

## Prevalence of Geophagia and its possible implications to health – A study in rural South Africa

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**Abstract**-Habitual and intentional consumption of soil (geophagy) by both humans and animals have been reported in literature as a complex eating behavior. A survey was conducted in one of the rural districts of the Eastern Cape province in South Africa to assess and document the prevalence of geophagic practices among its population. The results of the survey indicated the wide spread practice of geophagia among young girls, pregnant as well as non pregnant women. Reasons for the practice ranged from simple craving due to smell and texture, the soils ability to reduce the symptoms of morning sickness, hunger pangs and the belief that soils can provide some micronutrients important for health. Geophagic soils collected from consumers included soils from garden, mountains, river beds, termite mounds, mole hills and earth worm casts. Soil texture of samples varied from loamy sands to sandy clay and clay. Cation exchange capacities (CEC) of the geophagic soils collected in the area varied considerably and ranged from 3 – 89meq/100g. Relatively high CEC values obtained in some of the clay soils consumed in the region may have beneficial (protection from enterotoxins) or harmful (hypokalemic myopathy) health consequences to consumers. Hypokalemic myopathy has been reported for similar soils from other parts of South Africa.

**Key words**-Prevalence; geophagia; cation exchange capacity; hypokalemia; enterotoxin

### I. INTRODUCTION

Deliberate consumption of soil (geophagia) is reported to be an age old practice not restricted to any particular age group [1-3]. Children are more vulnerable to this habit at infancy when hand to mouth activity is high and is considered normal at that age [4]. Geophagia in older humans are considered abnormal [5]. There are number of reasons put forward for the habit of consuming soil. It is a culturally sanctioned practice in many societies while considered by many as harmful or possibly nutritious. Geophagy is reported by some as a physiologic response to a deficiency like iron or calcium in the body [6]. It is commonly practiced by women in many different cultures around the world including many African countries and South Africa [7]. The authors reported prevalence rate of 40% among the women of African decent and is higher than the rates occurring in other population groups. The assumption of physiologic response might have arisen from the fact that non human primates and various other animals including birds ingest soil in their normal lives [8, 9]. It is considered an adaptive behavior in nonhuman primates and many other mammals [8]. Physicochemical properties of geophagic soils

are important in establishing its beneficial or harmful effects both in animals and humans [10]. The authors also have noted that the physicochemical properties of most of the geophagic soils are not known to make a valid assessment on their beneficial or harmful nature. In humans the possible harms may overshadow the benefits because of the potential for soils to expose them to parasitic infestations [11], heavy metal poisoning such as lead, copper and cadmium, as well as hyperkalemia [12]. Harmful nature of geophagic soils are also increased when soils and clays with high potassium content or high cation exchange capacities (CEC) are consumed by humans. High potassium content of soil may cause hyperkalemia, cardiac arrhythmia and cardiac arrest [13] while soils with high CECs may cause iron deficiency anemia due to decreasing the absorption and bioavailability of iron and hypokalemic myopathy by gastrointestinal potassium depletion [14 -17]. Hypokalemic myopathy due to habitual ingestion of soil has been reported in South Africa [17,18]. Though geophagia is known and reported to be a common practice among South African population there is no documented evidence on its prevalence or its health effects. The present study aims to establish its prevalence in the rural Oliver Tambo District area of the Eastern Cape Province and its possible implication to health.

### II. MATERIALS AND METHODS

Prevalence of geophagia was estimated through a questionnaire based random survey in Oliver Tambo district in the Eastern Cape Province of South Africa. A standardized questionnaire previously used by the geophagia working group in other parts of South Africa, Botswana and Swaziland was used in the study [19]. Samples of geophagic soils ingested by individuals who responded to the questionnaire in the study were obtained from them and analysed for their cation exchange capacity by the barium chloride method [20]

### III. RESULTS AND DISCUSSION

#### *Prevalence of geophagia in the population*

A total of 240 people participated in the survey. All participants in the survey were females between the ages of 20-60 years and of African decent. The results are presented in Table 1. It was observed that 75% of the people responded as having practiced geophagia. It was found to be common among rural and urban dwellers, educated and illiterate alike. The frequency of consumption varied from more than once daily to occasionally. Major reason for eating soil was due to

craving during pregnancy or otherwise. Smell, taste and texture of the soil made it attractive to the consumers. Less than 1% of the participants said they eat soil to supplement diet. 75% of the participants said that family members and friends knew about their practice of eating soil. Majority of the participants reported that some people are positive while some are negative about their habit. Sources and Location of Geophagic soils included hill/mountain, garden soil, river bed, termite mound and termitaria. Soft, very soft and hard textures were preferred by consumers and there seemed to be individual preferences.

#### *Cat Ion Exchange Capacity(CEC) of geophagic soils in the area*

The cation exchange capacities of the geophagic soil samples varied from 3- 89meq/100g (Table 2). Soil texture influenced the CEC of the soils. CEC of Clay samples were higher than loam sands, sandy loam, sandy clay loam and sandy clay. The cat ion exchange capacities of geophagic clay samples collected from the Eastern Cape Province in this study is higher than the values reported for geophagic soils recently reported from the Free state in South Africa and Swaziland [21]. The type, amount and the frequency of consumption of soils varied in individuals. The adsorption capacity of some of the clay soils in this study could be classified as high and their ability to cause hypokalemia on regular consumption need to be investigated. These Clays with high CEC may have the ability to absorb enterotoxins as reported earlier [22].

Detailed study on the physicochemical characteristics of the soil, biochemical and nutritional effects on consumers are being investigated and is in progress.

#### IV. CONCLUSION

This study has established that geophagy do occur in the Xhosa population studied in the Eastern Cape of South Africa. Though the practice is known and taken for granted the behavior is some what secretive. Samples collected varied in texture color and possibly in mineral composition. There is no geophagic soils commercially available in the area. The CEC of the soils varied widely and hence their potential for harm and beneficial health effects. Further studies are required to characterize the soils and fully assess their nutritional and medicinal effects.

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TABLE 1 - THE PROFILE OF PARTICIPANTS

Number of participants in the survey	240
Number of geophagic participants	180
Prevalence of geophagia	75%
Urban	48 (23.4%)
Rural	138(76.6%)
<b>Age Range of participants</b>	20-60years
20-30years	89 (49.4%)
30-40 years	71 (39.4%)
40-50years	18 (10%)
50-60years	2 (1.1%)
<b>Marital Status</b>	
Married	98(54.4%)
Unmarried	82(45.6)
<b>Employment Status</b>	
Employed	45 (25%)
Unemployed	85 (47.2)%
Scholars	50( 27.8)%
<b>Level of Education</b>	
No formal schooling	18 (10%)
Primary education	9 (5%)
Secondary education	72 (40%)
Tertiary education	81(45%)
<b>Frequency of consumption of soil</b>	
Once a day	60 (33.3%)
More than once a day	58 (32.2%)
Weekly	40 (22.2%)
Occasionally	22 (12.2%)

TABLE 2 - CATION EXCHANGE CAPACITY (CEC) OF GEOPHAGIC SOILS

Soil Texture	Sample	CEC (meq/100g)
Clay	SA 1	59
	SA 2	89
	SA 3	28
	SA 4	43
Sandy Clay	SA 5	24
Sandy Clay loam	SA 6	20
	SA 7	23
Sandy Loam	SA8	18
Loam Sands	SA 9	3