



Sociocultural and Environmental Drivers of Geophagy Among Women of Reproductive Age: Evidence from Tambach and Munyaka Wards, Kenya

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Abstract

Geophagy, the deliberate consumption of soil materials remains a culturally entrenched yet understudied practice among women of reproductive age in Kenya. Despite being socially accepted in many communities, the practice raises significant nutritional and toxicological concerns due to possible exposure to heavy metals and interference with nutrient absorption. This study examined the sociocultural and environmental determinants of geophagy among women in Tambach (Elgeyo Marakwet County) and Munyaka (Uasin Gishu County). A cross-sectional descriptive design was employed involving 322 women of reproductive age (15-49 years) selected through purposive and snowball sampling. Data were collected using researcher-administered questionnaires and analyzed using SPSS version 20. Principal Component Analysis (PCA) was used to identify the most influential factors associated with geophagic behavior. Results showed that soft stones were the most consumed geophagic substances (95–97%), mainly obtained from nearby quarries. Geophagy was most common among single and unemployed women. Family history emerged as the strongest social influence, followed by peer pressure and ease of access to soft stones. Cultural and traditional beliefs played a secondary role, with many women citing physiological cravings rather than cultural obligations as the main reason for consumption. Pregnancy, often assumed to drive geophagy, was not a dominant factor in this study. This study concludes that geophagy is a normalized behavior influenced by social learning, availability, and environmental exposure rather than culture or pregnancy. It recommends strengthening community-based nutrition education through maternal clinics, integrating geophagy awareness into county health programs, and conducting further research on mineral bioavailability and health impacts of soft stone consumption.

Keywords: *Geophagy, Soft stone, Women of Reproductive Age, Cultural Practices*

Introduction

Geophagy, the deliberate consumption of soil or earthy materials, remains a complex and culturally influenced behavior that is difficult to ascertain, especially among women of reproductive age. The ambiguity lies in whether this practice is socially acceptable or considered deviant within various communities. In Kenya, there is no clear consensus on the broad social acceptability of geophagy; however, it appears to be tolerated among pregnant women, as documented by Odongo et al. (2016). This perception aligns with longstanding cultural narratives that normalize soil consumption during pregnancy as a common and even expected phenomenon.

A widely held hypothesis suggests that geophagic cravings emerge as a physiological response to micronutrient deficiencies, particularly iron and calcium, during pregnancy (Macheke et al., 2017; Olowoyo & Matsela, 2017). The American Dietetic Association (2015) further supports a possible link between geophagy and iron deficiency, proposing that non-food consumption behaviors may reflect the body's attempt to compensate for nutritional deficits. Despite this assumption, iron supplementation alone has not been found to eliminate geophagic behavior among pregnant women, indicating that psychological, cultural, or habitual factors may also contribute (Gundacker et al., 2017; Diebelius, 2018).

Evidence from both developed and developing contexts, including Australia, Canada, Israel, and Uganda, demonstrates that geophagic women often exhibit low hemoglobin concentrations and anemia (Macheke et al., 2017). However, studies examining the mineral composition of geophagic substances have revealed alarming findings. For instance, Chinouya and Madziva (2017) reported high concentrations of lead (40 mg/kg), cadmium (0.52 mg/kg), and mercury (0.85 mg/kg) in clay samples from the United States and Europe. Similarly, Placek and Hagens (2013) found elevated levels of arsenic and lead in imported baked clay from Bangladesh, indicating that habitual consumption of such materials can lead to toxic exposure. Chronic ingestion of contaminated soil or clay may result in multiple health complications, including premature birth, spontaneous abortion, and neurodevelopmental deficits in infants (Miller et al., 2019; Young et al., 2016). Other complications include gastrointestinal obstruction, iron deficiency anemia, and parasitic infections (Miao et al., 2015). Arhin and Zango (2017) also caution that the consumption of clay or soil poses serious health risks due to the accumulation of toxic metals and sediment deposits in the digestive tract.

In Africa, geophagy is far more prevalent than other forms of pica such as amylophagy (starch eating) or pagophagy (ice eating). In countries such as Nigeria and Ghana, the mining and sale of geophagic clay provide livelihood opportunities for women who extract, shape, bake, and market the clay in local settings (Frazzoli et al., 2016; Young et al., 2016). Across the continent, edible clays are commonly sourced from termite mounds, house walls, or open markets (Gundacker et al., 2017; Chung et al., 2019). It is estimated that nearly 50% of women in Africa engage in geophagy, with Uganda reporting a prevalence of 64% among women of reproductive age (Young et al., 2016).

In Kenya, soft stones consumed for geophagy are mined predominantly in the western and Rift Valley regions, including Kisii, Kisumu, and Eldoret (Odongo et al., 2016; Miller et al., 2019). Despite its widespread occurrence, geophagy remains understudied and often perceived as a “normal” cultural practice among women. This study, therefore, sought to assess the contributing factors of geophagy among women of reproductive age in Tambach and Munyaka wards. The findings aim to provide insights into the sociocultural and environmental implications of geophagy within these communities.

Methodology

Research Design

This study adopted a cross-sectional descriptive survey and experimental design and was conducted in Uasin Gishu and Elgeyo Marakwet Counties, Kenya. Tambach Ward in Elgeyo Marakwet and Munyaka Ward in Uasin Gishu were purposively selected due to the presence of major geophagic soft stones quarries. In Tambach, geophagic soil is mined in Andi-Kipkaa village, while in Munyaka, Mwitirithia serves as the main quarry site. The study targeted women of reproductive age (15–49 years) who engage in geophagy. The sample size was determined using Fisher’s formula (Fisher et al., 1998), assuming a 70% prevalence, 95% confidence level, and 5% margin of error, resulting in 322 respondents. A multistage sampling strategy was employed, where the counties, wards, and villages were purposively selected based on geophagic activity. Participants were then identified through snowball sampling, a purposive technique suitable for hard-to-reach populations without formal records. This approach facilitated the identification of authentic geophagic women and enhanced the reliability and contextual accuracy of the data collected.

Data Collection Tools and Procedures

Four enumerators were trained for a week to help standardize data collection and minimize variations in data collection procedures that could bias the results. Before commencement of the data collection, a list of commonly consumed geophagic substances was generated using computerized free listing techniques. The piloted group were asked to list all geophagic items that they craved and were not categorized as food. The list included termite soil, clay, bricks, soft stones, mud, ash, charcoal and match sticks. Survey questions were then generated but limited to the frequently stated geophagic substance. A researcher-administered questionnaire was adopted as the major tool for data collection in this study. The questionnaire included information on demographics, geophagic substances consumed and factors that contributed to geophagy among women were captured. This was subdivided into physical environment, psychological and social factors. Information on past exposures was captured since it considerably strengthens the ability of surveys to identify exposure outcome relationships. Other variables included hunger and reports of family history on geophagia that would trigger a person to indulge in the practice.

Statistical analysis

Data were cleaned, coded, and analysed using the Statistical Package for Social Sciences (SPSS) version 20. Descriptive statistics were applied to summarize demographic characteristics and survey variables, with results presented as frequencies, percentages, and means. Frequency distribution tables and graphical illustrations were used to depict the distribution and relationships of key variables influencing geophagy. To further explore the underlying structure of the data, Principal Component Analysis (PCA) was performed to identify the most influential factors contributing to geophagic behaviour among women and to assess the strength of their interrelationships.



Ethical considerations

Research permit was issued by the National Council for Science and Technology (NACOSTI), license number: NACOSTI/P/19/1688. An informed consent was sought from the participants before involving them in the study. Privacy, confidentiality and rights of the respondent were respected and maintained throughout the research period. Participation was made voluntary to all women.

Results And Discussion

Socio-demographic characteristics of the study participants

The study findings revealed that Munyaka had the highest number of single women at 57% with at least a recorded number on separated and divorcees. Tambach single women were at 48% with no record on separated and divorced. Majority of the respondents (52.5%) were single, meaning they took up the financial burden. Even the few who were married 40% were unemployed, their economic status was still low. The results of this study were aligned with Miller et al., (2019): Frazoli, et al., (2016) who mentioned that geophagy more often was predominant among women of lower socioeconomic background. A study conducted in coastal Kenya where 58% of the geophagic respondents were unemployed, openly admitted geophagic practice to quench their hunger pains with only 9% in the labour force (Young, et al., 2018). It is then a clear picture that employed women were not actively involved in geophagia compared to the unemployed.

Most of the women (38.8%) had college certificates, while only 16.9% had university degrees. The findings showed that the level of education did not have much effect on the consumption rate of soft stones. The results indicated that majority of women who had knowledge on the possible impacts of geophagy, indulged in it irrespective of their education. Similarly, a study by Borgna-Pignatti & Zanella (2016), revealed that women with university education and strikingly a high lifestyle, equally indulged in geophagy. These however contrasts a study in Tanzania by Crystal (2014) that revealed only 6% of the geophagic respondents had a tertiary education level, this trickles down to the negative or positive impact that education level could have on a person's nutritional choices.

Religious affiliation was also sought among the geophagic interviewees, and the results elaborated that majority of the geophagists were protestants (48%). Adventists had the lowest recording of 6.9%. These finding agreed with that of Frazolli, et al., (2016) that historically christianity was associated with clay eating where clay tablets were blessed by the Roman Catholic and distributed to the congregation for consumption to ward off bad spirits.

Geophagic substance often consumed by the study participants

The study findings established that out of the seven geophagic substances listed on the questionnaire, the respondents only consumed three. The majority stated soft stones (95% and 97%) as their favorite and only 1.2% mentioned clay. There were no respondents from Tambach who consumed clay, this could be attributed to the area topology. The quarry in Tambach is located on a higher dry land, with the same type of geophagic substance, while in Munyaka, the few who consumed clay could be attributed to its availability because the mine area is swampy. This indicates that most women consumed non-food substance within their reach and the ones that they easily afforded. Tambach women acquired their geophagic substances from quarries (44%) recording the highest. Contrary, Munyaka's geophagists preferred to buy their soft stones from the street vendors (33%).

Consumption patterns of geophagic soft stones

The amount of geophagic soft stones consumed by women of reproductive age per day was sought. The daily consumption quantities of geophagy posited 100g as the highest with 35% respondents. Following closely was 27% who agreed that they consumed 200grams of soft stones per day. Only 3% recorded to consume 300grams of soft stones per day. The quantities of geophagy consumed per day by the women were high. This outcome could be alluded to the growth in the urge to continue eating the soft stone until the urge is gone. This reasoning is supported by a study by Young et al. (2016) among Zambian women who reported that they could not measure the amount they consumed, they just ate to satisfactory. Similarly in a study by Borgna & Zenalla, (2016): Madziva & Chinouya (2020) the geophagic soil amounts consumed daily by women was ranged 60g to 800g depending on number of times taken per day and quantity taken.

Sociocultural and Environmental Factors associated with geophagy among women in Tambach and Munyaka wards, Kenya

Social Factors

Majority of the respondents reported that they had a family member who was geophagic. Influence from mother recorded the highest in both study sites Tambach and Munyaka with 42.5% and 27.5% respectively. This meant that family history had a major role in geophagic behavior. Similarly, 22.5% and 31.5% in Tambach and Munyaka respectively reported they were highly influenced by family members on geophagic practices. This would then trickle down to a “learned behavior” among the geophagic women. PCA showed a strong association between family members and geophagy followed by friends and colleagues as shown in Figure 1. These findings were aligned with the results of a study by Causik & Hickery. (2016) who found that 41% of the geophagic respondents declared geophagic practice was common within other close family members. Other findings that were comparable with the current study were by Frazolli et al. (2016) where 60.2% of their subjects similarly stated that geophagic soil consumption was also practiced by close family members.

Strikingly, a study conducted in Lusaka on school going children revealed 79.5% of the children categorically mentioned they had a close relative who was geophagic in the same household. Therefore, this study supports the statement by Lumish et al. (2014) that geophagic practices have increased from generation to generation because it has been believed to have emanated from seeing their mothers and relatives indulge in soft stone eating. Similarly, some of the previous studies that assessed social environment in relation to geophagy reported results that concurred with this study. For instance, studies by Kamau et al. (2015), Young et al. (2018), Chinouya et al. (2017) and Chung et al. (2019) have sited that geophagic practices were highly influenced by the social environment that an individual resided.

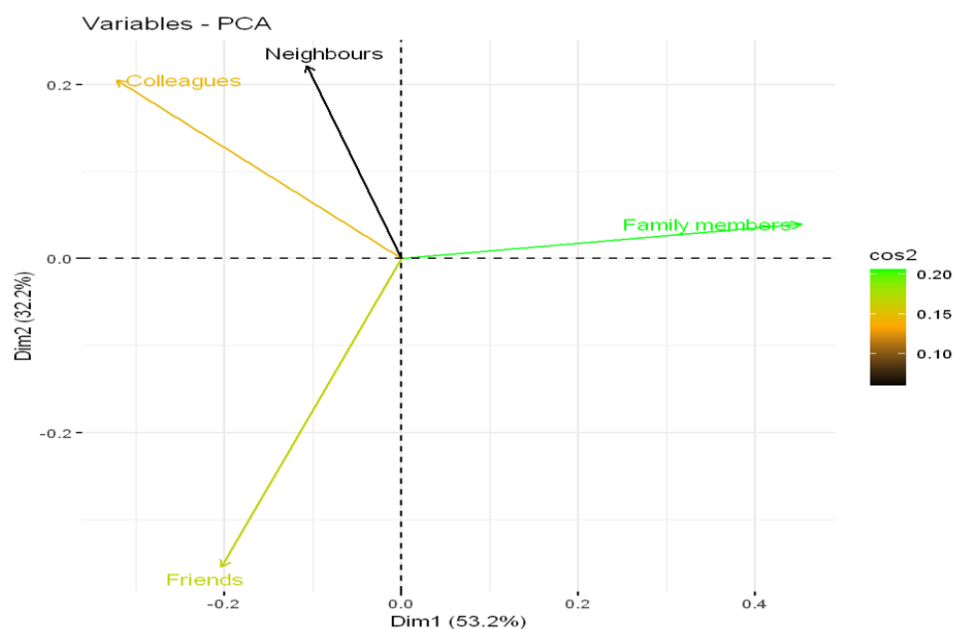


Figure 1. Social factors associated with geophagy among women of reproductive age in Tambach and Munyaka wards, Kenya.

Physical and Environmental factors

Living near the quarry was the most significant environmental contributor to geophagy among the women as showed by Figure 2. This is closely followed by affordable prices of the geophagic substances in the two counties. This shows that availability and affordability of the geophagic substances positively influenced the consumption and behavior adaptation of the women. The reason for this outcome might have been influenced by the physical environment that the geophagists were exposed to Chung et al., (2019) in their study around lake Victoria depicted that physical environment contributed greatly to geophagic practices. The findings of the current study were in absolute agreement with the findings of Madziva & Chinouya, (2020) that highlighted that people exposed to quarries or mining sites are more prone to adopting geophagic habits. However,

Matt Rosenberg (2020) and Gundacker et al. (2017) differed with these findings, they found that low-income Mexican women living far away from quarry sites had to buy geophagy to quench their cravings irrespective of the cost. Results of this study indicated that the amount of money geophagic women were willing to spend on geophagic substances was an indicative of their deep desire as well as the degree to which their cravings impacted their daily lives.

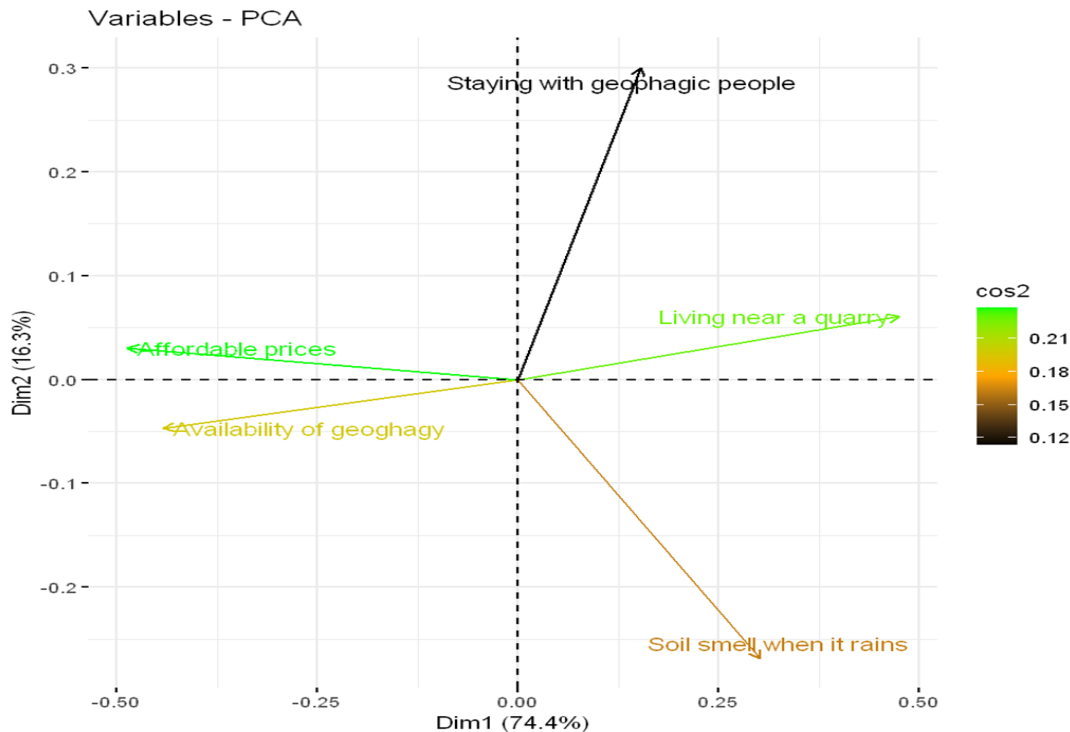


Figure 2. Physical and Environmental factors associated with geophagy among women of reproductive age in Tambach and Munyaka wards, Kenya.

Cultural and Traditional beliefs

PCA was conducted to explore the cultural and traditional beliefs associated with geophagia among women of reproductive age. The first two dimensions (Dim1 = 32.5%, Dim2 = 28.3%) accounted for a cumulative 60.8% of the total variance, revealing clear patterns in the beliefs expressed as shown in Figure 3. Notably, health-related motivations such as “fill physiological need for nutrients,” “strengthen bones,” and “increase blood in the body” clustered closely together, indicating a strong perception of geophagia as a nutritional remedy. Reproductive beliefs such as “promote fertility” and “increase milk productivity” also featured prominently, reflecting maternal and child health considerations. Medicinal and spiritual beliefs, including “treat cholera and bacterial infections,” “stop intestinal infection,” and “bring good luck,” were more dispersed, suggesting varied cultural interpretations. These findings underscore the multifaceted role of geophagia, driven by both physiological and sociocultural influences within the community.

Geophagy has been linked to cultural significance that was related to healing, fertility and childbearing (Chinouya & Madziva, 2017). In North India for instance, geophagic cravings were used as a sure way to predict the gender of the unborn baby. It was believed that a woman who craved ash, was expectant with a baby girl, whereas dust cravings symbolized that she was pregnant with a baby boy (Cousik & Hickey, 2016). Culture undeniably informs more of human behavior, it is therefore sensible to expect that sociocultural concepts reinforce or inhibit geophagic behavior (Quintanilla et al., 2016). In the current study most of the respondents 32.5% agreed that they consumed geophagic softstones for “nutrient replacement”. Most geophagists agreed that they consumed soft stones to strengthen bones, increase blood volume in their bodies and physiological need for nutrients. A section of the respondents believed consumption of softstones would bring them good luck, stop infections and relief common ailments. Geophagic women (28.3%) disputed that they consumed soft stones to promote fertility, treat cholera or increase lactation milk.

This finding differs from the finding of a study carried out in Lake Victoria, Kenya, which showed that geophagic women agreed to consume soft stones during pregnancy because of an illusion that “it added blood volume” in the body and had “capacity to improve health” of women (Chung, et al., 2019; Miller et al., 2019). The results of this study concurred with a study done by Chinouya and Madziva (2017) who hypothesized geophagic practice as an adaptive behavior based on nutritional requirements by women of childbearing age. Similarly, it was noted in a study by Young et al. (2018) that in pregnancy nutrient requirements are high hence expectant women with insufficient nutrients develop cravings for geophagic substances, as a way of supplementing deficient nutrients like iron, calcium and zinc.

Geophagic women in this study, agreed that their consumption was partially influenced by their culture, traditional and religious background. The findings of this study echo a statement by Frazzoli, et al., (2016) that geophagy has widely been associated with spiritual ceremonies, traditional and cultural activities or customs. Women in Mexico practiced geophagia for religious reasons. They consumed the virgin Guadalupe made from holy clay to get blessings (Songca et al., 2010). The Black Christ cult in Esquipulas town was customarily known for openly promoting consumption of holy white clay tablets to alleviate pregnancy sickness and ease childbirth.

Common reasons for geophagic practices in a study by Frazzoli et al., (2016) included a belief that clay acted as an instant remedy for diarrhea and alleviation of nausea in pregnant women. Contrary to his findings, majority of the respondents in the current study disputed that they ate soft stones for medicinal purposes. Contrary to these findings Arhin and Zango, (2017) conducted a study in Ghana where geophagic women stated numerous health reasons for geophagic consumption. Mostly mentioned was the management of diarrhea, dizziness and nausea, which posed as a major challenge in the initial trimester of many pregnancies.

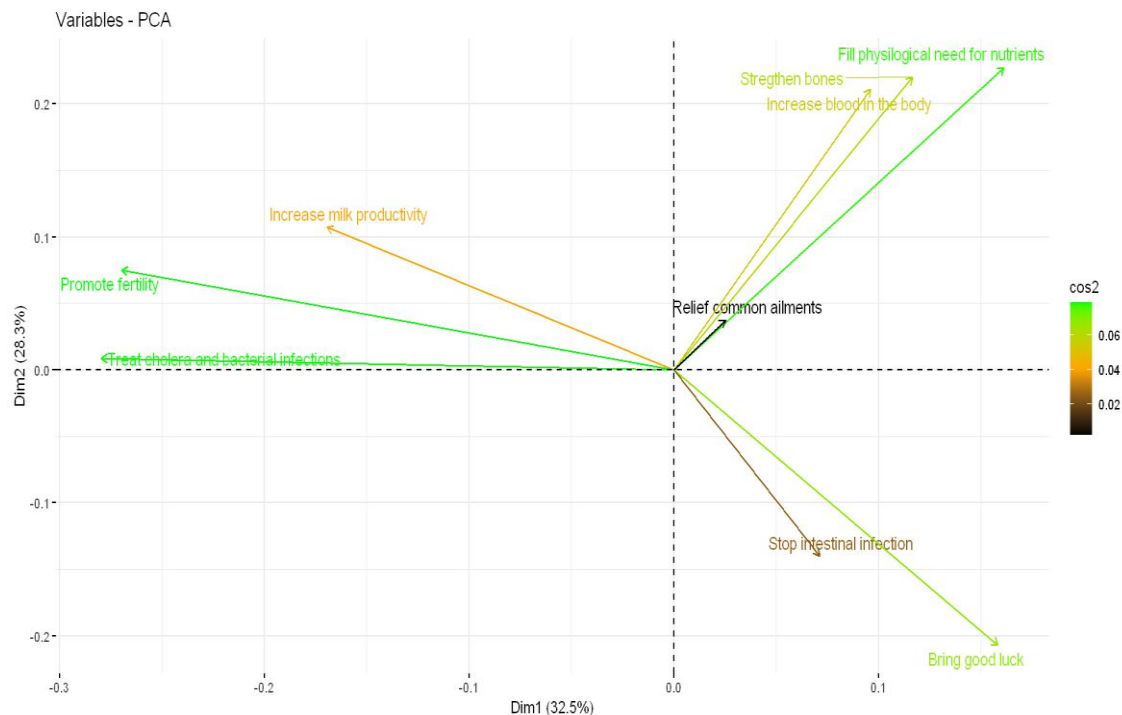


Figure 3. Cultural and traditional beliefs associated with geophagy among women of reproductive age in Tambach and Munyaka wards, Kenya.

Conclusion

The results outline that geophagy is high among women of reproductive age in Elgeyo Marakwet and Uasin Gishu Counties. Soft stones are the most preferred geophagic substances in Tambach and Munyaka wards. Quarry sites remain the major source of geophagic soft stones in this study. Smell and taste make up the highest attributes in choice of the geophagic



substance. Consumption patterns is high, geophagists consume quantities of 100g-200g soft stones daily, three times a week for several years. Hence geophagia appears as a normal practice among women in these communities.

The findings of this study demystify pregnancy as a major factor contributing to geophagia. Family history is a dominating influential factor in geophagy in both study sites. Most women acknowledge peer pressure and availability of the soft stones as the major trigger to geophagic practice. Culture broadly examined is not a satisfactory explanation for geophagic practice in this study.

Recommendations

Uasin Gishu and Elgeyo Marakwet counties should develop and implement integrated nutrition and health strategies that incorporate geophagy awareness into existing maternal and child health programs. Health professionals should enhance nutrition education and counseling within maternal clinics and community health initiatives to promote healthy dietary habits and discourage geophagic behavior among women of reproductive age. Further research is recommended to assess the bioavailability and physiological effects of minerals derived from geophagic materials, providing evidence to inform effective public health interventions.

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