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Physiological Effects of Geophagy (Soil Eating) with Reference to Iron Nutritional Status in Pregnant Women: – A Study in Selected Antenatal Clinics in KSD Municipal Area of the Eastern Cape, South Africa

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Abstract. Geophagy, the regular and deliberate consumption of soil is a culturally sanctioned practice among pregnant women and young girls in many populations around the world including sub-Saharan Africa. A previous study in the area by George etal indicated a prevalence rate of 75% for geophagia among women aged between 15 -70 years. The present study examined the prevalence of geophagia and iron nutritional status among pregnant women attending selected ante natal clinics (ANC) in KSD municipal area of the Eastern Cape of South Africa. During their routine ANC visits, pregnant women (12-20weeks of gestation) were identified and invited to participate in the study. Consented women (N=210) were requested socio - demographic information, dietary habits and geophagic practices if any; through a structured questionnaire. Occurrence and severity of anaemia and iron nutritional status and profile were assessed through routine laboratory investigations on blood drawn for the purpose. Data analysed using SPSS. 36.6% of the pregnant women who participated in the study were found to be practicing geophagia . There were individual choices and preferences for the soil they consumed .Frequency , quantity and reasons of consumption of soil varied within the group. 11.7% ate soil on a daily basis while 45.5% and 41.6% of pregnant women consumed it weekly and monthly respectively. 52% of pregnant women were anaemic according to WHO criteria (Haemoglobin <11gm/dl) 68.8% of geophagics and 15.8% of non-geophagics respectively. Statistically significant differences were observed in biochemical markers of iron status (serum iron, transferrin , transferin saturation, ferritin and haemoglobin) and haematological markers such as haematocrit , Mean corpuscular volume (MCV), Mean corpuscular haemoglobin (MCH) and Mean corpuscular haemoglobin content (MCHC) between the groups. Geophagic practices affected the iron nutritional status negatively. The results of the present study points to the potential harm geophagia can cause in pregnant women. Anaemia can affect the expectant mother, foetus and pregnancy outcome negatively. The results warrant an urgent need for health education and health promotion in the community. Further studies are recommended.

Keywords: Geophagia, Pregnancy, Iron nutritional status, Anaemia

1. Introduction

Geophagy (soil eating) is a form of 'pica' known to be practiced by pregnant women in many cultures around the globe including Sub Saharan Africa since ancient times [1-3] . It is thought by many to be an adaptive behavior to rectify nutritional deficiencies particularly of micronutrient deficiencies in pregnant women [4-6]. Association between geophagy and anaemia was reported by many ancient writers [7,8] including Hippocrates [3] who differentiated jaundiced skin from the bad color of skin caused by strange longings for non- food substances such as stones and earth. Though the practice is known, few case studies have been reported in South Africa [9-11]. No systematic studies have been been reported on the practice of geophagia and iron deficiency

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anaemia in pregnant women. The present study attempts to document the prevalence of geophagic practices and prevalence of anaemia among pregnant women in some selected ante natal clinic facilities in KSD municipal area in the Eastern Cape of South Africa.

2. Materials & Methods

The cross-sectional study was carried out in three primary health care antenatal clinics located in King Sabatta Dalyndyebo (KSD) Municipality (approximately 3019km^2), one of the seven local municipalities within the Oliver Tambo District Municipality in the Eastern Cape Province of South Africa to study the prevalence of geophagia among pregnant women. The selected antenatal-clinics catered for rural, periurban and urban population. Based on the clinics' antenatal attendance and the prevalence rate reported earlier in the area among women [12] the sample size was determined. 210 pregnant women of African descent (12 – 20 weeks of gestation) participated in the study after giving written informed consent. Socio-demographic information and geophagic practices if any were obtained through a structured questionnaire. Iron nutritional status and profile were assessed in non-geophagic (control) and geophagic pregnant women using venous blood and standard laboratory procedures in the National Health Laboratory Services attached to the academic hospital, Data obtained for the two groups were compared using SPSS.

3. Results

Results are presented in Table 1.

37% of the pregnant women reported that they eat soil on a regular basis. Individual choices of soils varied in texture, quantity and frequency of consumption. 11.7% ate soil on a daily basis while 45.5% and 41.6% of pregnant women consumed it weekly and monthly respectively. The reasons for consumption of soil were mainly due to a liking for the smell texture and to curb the morning sickness and salivation. 80% of the consumers believed that the soil will provide them the much needed minerals during pregnancy. Haemoglobin values in pregnant women ranged from 8.1gm/dL – 16gm/dL. The mean haemoglobin levels in the non-geophagic group was 11.42gm/dL+/-2.56 while in the geophagics the mean hemoglobin level was 10.42gm/dL +/-1.15. Between the groups the geophagic pregnant women had a lower hemoglobin levels compared to the non-geophagics and these values were statistically significant at $P<0.001$.

In terms of the South African National Department of Health [13] the definition of anaemia in pregnancy (haemoglobin <10gm/dL) was observed in 28.2% of pregnant women who participated in the study. These figures were 12.2% in non geophagics and 27.3% in geophagics. According to the World Health Organisation (WHO) criteria (Hb < 11 gm/dL), the prevalence of anaemia was 52%. The difference in the prevalence of anaemia on the basis of the two different criteria was statistically significant ($p = 0.000$). Severe (anaemia haemoglobin < 7gm/dL) was not observed in the study. Statistically significant differences were observed in biochemical markers of iron nutritional status between the groups. These included serum iron (P=0.000), transferin(P=0.000), transferin saturation(P=0.000) and ferritin (P=0.001). The above biochemical indices were also corroborated by the haematological parameters such as haematocrit (P=0.002), MCV (P=0.016), MCH (P=0.000) and MCHC (P=0.006) . Both biochemical and haematological parameters points to iron deficiency anaemia in the geophagic group. Geophagic practices affected the iron nutritional status negatively.

4. Discussion

The prevalence of anaemia observed in this study are similar to the rates reported in rural South Africa. In a recent study in rural Kwa Zulu Natal by Hoque etal [14] reported a prevalence rate of 30% for anaemia (as per SA guide lines) and 57.7% (as per WHO guidelines) among pregnant women. Geophagic practices were not considered as a cause of anaemia in the above study. Anaemia in pregnancy is a leading cause of maternal and perinatal deaths in developing countries. In developing countries, anaemia affects almost two thirds of the pregnant population. It is also estimated that anaemia is responsible for as much as 20% of all maternal deaths in sub-Saharan Africa [15]. Maternal anaemia is a risk factor for infant iron deficiency anaemia and, if left uncorrected, can be associated with adverse behavioural and cognitive development in children [16]. The prevalence of anaemia in pregnancy is estimated between 35% and 75% in sub-Saharan

Africa [17]. Geophagia has been reported earlier in this community by George and Ndip [12]. Pica has been reported to be common from other parts of Africa including South Africa as well as other developed and developing countries by many authors. Hence geophagic habits followed by pregnant women in this community were not surprising. The prevalence of geophagia found among pregnant women is lower than the prevalence reported in the African female population in the area. It is probably due to the fact that this study targeted only an age group 18 – 40yrs (mean age 24yrs). Geophagy as a cause of anaemia has been reported by many authors [9-11] But the practice of geophagia was neglected as a possible reason for the wide spread anaemia among pregnant women in any of the above studies. The extent of anaemia, soils can cause will depend on several physicochemical characterestics of the soil, frequency and quantity of consumption. George and Ndip [18] recently reported some of the physicochemical properties of geophagic soils collected from this area. The above study reported that the geophagic soils from this area differed widely in their elemental composition though iron was found to be the major element, pH, Cation Exchange Capacity and texture. These inherent soil differences may also cause differences in the absorptive capacity of iron and interfere negatively on the bioavailability of dietary iron [11]. In this study we observed that pregnant women had preferences for texture and taste of soils and hence the effect may vary in each participant depending on the varity of soil consumed. In a recent invitro study using Caco2 cell model Seim etal reported that though geophagic soils from Zanzibar contained high levels of total iron, the bioavailability of this iron was minimal from some while majority of soil samples inhibited the bioavailability of iron from food [19].

5. Conclusion

The prevalence of anaemia observed in the geophagic pregnant population is significantly higher than in the non-geophagic group. Geophagia as a risk factor for anaemia need to be further investigated in this community. The anaemia observed in early pregnancy can be worsened later causing adverse pregnancy outcome. The results warrant an urgent need for intensive and extensive health education regarding the detrimental consequences of this common practice and health promotion in the community. Further systematic in vivo studies are recommended on geophagic soils.

6. Acknowledgement

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Table 1: Profile of pregnant women and their iron nutritional status.

Parameter	Non-Geophagics (Control)	Geophagic	Significance & P value
Number of participants	133	77	
Age (yrs)	25.5 +/- 5.2	23.7 +/- 5.3	NS
Gestation (Wks)	14.5	14.6	NS
Haemoglobin(gm/dL)	11.42+/-2.56	10.42+/-1.15	S (P<0.001)
Serum Iron(Umol/L)	13.88+/-5.35	9.91+/-6.01	S (P<0.000)
Transferin(gm/dL)	3.44+/-0.68	3.94+/-0.72	S (P<0.000)
Transferrin Saturat (%)	17.37+/-10.65	11.04+/-8.06	S (P<0.000)
Ferritin (ug/L)	35.19+/-40.03	24.73+/-32.56	S (P<0.053)
Haematocrit(%)	36.35+/-5.95	34.08+/-3.04	S (P<0.002)
MCV (fL)	93+/- 9.00	90+/-12.42	S(P=0.016)
MCH(Pg)	29.27+/-2.27	30.21+/-2.68	S (P<0.000)
MCHC(g/dL	31.07+/-1.77	30.21+/-2.68	S (P<0.006

NS – Non significant
S - Significant