnant women who have rarely been considered in geophagy studies before. Moreover, this is the first study that also includes the perspectives of health-care workers. The findings show the presence of this behavior across a spectrum of ages and in both sexes. The data were conducted in an area where geophagy is a common practice and a broad acceptance within the community led to an uninhibited conversation.

The main limitation of this study was the language barrier. With translation, the nuances of language might have been lost. Due to limited time in the field, only interviews were conducted and no other qualitative method was performed.

CONCLUSION

Geophagy is a broad and accepted practice that is not limited to pregnancy and can be found in nonpregnant women and men in northern Uganda. Our findings suggest that men should be included in further studies. Especially nurses at the ANC unit are exposed to geophagists and information on geophagy should be part of every health education. It is necessary to create guidelines for geophagy or modify clinical guidelines for a low-resource setting, which then can be included in medical training and practice.

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