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Contributing Factors to The Awareness of Health Risks of Geophagy Among Pregnant Women in Lubumbashi

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Abstract

Geophagy is widely practiced during pregnancy especially in Africa. In Lubumbashi geophagic material contains high levels of toxic metallic elements next to the eggs, larvae, or adult species of the geohelminths and micro toxins. Despite the health risks uncounted, pregnant women still consume clay. Whether pregnant geophagists are aware of the risks-related to geophagia is unknown. A case- control study of 104 geophagists and 107 no geophagists pregnant women was conducted from September 1st, 2022, to February 28th, 2023The pregnant women consecutively enlisted were attending the prenatal care in four medical institutions in Lubumbashi and completed an interview-based questionnaire. 51.7% of the study population were not aware of the health risks of geophagia and consumed large amounts of clay during the early stages of the pregnancy. Identified health risks related to geophagy were mainly helminthic infestation and anemia. The degree of awareness is related to the level of women education and societal/marital status. Our results demonstrate that despite the identified related health risks and the awareness of them, geophagia remains common practice during pregnancy in Lubumbashi. A holistic prevention approach should be implemented to reduce the consequences of geophagy among pregnant women.

Keywords: geophagy, awareness, pregnant women, health risks, Lubumbashi

Introduction

Geophagy also called geophagia, an ancestral habit of consuming clay soil (chalk or kaolin), is the most frequently observed and culturally accepted pica reported to occur in Africa [1, 2]. The worldwide aggregate prevalence estimation of geophagy is 28%. Noteworthy, this prevalence is higher in Africa, ranging from 45.6% to 91%, depending on places and studies [3-7]. Women generally describe geophagy as a habit and crave for it with time. It is thought that the craving is in relation with micronutrients needs. Therefore the consumption of clay soil relies on the belief that it acts as an iron supplement and alleviates gastrointestinal upset [4, 8]. In up to 74% of the cases craving is the main reason for consumption followed by the organoleptic appeal of clay soil like smell and texture [5, 9]. Craving shows similarities with dependency syndrome; if picked up in childhood, geophagy is more likely to be continued throughout life [10].

However, studies have shown that geophagy can result in medical issues and chronic health problems. Indeed, due to complex ionic interactions with the digestive tract, geophagia may lead to ion and Zinc deficiency. For the foetus, in addition to the risk of preterm birth associated to maternal anemia,

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maternal geophagia may lead to overexposure to heavy metals, including Aluminum, known to potentially damage its neurological development [11]. The geophagists develop chronic illnesses such as headaches, anemia, constipation iron deficiency and high blood pressure [5, 12-14]. Lubumbashi is in the Haut Katanga, a region with many mining activities known to be a source of severe pollution with in particular high levels of toxic trace elements (TE), in soil, water and air (references). Studies done in Lubumbashi reported that the geophagic pregnant women are at risk of high concentration of Aluminum, Lead, Nickel, and Chromium but display often anemia and maternal hypertension. These findings may suggest a link between reported medical issues and pollution, namely that the soil from which the clay is extracted is polluted by toxic trace elements originating from mineral exploitation [15, 16].

In Lubumbashi, the prevalence of geophagy is estimated between 51 to 68% [15, 16]. The rate of awareness of harmful effects of geophagy among women is overall low with most of them not being aware of several health risks and complications related to clay consumption. Mostly, women report the consequences of geophagy based on some perceptions and thoughts: accordingly, geophagy might be harmful to the pregnancy, with several women associating it with toxic lead, or the presence of intestinal parasites, but none associating geophagy with severe health risks [8, 9, 14]. However, despite the dangerous impact of geophagy, it remains culturally observed, likely due to a lack of awareness of its risks for the pregnant women and their fetuses. Therefore, our study aims to identify the perception of the geophagists and non geophagists pregnant women regarding geophagy associated health risks and elucidate the contributing factors to the awareness of these risks.

Methods

Study design and participants

A case- control study of pregnant women reporting eating clay or not was conducted from September 1st, 2022, to February 28th, 2023, in the city of Lubumbashi in the Democratic Republic of the Congo. This study included 211 pregnant women enlisted in four medical institutions in Lubumbashi (Lubumbashi University Clinics, Medical center Mont Carmel, Medical Center la solution and NGO Salama) All the pregnant women attending the prenatal care of the selected hospitals and who deliberately agreed to participate to the survey (104 cases and 107 controls) were included in the study.

Data collection

After obtaining authorization from the ethics committee and from each selected medical facilities, data were collected from patients coming for their prenatal visits during the study period. We used a questionnaire-based interview (see annex) to collect information on clay consumption, socio-demographics, medical follow up of the pregnancy, and awareness of health risks. Daily, the completed questionnaires were transmitted to the principal investigator (PI) to be encoded and offline analysis of the answers was conducted.

Data Analysis

Data were encoded using the Excel 2023 software. SPSS 23 allowed us to set the two groups according to the consumption (case) or not of clay (control). We separately computed socio demographic data from the two groups. The potential contributing factors were tested by calculating a chi square in the two groups. If the Chi square value was statistically significant, we calculated the odd ratio. Only significant results are reported in this study ($p<0.05$). We also tested the relationship between contributing factors to the awareness of health risk associated with geophagy in subgroups by a chi square. The dependable variable was the awareness of health risk related to geophagia; others are explanatory variables.

Results

Pregant women in Lubumbashi consum clay during their pregnancy

Table I describes the socio demographic characteristics of the study population. Data from pregnant women reporting consuming clay (geophagists) were compared to data obtained from pregnant women not consuming clay. (control). We tested the difference between the two groups using a Chi-square test, only positive results ($p<0.05$) are reported.

Table I: Socio-demographic characteristics of the study population

Socio-demographic characteristics	Geophagists (104)	Controls (107)	Chi-square
Age (years)			
<18	3	4	
18-35	85	82	
>35	16	21	
Residential district			
Center town	9	31	P=0.000
Outskirt	95	76	
Level of education			
Illiterate	4	13	
Primary school	11	11	
Secondary school	51	54	
University	37	28	
Post-graduate	1	1	

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Occupation of the pregnant woman			P=0.000
Unemployed	73	77	
Working for government	5	21	
Working in private sector	8	-	
Informal	6	17	
Students	2	2	
Marital status			
Officially married.	46	60	
In couple	56	47	
Widow	2	-	
Profession of the partner/ spouse			
Unemployed	25	16	
Working for government	60	63	
Working in private sector	17	28	
Informal	2	-	

Table II: Obstetrical characteristics of the study population

Obstetrical caracteristics	**Geophagists**	**Controls**	**Chi-square**
Gestational age (weeks)			
<14	2	22	P=0.000
14-28	46	52	
>28	56	33	
Parity			
Nulliparous (0)	23	39	
Primiparous (1)	18	23	P=0.03
Pauciparous (2-3)	33	11	
Multiparous (4-5)	15	18	
Large multiparous (≥6)	15	16	

The study was conducted in 211 pregnant women, with 104 of them included in the control group and 107 included in the geophagist group respectively. The mean age of the study population was 28±6 years (min 16 years, max 44 years). As shown in Table 1, independently of socio-demographic characteristics approximately 50% of pregnant women reported consuming clay. Residency and the occupation of the pregnant woman were statistically associated to geophagy: the unemployed women and those living in outskirts of the city represented the majority of geophagists (respectively xx and 81% of the case group). Noteworthy, a large majority of the geophagists displayed a minimum level of education with 9.8% who had completed secondary school (51/107), and 30.8% university (37/107). The majority of partners/spouse were working for the government (58.3%). Table II reports the obstetrical characteristics of the study population.

Data indicate that parity and trimester of pregnancy were statistically associated with geophagy: the majority of geophagists were pauciparous and more, suggesting that women who did not experience any harmful conditions associated to geophagy in previous pregnancies had the tendency to keep on the practice. Most of them indicated that clay consumption occurred in the two first trimesters of gestation. The mean parity was 2 (min 0, max 11); the mean gestational age was 25 +/- 7.9 weeks (min 6 weeks, max 43 weeks).

Particularities of geophagy in Lubumbashi

Table III: Characteristics of geophagy in the pregnant women in Lubumbashi

Clay consumption	**Number (n=104)**	**Pourcentage (%)**
Period of consummation		
Anytime	81	78
During pregnancy only	23	22
Onset consummation' age (yrs)		2
<10	2	33
Oct-18	34	65
>18	68	
Pattern of consummation		
Daily	48	46
Weekly	19	18
Monthly	10	10
Randomly	27	26
Quantity consumed daily (gr)		
<55	18	17
55-110	48	46
>110	31	30
Undefined	7	7
Maximum consummation' period		
First	38	36
Second	40	38
Third	14	13
Undefined	12	11

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From table III, we can conclude that geophagy is culturally based. Indeed, as reported, clay consumption is not restricted to pregnancy and a majority of geophagists ate clay daily. For the survey, the mean onset age of consumption was 21±5years (min 5 years, max 37 years) with the majority of geophagists started consuming after 18 years old (65.4%). Most of the clay consumers reported consuming daily clay, ranging from minimum 55g up to 356g of clay consumed. Finally, data indicate that the maximum consumption of clay occurred during the first and second trimester. The reason for such consumption is unclear. Geophagists reported that nausea and the taste of clay were the principal motivations of this practice (34.6% and 33.7% respectively) followed by craving for soil (7.3%). Interestingly, about 6% of geophagists could not define their motivation.

Table IV: Motivation of geophagy

Motivations	Number (n=104)	Pourcentage (%)
Craving for soil	18	17.3
Taste of clay	35	33.7
Familial behavior	2	1.9
Hypersalivation	4	3.8
Smell of clay	3	2.9
Nausea	36	34.6
Undefined	6	5.8

Awareness of health risks associated with geophagy among pregnant women

Table V displays several health risks we have identified.

As shown above, most of the pregnant women consuming clay had helminthic infestation (58.7%). Anemia (17.3%) constipation (9.6%) and abdominal pain (8.7%) were also observed, but at a much lower incidence. Despite the associated health risks, geophagy remains culturally accepted and observed, likely due to a lack of awareness; in this section we assessed the awareness of health risks associated to geophagy among all pregnant women, geophagists and non geophagists. As shown in Table VI, 52% of all women, independently of their habits to consume or not clay, reported not being aware of the risks of geophagy.

We also found that the level of education and the marital status of the pregnant women were significantly associated to the awareness of health risks due to geophagia: OR :2.35 (129-4.26) for level of education and 0.31 (0.18-0.55) for marital status.

Table V: Identified health risk among geophagists

Health risks	Number (n=104)	Pourcentage (%)
Anemia	18	17.3
Constipation	10	9.6
Abdominal pain	9	8.7
Microtoxins (diarrhea)	2	1.9
Delay of labour	2	1.9
Helminths	61	58.7
Undefined	2	1.9

Table VI: Contributing factors to the awareness of health risks of geophagy

Contributing factors		Geophagist	Controls	Chi-Square	OR
Residency					
Center town		31	9	**0.03**	
Outskirt		95	76		
Age				0.009	
0-18 yrs.		3	4		
>18 yrs.		101	103		
Level of education				0.004	2.35 (1.29-4.26)
Up to secondary		66	78		
University and above	1	38	29		
Parity					
Up to pauciparous		31	31	0.151	
Multiparous and more		95	95		
Marital status					
Married		46	60	0	0.32 (0.18-0.55)
Others	1	49	56		
Occupation of the pregnant women				0.776	
Unemployed		77	73		
Others		28	29		
Trimester of pregnancy				0.487	
1st trimester		14	10		
Others		95	92		

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Discussion

Motivation of geophagy

In Lubumbashi the prevalence of geophagy is estimated between 50.8 to 68% % among pregnant women [15, 17]. The main motivations of geophagy were nausea (34.5%) in relation to the period of maximum consumption (first and second trimester) and the taste of clay (33.7%). Others reported that craving was the main reason (73.9%) [5, 9]. For some communities, especially in Africa, geophagy is common and culturally accepted [1, 2]; geophagic women assume it as an obvious sign of pregnancy. We also noticed that only 22.1% of geophagists consumed exclusively during pregnancy. In our study, some women declared to crave for soil (17.3%), showing similarities with a dependency syndrome, known as a mental problem related to high stress; despite the related health risks, stopping women to consum clay might be difficult and would require a multidisciplinary approach, as most likely, the practice is likely to be continued throughout life [10]. in that context, awareness campaigns by medical staff, by authorities are essential.

Known health risks

The majority of geophagists (58.7%) were aware of the soil-transmitted helminthiases and the risk of anemia (17.3%) in case of clay consumption. Despite the knwoledge, clay consumption remains. This habit is likely to be a consequence of the cultural perception of geophagy and the dependency syndrome induced by the craving for soil, making awareness a crucial element in reducing geophagy-associated risks, particularly in pregnant women [10]. Important determinants of risk factors in geophagy are the composition of clay and in particular its level of contamination, the quantity consumed daily, and the period of consumption during pregnancy.

The mineralogical and chemical compositions of clay vary from one region to another; in the same region different rocks exist from which clay is extracted (add a reference here). In Lubumbashi, Kaolin is the most consumed soil (81%), coming from artisanal exploitation in Katuba and Ruashi districts, but also as far as Kakanda, Kolwezi in Lualaba province, the Kasai province, Kinshasa and Zambia [17]. Authors found that clay soil contained Ascaris lumbricoides, Trichuris trichiura, Taenia Spp., Necator americanus and Ancylostoma duodenale and therefore contaminate the consumer [18]. In mining regions, like in Lubumbashi , the soil contains in addition substantial amounts of Lead, Manganese, Arsenic and Nickel with the likelihood of posing adverse health problems [18-20]. Furthermore, in Lubumbashi the soil from which clay is extracted contains high levels of metallic trace elements such as As, Cd, Pb,Ni and Uranium substances, known to induce severe health problemes like respiratory and cardiovascular diseases (add references Malmab-Lez, Nemery/ Pyana Kitenge J,/Banza Lubamba) [17]. Indeed, as shown previously , the post-delivery mothers who consumed clay are at high risk of having high concentration of Aluminum Lead Nickel and Chromium [15]. in the same study, geophagy was indeed also associated to high risk of anemia and maternal hypertension [16].

In our study most of geophagists consumed between a substantial amount of clay per day, mainly in first and second trimester. Depending on the period of exposure to toxic elements the physiologic response of the organism may differ, turning to detrimental reactions especially during period of fetal development. Organogenesis mainly occur in the first trimester, the fetus is therefore at risk of birth defects if the mother is exposed to high concentration of harmful components contained in the clay soil [15]. Considering all these health risks, geophagy should strongly be discouraged, especially among pregnant women due to the special physiological state of pregnancy, for the wellbeing of both mother and child [16].

Awareness of health risks of geophagy, contributing factors and prevention

In our study, around half f the women were aware of the health risks of geophagy, knowledge being related to education As also mentioned in other studies, geophagy decreased as educational attainment increased [4, 21]. Education is therefore the key factor that can help increasing awareness of health risks of geophagy in the general population and in Lubumbashi in particular. It is also important to notice that the implication of the community is crucial: indeedmarried women were more aware of the risks than those who were not legally married. Therefore, it is important to implicate communities in increasing awareness of health risk of geophagy by providing to the pregnant women relevant information during prenatal care and through awareness campaign starting as earlier as possible; we noticed in our study that the earliest onset of geophagy was under 10 years (1.9%) and between 10 and 18 years (32.7%); 77.9 % of geophagists consumed not only during pregnancy, this means that the awareness campaign should not focus only on pregnant women but rather on the entire community. Preventive measures should address the motivations, enabling communities and pregnant women to be inform about the related risks. It is also important to address micronutrient deficiencies during pregnancy; geophagy may be an indirect sign of micronutrient needs and the ingested soil compensate the needs by containing some essential trace elements. [4, 8, 22-24]. In our settings, pregnant women were deficient in essential trace elements [15], geophagy could be a way to compensate, unfortunately not. It worsen the situation because of the presence of high concentration of toxic TE in the consumed clay [15, 17]. It is crucial to prevent and compensate for these micronutrients' deficiencies in vulnerable groups especially in periods of maximum need such as pregnancy.

Conclusion

Geophagy is still practiced by pregnant women in Lubumbashi regardless of the awareness of the related health risks. A holistic approach to prevent the practice should be implemented by communities, health workers and policy makers to reduce this cultural habit and prevent its health-related risks.

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