

**THE PREVALENCE AND NUTRITIONAL STATUS OF WOMAN BETWEEN THE
AGES OF 18 TO 45 YEARS, PRACTICING GEOPHAGIA IN THE UMZINYATHI
AND UMGUNGUNDLOVU DISTRICTS, KWAZULU-NATAL**

by

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Bachelor of Home Economics (UNIZULU)

Dissertation submitted in fulfilment of the academic requirements for the degree of

MASTER OF SCIENCE IN HUMAN NUTRITION

**In the School of Agricultural, Earth and Environmental Sciences
College of Agriculture, Engineering and Science**

University of KwaZulu-Natal

Pietermaritzburg

SOUTH AFRICA

JANUARY 2017

ABSTRACT

Introduction: Geophagia refers to the eating disorder of consuming soil and other non-food substances. The practice of geophagia has been linked to nutritional, taste, psychological, cultural and medical aspects. Geophagia is most common among pregnant women, they believe that eating of earth eliminate nausea which is commonly experienced by most pregnant women during the first three months of their pregnancy. Soil is used for many reasons like to reduce hunger, fight heartburn or even used as a sunscreen. Despite of the advantages of geophagia, soil consumption has been criticised to contain the risk of soil- lead toxicity which in most cases affects the pregnant women.

Aim: The aim of this study was to investigate the prevalence and the nutritional status of women between the ages of 18-45 years practicing geophagia in uMgungundlovu and uMzinyathi districts in KwaZulu-Natal.

The objectives of this study were:

- To determine the socio-demographic status of women from uMgungundlovu and uMzinyathi district practicing and not practicing geophagia.
- To determine the nutritional status (anthropometric measurements) of women from uMgungundlovu and uMzinyathi district practicing and not practicing geophagia.
- To determine the food security status of woman from uMgungundlovu and uMzinyathi district practicing and not practicing geophagia.
- To determine the types of soils consumed by woman from uMgungundlovu and uMzinyathi district practicing geophagia.

Methods: The study design was a cross-sectional, descriptive study. A convenience sample of 32 women practicing geophagia and 30 women who did not practice geophagia was obtained. Questionnaires used were directly related to the aim and objectives of the study and all interviews were conducted by the researcher.

Results: The findings of this study showed that the majority of women 65.6% who ate soil were married and most of the women from the control group were single. The findings also showed that the 31.3% of geophagic women were making a living out of grants, non-wage employment and only 56.3% were on wage employment. The control group were all on wage employment. There were no significant differences in body mass index (BMI) and waist to hip ratio (WHR) of both groups (geophagia and the control group). The majority of participants from both groups fell under the obese group. There was a significant negative correlation between knowledge score and Household Food Insecurity Access Scale (HFIAS).

The majority of women were Zulu speaking. Women practicing geophagia had their own individual choices and preferences of soil they consumed and the frequency and reasons of consumption of soil varied. There was no significant difference in nutrition knowledge score between geophagia group and the control group. The majority of women who participated in the study were obese and had poor nutrition knowledge. The mean knowledge percentage of geophagia group was 56.9%, whereas the mean knowledge percentage of the control group was 56.8%. There was no significant difference in nutrition knowledge between the geophagia group and control group. Most of the respondents (43.8%) indicated that they preferred to consume soil that was Khakhish in colour followed by 21.9% who preferred soil that was reddish, 15.6% preferred whitish, 12.5% who preferred blackish and 6.2% who preferred to consume soil that was yellowish in colour.

Conclusion: The findings indicated that geophagia was more commonly practiced by women with low educational levels and low socio-economic status. There was a significant positive correlation between BMI and WHR ($r=0.381$, $p=0.002$). Women from the geophagia group had poor food security knowledge. The results showed a need for health and nutrition education in both communities for both groups (geophagia and control group).

PREFACE

The work described in this dissertation was carried out in the School of Agricultural, Earth and Environmental Sciences at the University of KwaZulu-Natal from July 2012 to January 2017, under the supervision of Dr Annette Van Onselen and Dr Nicky Wiles.

Signed: 

Lindokuhle Happiness S'khosana (Candidate)

Date: 10/02/2017

As supervisors of the candidate we agree to the submission of this dissertation

Signed: 

Dr Annette Van Onselen (Supervisor)

Date: 10/02/2017

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Dr Nicky Wiles (Co-supervisor)

Date: 10/02/2017

DECLARATION OF ORIGINALITY

I, Lindokuhle Happiness S'khosana declare that:

The research project in this dissertation, except where otherwise indicated, is my original research.

This dissertation has not been submitted for any degree or examination at any other university.

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ACKNOWLEDGEMENTS

I would like to express my sincere gratitude to Dr. Siwela who guided me throughout my registration.

I would also like to extend my acknowledgement to Professor Veldman for accepting me in the department and for the financial support.

A special word of thanks also goes to my supervisor Dr. Van Onselen who guided me all the way, supported and encouraged me.

I would also like to express my sincere gratitude to my co- supervisor Dr. Wiles for support and guidance throughout the completion of this study.

I would like not to forget Dr. Hendry who assisted me with statistically analysis of this study.

To my supervisor at work Mrs. Thoko Msomi for support and encouragement.

To Bacebile and Nqobile for their dedicated support in data collection.

To Sifikelwe Dumalisile for her support and dedication.

To the community of uMgungundlovu district and uMzinyathi who made this journey a success with their time participating in the study.

I thank my husband and my children for being so understating and supportive.

I would also like not to forget the ward councillors who granted me the permission to conduct research in their areas and the extension officers from department of Agriculture and Rural Development for assisting me to organize the people.

DEDICATION

Dedication to my Husband Sbusiso, my children S'phesihle, Londwayinkosi and my little girl Ayalondwa and my mother Makhosazana for their support and encouragement.

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+CHAPTER 1: THE PROBLEM AND ITS SETTING

1.1 Introduction and importance of the study

Geophagia is the practice of eating earthy substances such as soil or clay among people of all races (Ngozi, 2005, Luoba *et al.*, 2004, Bisi-Johnson *et al.*, 2010). Geophagia has been linked to nutritional, taste, psychological, cultural and medical aspects (De Jager, 2008). The practice of geophagia is most common in pregnant women because they believe that earth eating eliminates nausea (Luoba *et al.*, 2004; Faustina *et al.*, 2010). Geophagia is one form of pica. Pica is defined as an eating disorder or persistent eating of non-nutritive substances. Geophagia is sometimes regarded as a psychiatric disease. According to Williams and Moturi (2008) geophagia is more common in people living in poverty. In most cases geophagia in children is associated with malnutrition. Geophagia is not restricted to any particular age group, sex and geographic region (George and Ndip, 2011).

According to Kutalek *et al.* (2010) geophagia is an ancient practice which is still widely seen in many parts of the world, especially in traditional societies. Soils selected for particular qualities such as flavor and plasticity, from carefully chosen sites are consumed for a variety of reasons from religious to medicinal, as well as part of a regular diet.

According to Obi (2008) geophagia may contain good and harmful aspects in such a way that the use of white clay may be beneficial to treat diarrhoea, gastritis, colitis and maintenance of normal intestinal flora by flora found in soil. Consumption of soil may lead to electrolyte disturbances, intestinal obstruction and constipation. The practice has been criticised as unhygienic because it can expose consumers to toxic soil constituents, such as heavy metals or parasites (Knishinsky, 1998; Reilly and Henry, 2001; Hunter, 2003; Ellis and Schnoes, 2006).

Iron deficiency anemia has been identified as a risk factor for geophagia (Van Onselen *et al.*, 2015). However, there is evidence that soil can be a valuable source of trace elements and nutrients. A number of investigations have been carried out to resolve such conflicting views and to provide data on which an objective conclusion can be made regarding the clinical, medicinal and nutritional implications of the practice (Halsted, 1968; Abrahams, 1997).

Different studies concerning geophagia have been done in different parts of the world including South Africa. Studies that have been carried out in South Africa include the nutritional Status and risk factors associated with women practicing geophagia in QwaQwa. Haematological and iron status of QwaQwa women in South Africa whom ingest soil. The impact of geophagia on iron status of black South African women (QwaQwa). Demographic characteristics associated with consumption of geophagic clay also in QwaQwa, and Geophagia in the Transkei Region Mthatha.

1.2 Aim of the study

The aim of the study was to investigate the prevalence and nutritional status of woman between the ages of 18 to 45 years, practicing geophagia in the uMzinyathi and uMgungundlovu Districts, KwaZulu-Natal (KZN). The reason for the study is because less of the information concerning geophagia has been done or documented for KZN

1.3 Research objectives

The research objectives were:

1.3.1 To determine the socio demographic status of women from uMgungundlovu and uMzinyathi district practicing and not practicing geophagia.

1.3.2 To determine the nutritional status (anthropometric measurements) of women from uMgungundlovu and uMzinyathi district practicing and not practicing geophagia.

1.3.3 To determine the food security status of woman from uMgungundlovu and uMzinyathi district practicing and not practicing geophagia.

1.3.4 To determine the types of soils consumed by woman from uMgungundlovu and uMzinyathi district practicing geophagia.

1.4 Hypothesis

- The socio demographic status of women practicing geophagia will not differ from women who are not practicing geophagia.
- The nutritional status of women practicing and those not practice geophagia will differ.
- Women practicing geophagia will be more food insecure than women not practicing geophagia.
- Types of soils consumed are determined by the area or location where soil is collected.

1.5 Inclusion and exclusion criteria

The inclusion criteria were as follows:

Geophagia group

- Women who have been practicing geophagia for at least a month.
- Women who resided in uMgungundlovu district and uMzinyathi district.
- Women between the ages of 18-45.
- Non-pregnant females.
- Females who are willing to participate and gave consent (Appendix A).

Control group

- Females between the ages of 18-45
- Non- pregnant females.
- Women who resides in uMgungundlovu and uMzinyathi district.
- Females who are willing to participate in the research and gave consent (Appendix A)

1.6 Abbreviations

- BMI Body Mass Index

- FANTA Food and Nutrition Technical Assistance
- HFIAS Household Food Insecurity Access Scale
- HIV Human Immunodeficiency Virus
- IDA Iron Deficiency Anemia
- KZN KwaZulu-Natal
- UKZN University of KwaZulu-Natal
- USAID United State of America International Development
- WHR Wait Hip Ratio
- WHO World Health Organization

1.7 Definitions of terms

Geophagia: Geophagia is defined as eating or consumption of earth, soil or clay (Bisi-Johnson, *et al.*, 2010). Geophagia is sometimes regarded as a psychiatric disease. Woywodt and Kiss (2002) define geophagia as the consumption of soil.

Geophagist: A person who eats soil, earth or clay www.dictionary.com

Non eaters: Individuals who do not eat or include soil, earth or clay in their diet (Zimmerman, 2006).

Pica: Pica is described as the eating disorder of consuming substances with little or no nutritional value for a period of at least one month. (Young, 2011)

Soil eaters: People who eat soil or earth as part of their diet (Zimmerman, 2006).

1.8 Outline of dissertation

The dissertation is divided into six chapters and is laid out as follows:

Chapter one includes introduction and importance of the study, aim of the study, research objectives, hypothesis, inclusion and exclusion criteria, abbreviations, definitions of terms and referencing style. Chapter two focuses on exploring the literature related to the research under the following topics: pica, etiology of pica, causes of pica, geophagia, the history of geophagia, geophagia in the world, the prevalence of geophagia in Africa, the prevalence of geophagia in South Africa, the prevalence of geophagia in KwaZulu Natal, the reasons for practicing geophagia, health implications of geophagia, nutritional implications of geophagia, soil consumption, and types of soils consumed. Chapter three: describes the methodology of the research. Chapter four describes people participated in the study and presents the results.

Chapter five, deals with the discussion of data that was collected and analyzed. Chapter six includes the summary of research, conclusions and recommendations.

1.9 Referencing style

This dissertation has been referenced using the University of KwaZulu-Natal (UKZN) Library Harvard style referencing guide.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

Pica is defined as craving and consumption of non-food substances (Young *et al.*, 2010a). Pica is common in almost every culture (Halsted, 1968, Reid 1992). There are different types of pica including eating of ice called phagophagia, eating of starch referred to as amylophagy as well as the most common type of pica called geophagia or eating of earth and clay soils substances (Ashworth *et al.*, 2008). Geophagia is defined as the intentional and sometimes accidental consumption of earth substances (Halsted, 1968, Ellis and Schonoes, 2006, Young *et al.*, 2008). Geophagia is more commonly observed in people who live under poverty and famine but can also be noticed in the absence of poverty and hunger (Bisi- Johnson *et al.*, 2010). The practice of geophagia is more commonly identified in mentally handicapped individuals, during pregnancy and in anemic individuals (Woywodt and Kiss., 1999).

The practice of geophagia is observed worldwide in both human and animals; geophagia is more common among people with low socio-economic status in tropical regions of the world and in tribal societies (Ellis & Schonoes, 2006). In poor societies earth may serve as an appetite suppressant and filler and geophagia is more common in people with anorexia nervosa (Woywodt *et al.*, 2002). According to Njiru *et al.* (2011) in some countries geophagia is associated with religious practice, culture and famine. In Africa the habit of earth eating is more common and widespread passed from generation to generation, because of cultural beliefs and enjoyment of the habit (Woywodt and Kiss, 1999).

Different reasons are stated why people consume soil as well as the types and colour of soils consumed. According to Ngole *et al.* (2010) geophagic soils contain lot of mineral nutrients including zinc, copper, manganese, magnesium, iron and even toxic substances such as lead and aluminium. The following clay soils colors are preferred and used for geophagia creamy, whitish, greyish, brownish, blackish, yellowish and reddish (Woywodt and Kiss, 2002). Different forms of pica is noticed in different parts of the world, pica, etiology of pica, causes of pica and its implications will be discussed in this chapter as well as the historical background of geophagia , the prevalence of it in different parts of the world, its causes and implications.

2.2 Pica

The word “pica” is a Latin word for the bird called Magpie due to their vigorous appetite. (Woywodt and Kiss, 2002). According to Young (2009) pica is described as the eating disorder of consuming substances with little or no nutritional value for a period of at least one month. Young *et al.* (2010a) state that pica is the craving and a purposive consumption of non-food substances. Pica is a worldwide phenomenon and seems to be more common during pregnancy. Pica is noticed in all ages and both sexes and particularly in women and is more common in areas of low socioeconomic status. Children between the ages of one to six can be affected with pica. While some authors define pica as eating normal food in abnormal quantities; pica may also present a symptom rather than a disease. As mentioned earlier pica is more common in people with the problem of iron deficiency anemia or deficiencies of other nutrients like zinc (Detroit, 2000).

2.2.1 Etiology of Pica

The etiology of pica is still not clear but it is associated with iron deficiency anemia (Ellis, 2014). The practice of pica is an unusual craving and sometimes can be triggered by nutrient deficiency especially iron and zinc. Pica can cause risk to human health (Khan and Tisman, 2010). Different people have tried to explain the phenomenon ranging from psychosocial causes to biochemical origin (Ellis, 2014). Pica has been practiced for long time without clear etiology.

The common types of pica are geophagy (earth), amylophagy (raw starch), and pagophagy (ice). Young *et al.* (2010a) noted that different etiology of pica have been suggested including hunger, micronutrient deficiencies, gastrointestinal distress, and increased exposure to pathogens and toxins. Pica is associated with positive and negative health effects (Young *et al.*, 2010a). These effects will be discussed later in this chapter.

2.2.2 Causes of pica

Young *et al.* (2010a) mentioned that there are three causes of pica which include hunger, micronutrient deficiency and protection from toxins.

2.2.2.1 Hunger

Hawass *et al.* (1987) & Woywodt and Kiss (2002) pica is commonly practiced in societies where poverty and famine are prevalent to serve as an appetite suppressant and filler. Pica is practiced because of the shortage of food. People tend to crave for nonfood substances because they do not have food (Young, 2011).

2.2.2.2 Nutritional deficiencies

According to Sugita (2001) malnutrition has been seen as one of the reasons for practicing pica. Iron deficiency is the most common type of anemia. Iron deficiency is characterized with strange craving to eat nonfood items such as dirt, ice, or clay. According to Young *et al.*, (2010a) iron deficiency anemia is associated with pica. Other scholars argue that pica causes iron deficiency anemia. However, there is evidence that soil can be a valuable source of trace elements and nutrients (Halsted, 1968, Abrahams, 1997). Pica is also associated with zinc deficiency Singh *et al.* (2003).

2.2.2.3 Cultural and familial factors

People from different cultures practice pica as a result of their cultural beliefs (Geissler *et al.* 1999). In some cultures pica is considered normal.

2.2.2.4 Stress

In a study by Bay *et al* (2013) children with pica and iron deficiency anemia (IDA) had a significant higher oxidative stress index towards children with IDA but not practicing pica. (Bay *et al* 2013). Some pregnant women in a study conducted by the American Board of Family

Medicine (2000) stated that eating ice helped during stressful times. Pregnant women practicing pagophagia experienced some levels of stress and anxiety which were observed by the researchers (Ayeta *et al*, 2015).

2.2.2.5 Negative implications and health effects of Pica

Pica can be dangerous because the substances consumed may contain poisons, toxic chemicals or bacteria which can lead to the damage of gastrointestinal tract and lead to bowel problems, ulcerations, perforations or obstructions (Stewart, 2010). The non-nutritive and non-food substances consumed can cause risks in human health such as metabolic disorder lead and mercury poisoning parasitic infections, tooth wear intestinal obstruction and different health problems in the gastrointestinal tract (Khan and Tisman, 2010).). The negative health effects associated with pica include heavy metal poisoning especially lead, micro nutrient imbalances and transmission of parasites.

2.3 Geophagia

Geophagia is considered as one form of pica. Geophagia is also regarded as the habit of eating clay or earth (Abrahams, 2006, Ghorbani, 2008). The historical background of geophagia, the prevalence of geophagia in different countries, etiology, the reasons and implications associated with geophagia are going to be discussed.

2.3.1 The history of geophagia

Geophagia is practiced in many parts of the world. Africa is one of the continents that is regarded as the continent of origin for the practice geophagia and practice is thought to have spreads to other part of the world through migration and slavery (Abrahams, 2005). The practice of geophagia was reported by travellers and missionaries in African countries like Nigeria, Ghana and Sierra Leon during the 18th and 20th century (Hunter, 1993). Geophagia is more common in children than adults, women than men, black people than in white people, and more common in rural areas than in urban areas. Geophagia in human is regarded as a global health issue and it is viewed as an unusual behavior as a symptom of metallic dysfunction (Norman *et al.*, 2015).

People have different views concerning the practice of geophagia some young women in urban South Africa believe that earth eating will give them lighter skin color and make their skin soft and attractive (Woywodt and Kiss, 2002). During the 16th and 17th century geophagia was regarded as a symptom of disease chlorosis known as the green diseases affecting young girls (Woywodt and Kiss, 2002).

Geophagia is common in many countries in Southern United States and geophagia has been noticed as common practice since the 1800s and it was more common among slaves. Geophagia is still common and practiced by many people of different cultures even now. It has been practiced as part of religious ceremonies, magical beliefs and attempt at healing (Detroit, 2000).

2.3.2 Geophagia in the world

Geophagy has been around and practiced by many people from different parts of the world. The practice and the reasons of geophagia may differ from country to country. The study conducted in Mexico showed that the prevalence of geophagia was 37% (n=28) in a study of seventy six women (Lin *et al*, 2015). The study conducted in 16 villages in the Marika protected area of Madagascar found the prevalence of geophagia to be 53.4% in a sample of 760 individuals (Golden *et al*, 2012). According to the results of the study conducted in Panama the prevalence of geophagia was 22.5% in sample of 41 women (Lachlan and Bodkin, 2011).

In rural South America the practice of geophagia is reported to be more common among the black women. It is believed that the spread of geophagia has been introduced by slaves in South America (Anitei, 2008). In Bangladesh the practice of geophagia is noticed among pregnant women. Women in Bangladesh believed that consuming soil boosts their appetite and health which they believe will result in into the delivery of healthy babies. Poor and unemployed individuals in Bangladesh collect burnt mud and sell it as a way of generating income (Anitei, 2008). It is reported that in China large number of people consumed soil during the severe food shortage period (Hunter, 2003).

2.3.3 The prevalence of geophagia in Africa

Geophagia is practiced in many parts of the world even though the prevalence varies. In different countries pregnant women have been identified as a group in which geophagia is more common. The highest incidences of geophagia have been noticed in African countries (Ngozi, 2008). According to Walker *et al.* (1997) geophagia is commonly practiced mainly in five different African countries, Zimbabwe, Zambia, Malawi, Swaziland and South Africa. The study conducted in Tanzania showed that the prevalence of geophagia was 64% (Nyaruhucha, 2009). A study conducted in Ghana showed that geophagia was practiced by both men and women. The practice of geophagia was not limited to pregnant and lactating women, and it was found to be common in both rural and urban communities (Norman *et al.*, 2015). Another study conducted in Ghana in rural and urban areas of Kumasi showed that the prevalence of geophagia was 47% in a study of 400 pregnant women (Faustina, *et al.*, 2010). The prevalence of geophagia according to the study conducted in Nairobi Kenya was 74% (Ngozi, 2008). The prevalence of geophagia according to the results of a study conducted in Tanzania in a sample of 971 HIV positive pregnant women was 29% (Kawai *et al.*, 2009). According to the study that was conducted in Kenya in Likuyani District of Kakamega County the prevalence of geophagia was 45%. The prevalence of geophagia in Western Kenya among children was reported to be 73.1% (Geissler *et al.*, 1999). The prevalence of geophagia among Zambian girls was 74.4% (Nchito *et al.*, 2004).

2.3.4 The prevalence of geophagia in South Africa

The practice of geophagia is also noticed in different provinces in South Africa. According to the study conducted by George and Ndip (2011) in the Eastern Cape uMthaththa the prevalence of geophagia was reported to be 75% and to be very high among girls, pregnant and non-pregnant woman. Various reasons for the practice of geophagia were mentioned ranging from craving, due to smell and texture, belief of reducing morning sickness, hunger pangs and providing essential nutrients (George and Ndip, 2011). The study conducted in Johannesburg revealed that large number of women practiced geophagia especially the migrant women. The prevalence of geophagia in pregnant women was reported to be 20% and was at risk of anemia. The study conducted by Mathee (2014) in Johannesburg consisted of women born in South Africa and those not born in South Africa (Mathee, 2014).

2.3.5 The prevalence of geophagia in KwaZulu Natal

Geophagia has been practiced in different parts of the world, even though less is documented for KwaZulu-Natal. The study conducted in uMkhanyakude district revealed that the prevalence of geophagia was 83.3% in a sample of 98 women. The practice of geophagia was more common among women even though it is stated that geophagia was secretly practiced by men. Most of the respondents 43% stated that geophagia was started during pregnancy and never stopped after delivery. The study further indicated that geophagia was more common in single women than married and more prevalent in poor female headed households (Msibi, 2014).

2.4 Reasons for practicing geophagia

In some countries soil or clay plays an economic and food security role, because it is available in the market for purchase and consumption (Abrahams *et al.*, 2005). The reasons stated for the practice of geophagia was not nutritional but psychosomatic reasons (Waswa and Imungi, 2014). The practice of geophagia is regarded as a complex behavior with etiology including psychological, cultural, physiological, medicinal reasons, traditional and religious beliefs.

2.4.1 Culture

According to Bisi-Johnson *et al.* (2010) geophagia is a traditional cultural or religious activity which has been observed especially during pregnancy. According to Ghorbani (2008) geophagia is a cultural practice done at religious ceremonies. The practice of geophagia is a traditional cultural practice which is used as a remedy or treatment for illnesses (Vermeer & Frate, 1979; Dominy *et al.* 2004). Some cultures believed that soil consumption is the link between good health, fertility and ancestor's blessings (Njiru *et al.*, 2011).

2.4.2 Religion

According to Ghorbani (2008) soil consumption or the practice of geophagia is a traditional cultural activity done at religious ceremonies. Geophagia is an ancient behavior practiced because of the belief in its religious and magical powers. Geophagia is a cultural practice passed

from generation to generation because of its religious beliefs and because is considered as a spiritual, ceremonial and traditional practice (Van-Wyk, 2013).

2.4.3 Psychological

The practice of geophagia is regarded as a psycho-behavioral disorder (Hunter 2003). Psychological upset can motivate the practice of geophagia and geophagia is linked to a number of psychological abnormalities (Callahan, 2003). According to Songca *et al.* (2010) geophagic women in South Africa believed that soil consumption improves their natural beauty.

2.4.4 Hunger and poverty

Geophagia is a widely spread phenomenon practiced especially in Africa. Geophagia is commonly practiced in societies where poverty and famine are present (Ghorbani, 2008). Soil consumption is usually practiced by women and children to relieve hunger (Brand *et al.*, 2009). According to Woywodt and Kiss (2002) hunger and starvation are the reasons to consume soil in order to suppress appetite.

2.4.5 Nutrient Deficiencies

Geophagia is a frequently practiced activity by women and children and the practice contributes to nutritional deficiencies (Brand *et al.*, 2009). Craving for nonfood substances may reflect shortage of minerals. Geophagia is associated with a deficiency disease of the blood called chlorosis. Chlorosis is also associated with shortage of minerals. Chlorosis also affects plants by yellowing its leaves even in plants is associated with shortage of minerals. It is noticed that the disease in both plants and human is caused by lack of available iron, zinc and other minerals in the human diet and in the soil with plants (Oliver, 1997; Brand *et al.*, 2009,).

Geophagia is considered an attempt to obtain the required minerals. In most cases human eat clay or soil when the nutritional demand is high. It is more common for children to eat more soil during their period of greatest growth, when their bodies require more nutrients (Abrahams, 2005). Young *et al.* (2008) noted that people consume soil to increase micronutrient intake and to supplement iron, zinc calcium and other micronutrient deficiencies. According to Abrahams

(2002) the shortage of calcium and iron may cause a craving for chalky substances. It is also believed that soil have the ability to increase calcium level (Van Wyk, 2013).

2.4.6 Pregnancy

According to Bisi-Johnson *et al.* (2010) pregnant and lactating women believe that the consumption of soil satisfy all the cravings associated with pregnancy. According to Reilly and Henry (2000) in Malawi geophagia is considered as a sign of pregnancy and not consuming soil during pregnancy is regarded as an unusual behavior.

Some women consume soil during pregnancy because they believe that soil consumption will cure oedema on legs and believe that it will make their babies beautiful. Van Wyk (2013) also noted that physiological changes during pregnancy can be the reason for geophagia. Geophagia is observed in pregnant women as a feature of iron deficiency. Due to contamination of geophagic material soil consumption is associated with a high rate of morbidity and mortality (Woywodt and Kiss, 2002).

2.5 Health implications of geophagia

According to Brand *et al.* (2009) geophagia is the practice that is more common in women and children as a folk medicine. According to Simon (1998) geophagia is associated with positive health effects. Geophagia may supplement mineral nutrients. According to Lambert *et al.* (2013) clay or soil substances that is consumed by people interacts with the food bolus and the digestive mucosa. Geophagia may have the harmful or beneficial effects on human health. Geophagia may strengthen digestive barriers against alkaloids and toxins, whereas on the other hand complex interactions of clay with metals and ions may generate low-level poisoning and deficiencies damaging the health and nutritious status of individuals practicing geophagia (Lambert *et al.*, 2013).

Hooda *et al.* (2002) noted that geophagia has numerous health and medical problems. According to William (2002) geophagic children are likely to be the victims of malnutrition, anemia, diarrhoea, constipation and worm infestation. According to Van Wyk (2013) geophagia is associated with medicinal treatment and a remedy for certain diseases. Geophagia

is one common form of pica that implies eating of soil. Geophagia can affect human health in various ways it may lead to some specific diseases or to any general ill health. Soil inhalation alone can lead to tumour if the soil contains asbestiform minerals. Some soils contain pathogens which can lead to tetanus and infestations of hookworm. Pathogens in soil may also cause elephantiasis in human if soil enters the human body through abrasions (Oliver 1997).

Oliver (1997) further noted that if radon from the soil is consumed may cause some cancers, and poorly drained soil has been linked recently with infant mortality. According to Hooda *et al.* (2004) geophagia is associated with iron deficiency. Geophagia has various health implications in the human body which includes constipation, cramping, pain perforation from sharp objects like rocks or gravel contamination (Hooda *et al.*, 2004). Geophagic soil may expose humans to parasitic infestations (George and Ndip, 2011). Most human illnesses that are associated with geophagia are caused by concentrations of the following elements in food or water that are either lacking or toxic, these elements includes copper, fluorine, iodine, lead, selenium aluminium, arsenic, cadmium and thallium (Oliver, 1997).

2.6 Nutritional implications of geophagia

According to George and Ndip (2011) geophagia contributes to nutritional implication. The consumption of soil may be of good benefit depending on the amount of soil consumed. Geophagia contain the risk of soil-lead toxicity which in most cases affects the pregnant women. It is also considered as a physiological response to iron or calcium deficiency in the human body. Physiochemical properties of geophagic soils are important in establishing its beneficial or harmful effects both in animals and humans (George and Ndip, 2011).

Craving could be attributed to a deficiency of nutrients or minerals such iron, zinc and calcium. Geophagic soils are selected from specific different sites. The colour and texture of clay may have influence on the type of soil consumed. White soil is composed mainly of kaolin whereas yellowish and reddish clay contain iron which could be a source of iron supplement. Where there is poverty and famine, earth may serve as filler. Geophagia has been observed in anorexia nervosa. However, geophagia is often observed in the absence of hunger, and environmental and cultural contexts of the habit have been emphasized (Njiru *et al.*, 2011, Vermeer & Frate,

1979). The practice of geophagia noticed in people with learning disability. Geophagia and other forms of pica are associated with a high rate of complications and high rate of morbidity and mortality geophagia is associated with micronutrient deficiencies especially in pregnant women (Ngole *et al.*, 2010). Soils interfere with the bioavailability of micronutrients which results in micronutrients deficiencies and also leads to the ingestion of geohelminths and heavy metals which puts people who consume it in danger (Njiru *et al.*, 2011).

Iron deficiency is one of the biggest problems faced by the world. The most affected group includes children and women especially of reproductive age (WHO, 2002). Geophagia is noted to be one of the major risk factor for iron deficiency worldwide. According to Oliver (1997) craving nonfood substances may reflect mineral deficiencies. Geophagia in particular is associated with deficiency diseases.

2.7 Soil consumption

2.7.1 The advantages of eating soil

According to University of Chicago (2011) there are several benefits of eating soil and clay. Earth eating protects the stomach against toxins, parasites, and pathogens. Different researchers agree about the benefits of geophagia others believed that geophagia provides nutrients such as iron, zinc, or calcium, whereas others believe that earth has a protective effect, or is working as a shield against ingested parasites, pathogens and plant toxins. Geophagia is believed to delay and ease the hunger pangs (University of Chicago, 2011). Clay may benefit calcium absorption. Clay retards the motility of the gastrointestinal tract and increase the time for calcium absorption from foods to take place by binding with secondary compounds in plant foods. Clay may release bound minerals make them available for absorption (Hunter, 2004). The mineral content of soils from different regions varies, some contain the following minerals which are very important during pregnancy, iron, calcium, magnesium and copper (Anitei, 2008). Soil lowers morning sickness in pregnant women. Kaolin in the soil also helps to prevent diarrhoea. Geophagia also act as a mineral supplement for pregnant women as the nutrients requirements increase (Anitei, 2008).

2.7.2 The disadvantages of eating soil

According to Magongoa *et al.* (2011) it is believed that soil eating inhibits the absorption of iron from the gut into the blood stream. Anitei (2008) mentioned the following effects of eating soil: constipation caused by clay, geophagia affects the ability of the body to absorb nutrients which may lead to nutrient deficiency, and soil may cause a person to crave for other non-food substances (Anitei, 2008). According to Abrahams (2005) consuming contaminated soil is dangerous in a way that it may cause maternal death. Coarse particles found in the geophagic soil can affect the dental enamel and can also cause the rupturing of the sigmoid colon (Ngole *et al.*, 2010). Consuming various minerals found in the soil can cause different types of complications to human health. Consuming soil with too much cadmium can cause kidney damage (Young, 2007).

2.7.3 Types of clay and soil consumed

Geophagia is practiced for different reasons by different people. People who consume clay have different choices, when it comes to selection of clay they consume. Geophagia materials are picked from different selected areas. Others prefer termite, moulds, pits, riverbanks whereas others even prefer house walls (Reilly and Henry, 2000). Ekosse *et al.* (2010) noted that the preference of choice on clay or soil to be consumed include colour, taste and texture. The preference of texture and taste also differ from person to person, some prefer the clay or soil a bit powdery whereas others prefer the clay in a rock form, some prefer tasteless and some prefer clay with sour taste (Reilly and Henry, 2000).

2.8 Conclusion

Literature has highlighted that pica is a wide spread phenomenon common in all cultures, race and different age groups (Ekosse, *et al.*, 2010). Literature has shown that there are different reasons that people choose to practice geophagia including the belief that consuming soil helps with the treatment of illnesses. Others believe that consuming soil or earth substances will

benefit their wellbeing in one way or other. Whereas others consume soil because they believe that soil consumption has various health benefits which includes mineral supplementation and creating a barrier to toxins and relief of gastro intestinal distress. (Knishinsky, 1998, Hunter, 2003, Luoba, *et al.*, 2004, Bisi-Johnson *et al.*, 2010). However different scholars have shown that even though geophagists believe in the benefits that they get from consuming soil, soil consumption may pose certain life threatening health risks to the geophagist including mental retardation, brain damage, epilepsy, heavy metal poisoning and the consumption of potentially pathogenic microorganisms, such as geohelminths (Halsted, 1968, Abrahams, 1997, Hooda *et al.*, 2002, Luoba *et al.*, 2004, Ngozi, 2008, Bisi-Johnson *et al.*, 2010). The non-nutritive and non-food substances consumed can cause risks in human health such as metabolic disorder lead and mercury poisoning parasitic infections, tooth wear intestinal obstruction and different health problems in the gastrointestinal tract (Khan and Tisman, 2010). Therefore more research is needed to be done focusing on the impact of geophagia on nutritional status and food security of women.

CHAPTER 3: METHODOLOGY

3.1 Introduction

This chapter presents the research methodology that was used to investigate the prevalence and nutritional status of woman between the ages of 18 to 45 years, practicing and not practicing geophagia women in KwaZulu-Natal under uMgungundlovu and uMzinyathi district. This chapter includes the design of the study, description of the population, sampling, data collection methods and analyses.

3.2 Design of the study

The study design was a cross-sectional, descriptive study. Cross sectional studies are relatively fast and inexpensive and are design to give the prevalence of a disease. Furthermore a descriptive study can provide information about the naturally occurring health status, behavior, attitudes or other characteristics of a particular group (Creswell *et al.*, 2003, p.14). The design of the study is presented in Table 3.1 below.

Table 3.1 Design of the study

Sample	Data collection tool	Data collected
Geophagic group (n=32)	Questionnaires <ul style="list-style-type: none">• Appendix A• Appendix B• Appendix C• Appendix D• Appendix E• Appendix F	<ul style="list-style-type: none">• Socio-Demographic information.• Anthropometric information• Nutrition knowledge information.• Soil habit information• Household Food security information• Food Frequency Questionnaire

Table 3.1 Design of the study cont.

Sample	Data collection tool	Data collected
Control / non geophagic group (n=30)	Questionnaires <ul style="list-style-type: none">• Appendix A• Appendix B• Appendix C• Appendix E• Appendix F	<ul style="list-style-type: none">• Socio-Demographic information• Anthropometric information• Nutrition knowledge information.• Household Food security information• Food Frequency Questionnaire

Integrated research methodology was used to triangulate various data collection instruments with the intension that they would meet the research objectives of the study. The study used a qualitative approach because it tends to give more attention to the subjective aspects of human experience and behavior. The questionnaire developed consisted of closed and open ended questions to enable the understanding of the relationships between human perceptions and geophagia. The quantitative approach allowed patterns of knowledge creation to be thoroughly described (Creswell *et al.*, 2003, p.153). A pilot study was conducted on a purposive sample of ten woman practicing geophagia in uMgungundlovu District.

3.3 Sampling

A convenience sample of 32 women practicing geophagia was used to obtain information regarding the prevalence of geophagia. A convenience sample of 30 women who do not practice geophagia also participated in the study as a control group in order to compare between the two groups. The total sample of 62 women participated in the survey.

3.4 The inclusion criteria were as follows:

Geophagia group

- Women who had been practicing geophagia for at least a month.
- Women who resided in uMgungundlovu District and uMzinyathi district.
- Women between the ages of 18-45.
- Non-pregnant females.
- Females who were willing to participate and gave consent (Appendix G, p.).

Control group

- Females between the ages of 18-45
- Non- pregnant females.
- Women who resided in uMgungundlovu District and uMzinyathi district.
- Females who were willing to participate in the research and gave consent (Appendix G).

3.5 Validity and Reliability

The questionnaires used were directly related to the aim and objectives of the study. All interviews were conducted by the researcher. The socio-demographic questionnaire (Appendix A) was validated by using the indicators of socio-demographic factors described in scientific literature and assessed by previous relevant studies (Msibi, 2013).

All anthropometric measurements were measured according to standard methods as recommended by Hammond and Litchford (2012, p.165). The researcher was trained in methods and techniques to determine accurate anthropometry (Appendix B). A calibrated scale were zeroed before each measurement and the weight recorded by the scale compared with a known weight to ensure that the reading on the scale reflected the same reading when measuring the standard weight after every 20th subject measured by researcher.

A nutritional knowledge questionnaire (Appendix C) consisting of 42 questions was adopted from a previous validated questionnaire (Whati *et al.*, 2005). The Food Based Dietary Guidelines (Vorster *et al.*, 2013) were also included to determine the nutritional knowledge of

the participants. Geophagic habits of the participants were determined by a validated questionnaire (Annexure D, p.) used in previous studies by the Central University of the Free State (Van Onselen, 2013). The Household Food Insecurity Access Scale (HFIAS) was used to determine the food security status of the participants (Appendix E, p.). Validated questionnaires with the recommended instructions and endorsements were used according to United State of America International Development (USAID), Food and Nutrition Technical Assistance (FANTA), Household Food Insecurity Access Scale (HFIAS) for measurement of food access: indicator guide, version 3 (Coates *et al*, 2007). The Food Frequency questionnaire was adopted from (Kassier, 2014) and was chosen to measure food consumption due to its ease of use and low cost. The food items were grouped into eight categories according to the similarity of nutritional content. All the questionnaires for were piloted to ten random women resided in district to ensure validity and reliability and will be discussed further in this chapter.

3.6 Data collection

The researcher used structured interviews to obtain information concerning the prevalence of geophagia and nutritional status of women between the ages of 18 to 45 years, practicing geophagia in KwaZulu Natal under uMzinyathi and uMgungundlovu district. The researcher also used structured interviews to get information concerning the nutritional knowledge and the food security of women who do not practice geophagia between the ages of 18-45 years of age from both districts uMgungundlovu and uMzinyathi district.

3.6.1 Pilot study

A pilot study was conducted by the researcher on a sample of ten women who consumed soil. The purpose of the pilot was to determine the amount of time required to complete the questionnaire. It also used to identify any mistake in the questionnaires and identify if the questionnaire would be easily understood in order to rectify all the mistakes before the commencement of the actual survey. There were no changes made to the questionnaire, following the pilot study.

3.6.2 Questionnaires

3.6.2.1 Socio-demographic questionnaire

The socio-demographic information was obtained during interviews with respondents by using open- and closed ended questions (Appendix A, p.). The information was used to collect demographic information such as location of respondents, gender, age, ethnic group, marital status, income, occupation, and educational level.

3.6.2.2 Anthropometric questionnaire

The weight and height measurements were used to calculate the body mass index (BMI) and waist and hip measurements were taken to determine the waist to hip ratio. BMI refers to current weight in kilograms divided by height in m².

3.6.2.3 Nutrition knowledge questionnaire

Nutrition knowledge of respondents was tested by asking different questions related to food and its nutrition or its nutritional value and health benefits (Appendix C, p.). Multiple choice questions were asked where respondents were supposed to select the correct answer and some questions were true or false questions.

3.6.2.4 Soil identification questionnaire

During the interviews with participants Appendix D was used to collect information regarding the practice of geophagia. The questions that were asked from the respondents included the following: habit of geophagia, number of years in the habit, reasons for geophagia, side effects associated with the practices, traditional names of substances consumed, price of the substances consumed, processing of geophagic substances, health related problems associated with the practice and types of substances consumed.

3.6.2.5 Household food insecurity access scale (HFIAS) questionnaire

Different questions were asked using a questionnaire (Appendix E, p.) about household food security where respondents were asked about availability of food and money to purchase food in a period of four weeks.

3.6.2.6 Food frequency questionnaire

Questions regarding eating frequency of different types of foods from different food groups were asked (Appendix F, p.). The questions that were asked were based on the food items usually consumed by Black Africans. Respondents were asked about frequency of food which was categorized in the following manner: -

- Never consumed
- Consumed 1-3 times a month
- Consumed once a week
- Consumed 2-4 times a week
- Consumed 5-6 times a week
- Consumed once a day
- Consumed 2-3 times a day
- Consumed 4-5 times a day
- Consumed 6 or more than six times a day.

3.7 Materials

3.7.1 Questionnaires

Questionnaires were used to collect data because they are inexpensive when used and administration costs are low in terms of money and time (Krueger, 1998).

3.7.2 Instruments

The following instruments were used to determine the height, weight and waist measurements of women participating in the study, height stick, weight measuring scale and tape measure. The purpose was to get correct measurements in order to calculate BMI and WHR.

3.8 Data analysis

Data for both groups control and geophagia was collected using a questionnaire. The tools used for the research were quantitative and qualitative. Data was collected and coded, entered into a spread sheet (Microsoft Excel) and analyzed using statistical package for social science (SPSS) Computer programme. Additionally, from the analysis derived from SPSS, tables, mean frequencies in percentages and correlation tests were also used to describe the level of significance of results from other questions that were asked in the survey. Descriptive statistics included means and standard deviations, where applicable. Frequencies are represented in tables or graphs. Chi-square goodness-of-fit-test: A univariate test, used on a categorical variable to test whether any of the response options are selected significantly more/less often than the others. Under the null hypothesis, it is assumed that all responses are equally selected. Chi-square test of independence: Used on cross-tabulations to see whether a significant relationship exists between the two variables represented in the cross-tabulation. When conditions are not met Fisher's exact test is used. Independent samples t-test: tests for significant differences in mean scores across two groups.

3.9 Procedure

3.9.1 Ethical consideration

Ethical approval was obtained from the Humanities and Social Science Research ethics committee of University of KwaZulu-Natal. Protocol reference number HSS/0787/014M (Appendix K, p.). The researcher contacted local ward counselors from both district to get permission to conduct the research in their areas.

The pilot study was conducted in a sample of ten women. The questionnaires were revised and finalized after the pilot study. Informed consent (Appendix I, p.) were given by each participant. The information letter and consent form was available in English and Zulu. Written consent forms were completed and signed prior to data collection.

Participants were informed that participation was voluntary, and of their right to withdraw at any time without detrimental consequences. Data was collected using the revised questionnaires by a Zulu speaking researcher a referral letter (Appendix J, p.) was available if a participant needed to be referred to a medical professional.

CHAPTER 4: RESULTS

4.1 Introduction

This chapter presents the results that were derived from questionnaires with women who practice geophagia and those who do not practice geophagia.

4.2 Socio-demographic information

The socio-demographic information is presented in Table 4.1.

A total of 31.2% (n=10) of women eating soil from uMgungundlovu participated in the study, whereas 68.7% (n=22) of women who ate soil were from uMzinyathi district. The study also included thirty females who do not eat soil. A total number of 33.3% (n=10) women who did not eat soil participated in the research were from uMgungundlovu and 66.7% (n=20) were from uMzinyathi.

All female who ate soil were Zulu speaking whereas 3.3% of those who did not eat soil were Afrikaans speaking, 6.7% were Xhosa speaking and 90% of them were Zulu speaking. According to Table 4.1 the majority of respondents from the geophagia group were married 65.6%, (n=21), whereas 31.3% (n=10) were single and only 3.3% (n=1) were widowed. The majority of respondents from the control group were single 70% (n=21) whereas 26.7% (n=8) were married and 3.3% (n=1) were widowed. There was a significant relationship between geophagia group and marital status ($p=0.003$). A significant number of respondents from geophagia group were married whereas the respondents from the control group were single.

All respondents geophagia group and control group were asked about their income source, 56.3% (n=30) from geophagia group indicated that their source of income is from wage employment whereas 12.5% (n=4) indicated their source as non-wage employment and 31.3% (n=10) indicated grant as their source of income. All respondents from the control group from both districts indicated their source of income as wage employment. There was a significant relationship between soil eaters and source of income ($p=0.005$). A significant number of

geophagia group their source of income was grant and non-wage employment and the control group their source of income was wage employment.

There was a significant relationship between geophagia group and occupation ($p=0.005$). A significant number of respondents from the geophagia group were unemployed and some of them were farmers whereas those who do not eat soil habit worked as professionals (Table 4.1). a total of 21.9% ($n=7$) from geophagia group were unemployed followed by 34.4% ($n=11$) indicated that they worked as general workers, 28.1% ($n=9$) worked as professionals and 15.6% ($n=5$) reported to work as farmers. In the control group 76.7% ($n=23$) worked as professionals whereas 23.3% ($n=7$) indicated that they worked as general workers.

The respondents were asked about their highest educational level. The total of 31.3% ($n=10$) from soil eaters indicated to had no schooling, 25.0% ($n=8$) had primary education, 31.3% ($n=10$) had secondary education and only 12.5% ($n=4$) reported to have tertiary education. In the control group 40.0% ($n=12$) indicated to have secondary education and the majority of 60% ($n=10$) had tertiary education.

There was a significant relationship between geophagia group and highest grade completed ($p=.0005$). A significant number from the geophagia group who had never been to school whereas the majority of those who do not eat soil have completed grade twelve and only few have completed grade eleven.

Table 4.1 Socio demographic information

	GEOPHAGIA GROUP		CONTROL GROUP		P-VALUE FOR DIFFERENCES BETWEEN GROUPS
	n (32)	% of total group	n (30)	% of total group	
Ethnic Group					N/A
• Afrikaans	0	0	1	3.3	
• Xhosa	0	0	2	6.7	
• Zulu	32	100	27	90	
Marital Status					p≤0.05
• Married	21	65.6	8	26.7	
• Single	10	31.1	21	70	
• Widowed	1	3.1	1	3.3	
Income source					p≤0.05
• Wage employment	18	56.3	30	100	
• Non-wage employment	4	12.5	0	0	
• Grant	10	31.3	0	0	
Occupation					p≤0.05
• Unemployed	7	21.9	0	0	
• General worker	11	34.4	7	23.3	
• Professional	9	28.1	23	76.7	
• Farmer	5	15.6	0	0	
Monthly income					NS
• < R1000	3	9.4	0	0	
• R1000-5000	17	53.1	0	0	
• R5001-10 000	10	31.3	7	23.3	
• >R10 000	2	6.3	3	10	
Highest educational level					p≤0.05
• No schooling	10	31.3	0	0	
• Primary	8	25.0	0	0	
• Secondary	10	31.3	12	40	
• Tertiary	4	12.5	18	60	
Highest grade completed					p≤0.05
• No schooling	10	31.3	0	0	
• Grade 5	2	6.3	0	0	
• Grade 6	3	9.4	0	0	
• Grade 7	2	6.3	0	0	
• Grade 8	0	0	0	0	
• Grade 9	2	6.3	0	0	
• Grade 10	3	9.4	0	0	
• Grade 11	0	0	1	3.3	
• Grade 12	10	31.3	29	96.7	

* Statistically significant p≤0.05; NS = no significant difference; N/A not applicable

4.3 Anthropometric measurements

4.3.1 Body Mass Index (BMI)

Measurements to calculate BMI were taken from both groups. The calculations shows that only 3.1% of respondents from the geophagia group were normal weight, followed by 28.1% who were overweight and 68.8% were obese, as opposed to 23.3% of respondents from control group who were normal weight , followed by 16.7% who were overweight and 60.0% of respondents from the control group were obese.

4.3.2 Body Mass Index (BMI) and Nutrition knowledge

The nutrition knowledge of normal weight respondents showed that 25.0% of respondents had fair knowledge about nutrition whereas another 25% of respondents their nutrition knowledge was good and a total of 50.0% of respondents their knowledge concerning nutrition was very good.

Looking at the overweight group 7.1% of respondents had poor nutrition knowledge, followed by another 7.1% with fair knowledge , 28.6% from the overweight group had a good knowledge compared to 50% whose knowledge is very good and 7.1% had excellent nutrition knowledge.

When it comes to obese group 2.5% of respondents had poor nutrition knowledge, followed by 17.5% with fair knowledge, 17.5% with good knowledge, and a total of 62.5% had very good nutrition knowledge and no one was found to have excellent nutrition knowledge from the obese group

4.3.3 Waist Hip Ratio (WHR)

The mean waist hip ratio for the geophagia group (n=32) and control group (n=30) was 0.82. There was a significant positive correlation between BMI and WHR (p=0.007)

4.4 Food security and geophagia

4.4.1 Food security knowledge

Table 4.2 shows the food security knowledge of both geophagia and the control group. Most of the respondents from the geophagia group had very good nutrition knowledge, whereas 53% of respondents from the control group had very good food security knowledge. No one from the geophagia group had excellent knowledge, while 3% of respondents from the control group who had excellent food security knowledge.

Table 4.2 Food security knowledge

Knowledge rating	Geophagia group	Control
Very poor	6.3%	0%
Fair	12.5%	20%
Good	18.8%	23%
Very good	62.5%	53%
Excellent	0%	3%

4.4.2 Food insecurity

The household food security information is presented in table 4.3 on page 32.

Both groups were asked questions about food insecurity. Most of the respondents 93.8% from the geophagia group had no concern of not having enough food whereas 3.1% indicated that they experienced a problem of not having enough food once or twice in a month but it was not common it was very rare and 3.1% of the respondents indicated to had a problem of not having enough food 3-10 times a month. When the same question was asked from the control group, 76.7% of respondents reported that they had not experienced the problem of not having enough food in a month, followed by 16.7% who rarely experienced the problem and 6.7% who sometime experience the problem.

A total of 29 respondents from the geophagia group compared to the 17 respondents from the control group had experienced the challenge of not having different kinds of foods they preferred to have because they lacked money. Seven respondents from the control group indicated that it was very rare for them to experience that problem.

A total number of 9.4% of the geophagia group compared to 20% from the control group sometimes experienced the problem of not having different kinds of foods that they preferred to eat because they lacked money. There was a significant relationship between the control group and problem of not having different kinds of foods $p = 0.003$.

Table 4.3 Household Food Security

	GEOPHAGIA GROUP			CONTROL GROUP			P-VALUE FOR DIFFERENCES BETWEEN GROUPS
	Never	Rarely	Sometimes	Never	Rarely	Sometimes	
In the past four weeks, did you worry that you would not have enough food?	98.3	3.1	3.1	76.7	16.7	6.7	N/A
In the past four weeks, were you not able to eat the kinds of foods you preferred because of a lack of money?	90.6	0	9.4	56.7	23.3	20	$p \leq 0.05$
In the past four weeks, did you have to eat limited variety of foods due to lack of money	78.1	9.4	12.5	63.3	26.7	10	N/A
In the past four weeks, did you have to eat some foods that you really did not want to eat because of lack of money to obtain any other types of food?	87.5	0	9.4	66.7	16.7	13.3	N/A
In the past four weeks, did you have to eat a smaller meal that you felt you needed because there was not enough food?	87.5	0	12.5	80	6.7	13.3	NS
In the past four weeks, did you have to eat a fewer meals in the day because there was not enough food?	90.6	0	9.4	80	16.7	3.3	N/A

* Statistically significant $p \leq 0.05$; NS = no significant difference; N/A not applicable

Table 4.3 Household Food Security cont.

	GEOPHAGIA GROUP			CONTROL GROUP			P-VALUE FOR DIFFERENCES BETWEEN GROUPS
	Never	Rarely	Sometimes	Never	Rarely	Sometimes	
In the past four weeks, was there ever no food to eat of any kind in your household because of lack of money to get food?	90.6	3.1	6.3	83.3	3.3	13.3	N/A
In the past four weeks, did you go to sleep at night hungry because there was not enough food	96.8	0	3.2	93.3	3.3	0	NS
In the past four weeks, did you go a whole day and night without eating anything because there was not enough food?	96.9	0	3.1	90	6.7	3.3	N/A

* Statistically significant $p \leq 0.05$; NS = no significant difference; N/A not applicable

A significant number from the control group experienced the problem of not eating different kinds of food they preferred because they lacked the money as compared to the geophagia group.

4.5 The practice of geophagia

4.5.1 Frequency of eating soil

Several questions were addressed to the geophagia group. The respondents were asked about the frequency of eating soil the findings in Figure 4.1 showed that 15.6% eat soil once a week, 34.4% eat soil once a day whereas 50% reported that they consumed soil more than once a day.

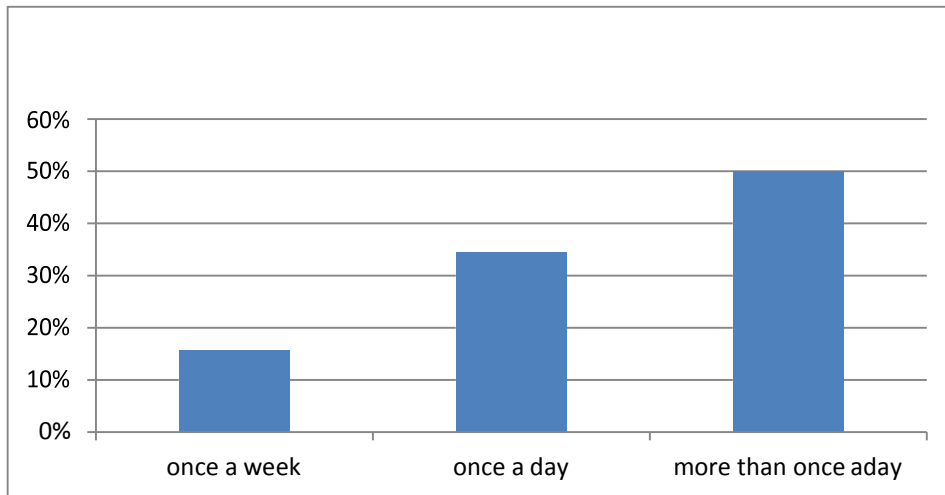


Figure 4.1 Frequency of eating soil

4.5.2 Frequency of soil craving

Table 4.4 shows that 9.4% (n=3) of the respondents craved soil weekly whereas 90.6 % (n=29) indicated that they craved soil daily. Furthermore the respondents were asked when they craved soil 28.1% (n=9) said that they craved soil when they were pregnant, 71.9% (n=23) said they craved soil at any time. More questions were asked about soil eating habit all respondents were asked how often they eat soil when pregnant, the results in the Table 4.4 revealed that 12.5 % (n=4) ate soil once a week, 53.1% (n=17) said that they ate soil once a day when pregnant, 28.1% indicated that they ate soil more than once a day when pregnant and 6.3% (n=2) indicated that they never been pregnant.

Table 4.4 Frequency of craving soil

How often do you cravesoil	n	Percentage %
Weekly	3	9.4
Daily	29	90.6
Total	32	100
When do you crave soil		
Pregnant	9	28.1
Anytime	23	71.9
Total	32	100

Table 4.4 Frequency of craving soil cont.

When pregnant how often do you crave soil		
Once a week	4	12.5
Once a day	17	53.1
More than once a day	9	28.1
Never	2	6.3
Total	32	100

4.5.3 Number of years in the soil habit

Figure 4.2 indicate the number of years women have been consuming soil. According to the findings presented in figure 4.2 twenty five percent of the respondents indicated that they had been eating soil for two years, followed by 21.9% who had spent three years in the habit of eating soil and 18.8 % indicated that they had been eating soil for four years.

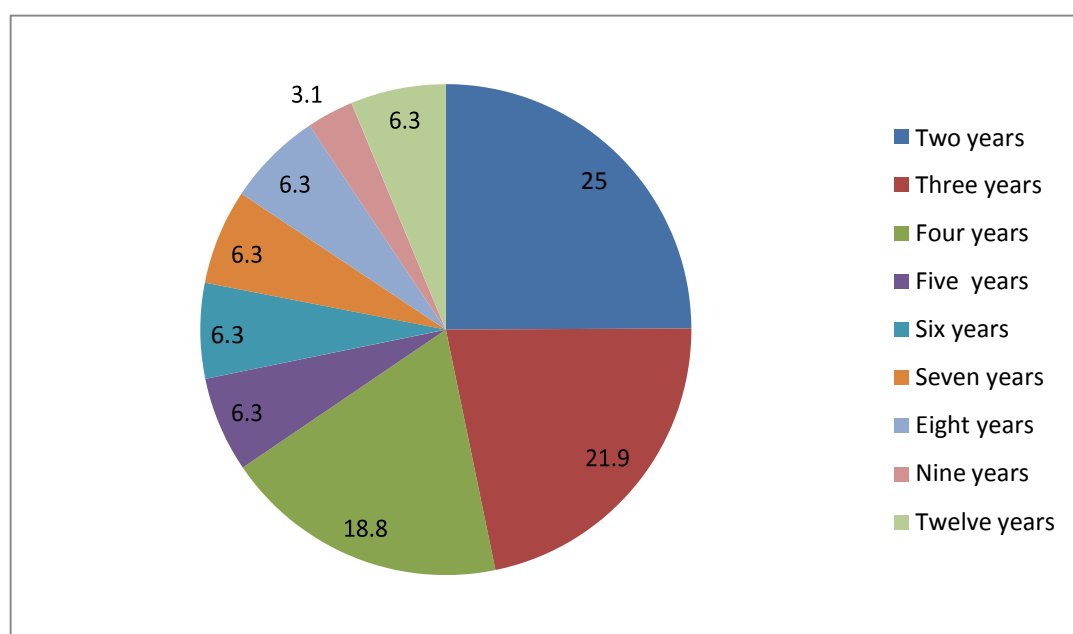


Figure 4.2 Number of years in the soil habit

4.5.4. Prevalence of geophagia

Most of the respondents reported that the practice of geophagia was common in the area, whereas 43.8% of respondents indicated that the practice was not common. According to the

respondents 37% reported that the practice of geophagia was common among friends whereas 6.3% indicated that the practice was common among other community members.

4.5.4.1 Types of non-food substances and traditional names of substances consumed

All respondents ate different types of substances 3.1% ate soil whereas 81.3% indicated that they ate clay and 15.6% ate soil from termite mounds. All respondents stated that they ate dry substances.

All respondents were asked about the traditional names of the substances that they ate. Figure 4.3 showed that the majority of the respondents' 65.6% (n=21) reported that the traditional name of the substance they consumed was Ibumba, while 3.1% (n=1) stated that the traditional name of the soil they consumed was called Ukhetha.

All of the respondents 100% (n=32) obtained the substances they consumed from nature; there was no brand name of the substances they did not buy the substances they consumed it was free.

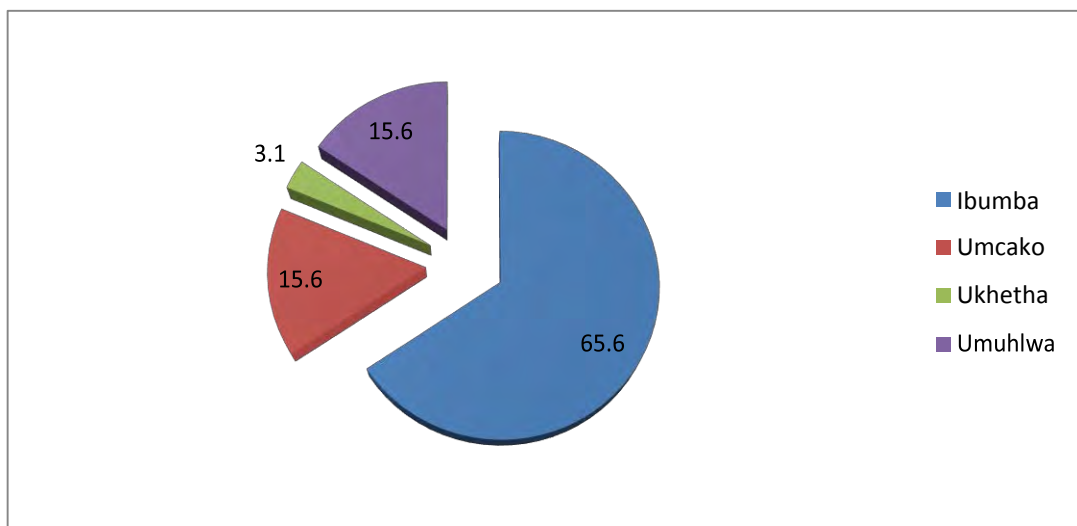


Figure 4.3 Traditional names of the substances consumed

Figure 4.4 below shows that most of the respondents 43.8% (n=14) preferred soil with a Khakhi colour, followed by 21.9% (n=7) who preferred reddish soil, while 15.6% (n=5) preferred soil with whitish in colour, 12.5% (n=4) consumed black soil and only 6.3% (n=2) consumed soil with yellowish colour.

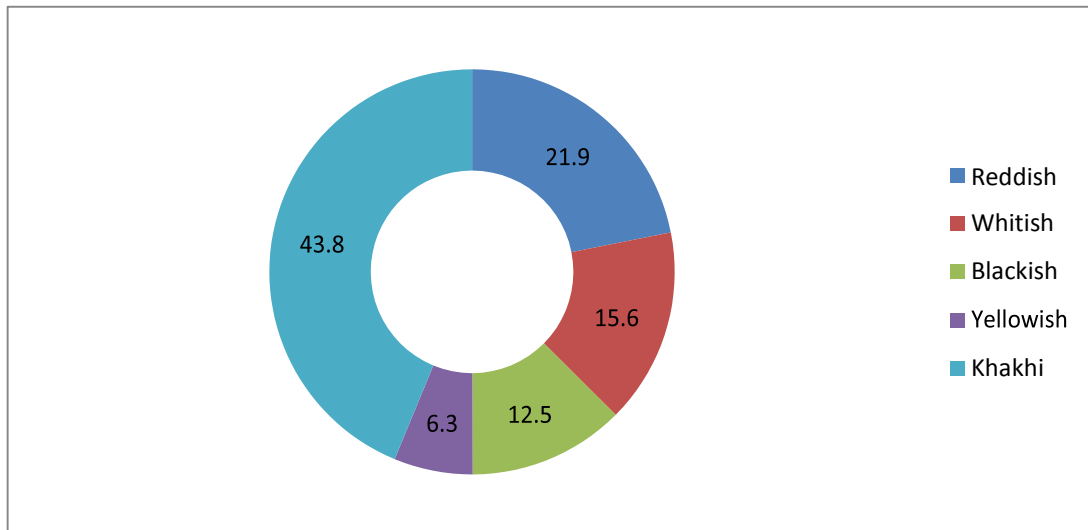


Figure 4.4 Colours of the preferred substances

The total of 81.3% (n=26) of respondents preferred to eat soil of a specific colour because of the taste of the soil, while 12.5% (n=4) preferred it because it was easily accessible for them and 6.3% (n=2) reported that they preferred it because it was a traditional belief to consumed soil with that specific colour.

The respondents were asked where they store their geophagic soil. Most of the respondents (n=14) 43.8% stored their geophagic substances in cupboards, followed by 25% (n=8) who stored their substances on window seals, whereas 15.6% (n=5) stored under the bed and another 15.6% (n=5) stored their substances in the ovens.

The total of 25% (n=8) of respondents stored their geophagic soil for the period of five days. A total of 18.8% (n=6) of respondents stored for two days and another 18.8% stored their geophagic soil for the period of six days. The total of 15.6% (n=5) also stored their geophagic soil for the period of three days whereas another 15.6% (n=5) stored their substances just for one day and 6.3% (n=2) stored for four days.

The total 40.6% of (n=13) respondents preferred soils found from the hills, followed by 28.1% (n=9) who preferred soils from the valley, while 21.9% (n=7) their preference was the soil from termite mound and 9.4% (n=3) consumed soils from the pit.

All geophagia groups were asked if they ate soils from termite mound and which part of the mound they prefer. The total of 78.1% (n=25) of the respondents reported that they did not use soil from termite. 15.6% (n=5) indicated that they used soil from the outer surface of the mound, 3.1% (n=1) reported to use the inside of the mound whereas another 3.1% (n=1) responded that it did not matter which part of the mound as long as it was in the mound.

Respondents were also asked if they prefer substances found close to the rocks and types of rocks. Most of the respondents 43.8% (n=14) didn't prefer substances found close to rocks, followed by 37.5% (n=12) who preferred to ate soil found closer to the rocks and 18.8% (n=6) were not sure of their preference. When the respondents were asked about the type of rock they prefer 62.5% (n=20) said did not matter the type of rock whereas 37.5% (n=12) preferred substances found closer to the hard rock.

Respondents used different methods to collect soil. Most of the respondents 78.1% (n=25) indicated that they used digging method, followed by 12.5% (n=4) who used scraping method and 9.4% (n=3) they use scooping handfuls to collect geophagic substances.

A total of 59.4% (n=19) of the respondents indicated that they dug five centimeters down before collecting the geophagic soil, followed by 6.3% (n=2) who dug about ten centimeters and another 6.3% (n=2) indicated to dug fifteen centimeters down before collection of the soil, 3.1% (n=1) dug two centimeters and 25.0% (n=8) were not sure how deep they dug before collecting the soil. Respondents were asked about the texture of the soil they consumed 21.9% (n=7) indicated that the soil they consumed felt gritty, 28.1% (n=9) indicated that it felt powdery while 25% (n=8) said it did not matter how the soil felt and another 25% (n=8) were not sure how the soil felt. All respondents reported that they collect only dry soil.

The respondents were asked if they process the soil before consumption. A total of 6.3% (n=2) respondents were processing the soil as while the majority of the respondents 59.4% (n=19) were not processing the soil before consumption, and 34.4% (n=11) indicated that they sometimes process the soil but not always.

4.5.4.2 Processing methods

The respondents were asked about the processing methods they used to process geophagic soil, the majority of 50% (n=16) were not processing the soil. A total of 21.9% (n=7) respondents used drying as their processing method, followed by 18.8% (n=6) who indicated to grind the soil before consumption, whereas 6.3% (n=6) sieve the soil prior to consumption and 3.1% (n=1) were pounding the soil before consumption.

The respondents were also asked whether they were any heat treatment applied to the soil before consumption 25% (n=8) of the respondents said there was heat processing treatment applied to the soil as while 75% (n=24) said there was no heat treatment applied to the geophagic soil before consumption.

The respondents were asked the type of heat treatment 21.9% (n=7) of the respondents were baking the soil prior to consumption, followed by 3.1% (n=1) who were burning it and 75% (n=24) did not apply any heat treatment to their geophagic soil.

4.6 Reasons for eating soil

The respondents were asked about their reasons for eating soil, Figure 4.5 showed that most of the respondents gave their reason for eating soil as a craving 62.5%, (n=20) and 18.8% (n=6) they indicated that they did not know why they ate soil.

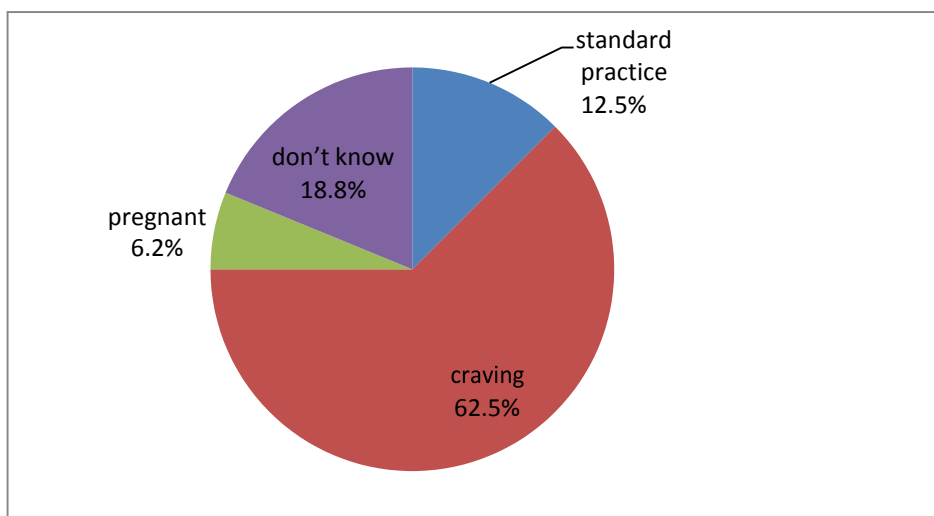


Figure 4.5 Reasons for eating soil

When the respondents were asked the reasons for eating the substances they were eating, a total of 65.6% (n=21) were not sure why they ate soil, whereas 12.5% (n=4) believed that they get additional nutrients from the soil, followed by 9.4% (n=3) who indicated that they craved soil while 6.3% (n=2) believed that soil give them light complexion and another 6.3% (n=2) believed that soil clean up their body systems.

4.7 Other non-food substances consumed

The respondents were asked if they ate other non-food substances findings showed that 15.6% (n=4) ate other non-food substances whereas 84.4% (n=27) reported that they didn't eat other non-food substances except soil.

Figure 4.6 shows the findings of other non-food substances consumed 6.3% (n=2) stated that they ate ice, 9.4% (n=3) indicated that they ate wood coal whereas 84.4% (n=27) indicated that they consumed soil only.

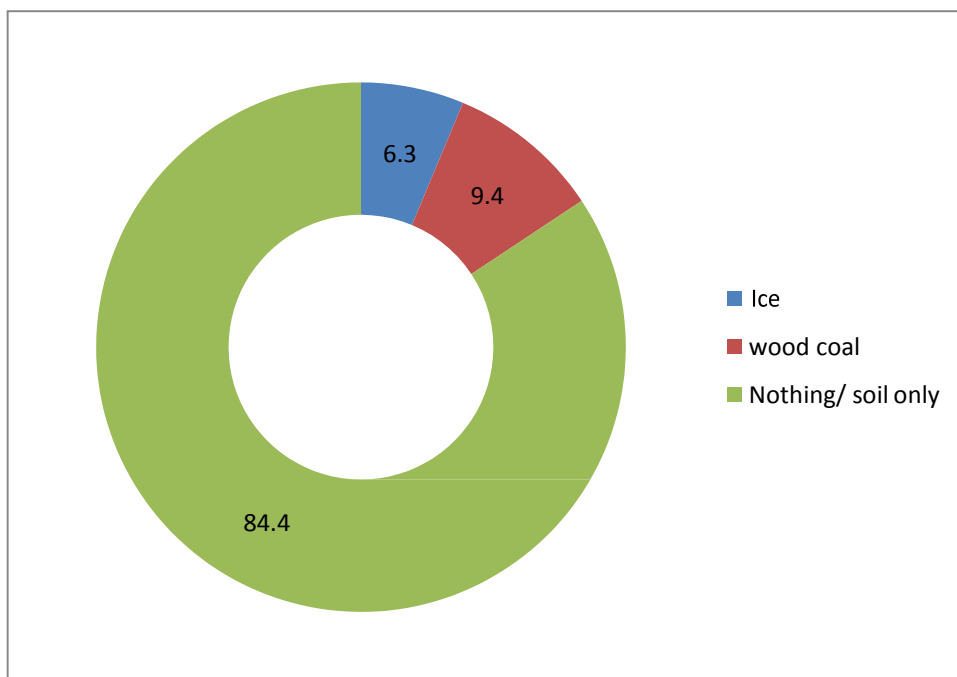


Figure 4.6 Other non-food substances

Those who consumed other non-food substances apart from soil were asked how often they ate those substances, 12.5% (n=4) indicated that they ate them daily and 3.1% (n=1) indicated that they ate them monthly. The most of the respondents indicated that they ate soil once a day (n=18) 56.3%, while (n=10) 31.3% ate soil more than once a day and only (n=4) 12.5% ate soil weekly.

4.8 Knowledge and perceptions of geophagia

The respondents were asked if anyone knew about their soil eating habit. Seventy five percent (n=24) reported that somebody knew about their habit, and 25% (n=8) did not know if anyone knew about their habit. Most 40.6% (n=13) said their family members were aware of their soil eating habit, 3.1% (n=1) indicated that their extended family knew, while 34.4% (n=11) indicated that their friends knew about the soil eating habit and 21.9% (n=7) did not know if anyone knew.

The respondents were asked if the practice of geophagia was common among other community members. Most of the respondents 56.3% (n=18) indicated that the practice of geophagia was not common, While 43.8% (n=14) of the respondents reported the practice was common. A number of 6.3% (n=2) said the practice was common among friends and 37.5% (n=12) said the practice of geophagia was common among other community members.

People had different perceptions towards the practice of geophagia the findings showed that 34.4% (n=11) of the respondents stated that people reacted negatively towards their soil eating habit, whereas 25 % (n=8) said people react indifferently and 40.6% (n=13) indicated that they did not know other peoples reaction toward their practice of geophagia.

4.9 Health implications of geophagia

The majority of respondents (75%) showed that eating of soil was very harmful for their health whereas 25% indicated that there were no harmful effects of geophagia. Findings showed that

25% of respondents did not experience any side effects caused by geophagia. 25% of respondents indicated that soil consumption poison the body, followed by 21.9% who mentioned that soil consumption caused constipation, whereas 15.6% said it caused tooth decay, and 21.5% mentioned that soil eating caused small worms.

The respondents were asked whether they had undergone surgery 3.1% said yes while 96.9% had not undergone any surgery. When they were asked the reasons for the surgery 3.1% reported that they had been diagnosed with gall stone problem. A total number of 71.9% of respondents indicated that there were no harmful elements or parasites present in the soil they consumed whereas 28.1% believed that there were harmful elements or parasites in the soil they consumed.

When the respondents were asked about the components present in the soil 96.9% reported that they did not know the components present in the soil while 3.1% indicated that they knew the components present in the soil they consumed. The respondents were further asked about the name of the elements present in the geophagic soil, 3.1% said geophagic soil contain vitamins whereas 96.9% said they knew the elements present in the geophagic soil.

The question of infections was also asked and only 6.3% of respondents indicated that they were often ill as compared to 93.8% who said they were not often ill. When they were asked about frequency of illnesses the most of the respondents 93.8% indicated that they did not get ill more often whereas 3.1% indicated that they got ill more than once a month and another 3.1% reported that they got ill twice a year.

The respondents were asked if they ate geophagic substances when ill. A total number of 40.6% said they ate geophagic substances even if they were ill, 34.4% said they sometimes ate the geophagic substances even if they were sick and 25% they said they did not eat geophagic substances when they were sick. The respondents were further asked about any medical conditions diagnosed. A total of 93.8% indicated that they have not been diagnosed with any medical conditions while 6.3% indicated to have been diagnosed. Three point one percent (3.1%) reported to had been diagnosed with iron deficiency, followed with another 3.1% who had been diagnosed with constipation. A total of 65.6% of respondents reported that they had

no stillborn children, followed by 15.6% who had one stillborn, 9.4% had three stillborn, 6.3% had two stillborn and 3.1% had five still born children.

None of the respondents reported having a miscarriage. When they were asked about the number of children born with abnormalities only 3.1% who showed to have born children with abnormalities. Those who indicated they had children with abnormalities were asked the type of abnormality and 3.1% reported deaf as the abnormality their children had.

Table 4.5 below show the food frequency intake scores for both groups. Both groups were asked about the frequency of foods intake they ate over the period of one month. The geophagia group indicated that they consumed an average score of 2.83 white or brown bread and or buns/rolls and control group indicated that they consume the average score of 2.02. Whole wheat, healthy, low GI, seed bread and/ rolls for geophagia group 0.13 and 0.80 for the control group. The geophagia group indicated the average score of 0.65 and 1.89 for the control group consumption of breakfast cereals or porridges such as All Bran, High Bulk Bran, Muesli, Weet-bix, Pronutro, and Oats. The results showed the average score of 2.71 and 2.13 for both geophagia and control group respectively breakfast cereals such as Rice Crispies, Cornflakes, Coco pops, fruit loops, Maize meal porridge, and morevite.

The geophagia group indicated the frequency score of 3.72 and 1.92 for the control group of rice, mealie rice, samp, phutu, pap, jeqe (steamed bread). The geophagia group indicated the frequency score of 0.29 and 0.81 of the control group for the consumption of pasta: macaroni, spaghetti, noodles.

Table 4.5 Food frequency intake scores for geophagia and control group

FOOD GROUP	Geophagia group	Control group	P value
STARCHES			
White or brown bread and /or buns/rolls	2.83	2.02	NS
Whole wheat,healthy,low, seed bread and/ rolls etc.	0.13	0.80	p=0.016
Breakfast cereals or porridges such as All Bran, High Bulk Bran, Muesli,Weet-bix,Pronutro,Oats etc.	0.65	1.89	p=0.006
Breakfast cereals such as Rice Crispies, Cornflakes,Coco pops, fruit loops ,Maize meal porridge,morevite etc.	2.71	2.13	NS
Rice, mealie rice, samp, phutu, pap, jeqe (steamed bread)	3.72	1.92	p=0.004
Pasta: macaroni, spaghetti, noodles	0.29	0.81	p=0.043
Potato: cooked ,baked, mashed	0.67	1.33	NS
Potato: cooked ,baked, mashed with fat e.g. margarine added or potato salad	0.49	0.92	NS
VEGETABLES			
Legumes. E.g. baked beans, lentils, Dhal, haricot beans, split peas, broad beans, kidney beans, sugar beans, dried bean salad/ soup, Soya mince etc.	2.09	0.58	p=0.001
Cooked vegetables: any type.(no sugar /fat/ sauce added)	2.03	1.42	NS
Mixed salad: lettuce, cucumber tomato, peppers, onion, mushrooms, carrots in any combination or alone	2.03	1.42	p=0.032
FRUIT			
Fresh fruit (any type)	2.06	2.74	NS
Dried fruit (any type)	0.09	1.07	p=0.004
Fruit juice	1.16	2.06	p=0.027
Fruit salad: fresh salad or tined	0.21	1.46	p=0.003

* Statistically significant $p \leq 0.05$; NS = no significant difference.

Table 4.5 Food frequency intake scores for geophagia and control group (cont.)

MILK YOGHURT AND CHEESE			
Full cream: milk,yoghurt,sour milk(maas), powerered milk(e.g. Nespray,Klim)	3.16	2.06	p=0.031
Skimmed/ low fat 2%: milk yoghurt, sour milk(maas)	0.22	1.05	p=0.006
Coffee creamer: in tea/ coffee e.g. cremora	1.82	0.87	p=0.028
Milk drinks: Milo, Nesquik ,Horlicks	0.68	0.88	NS
Cheese: gauda, cheddar, camembert, brie, edam (except low fat/ fat-free cottage cheese) cheese spread	0.68	1.21	NS
MEAT, FISH ,CHICKEN			
Schnitzels ,Cordon Bleu	0.09	0.61	p=0.032
Red meat e.g. beef, mutton, pork (Eat meat and visible fat)	2.08	0.99	p=0.035
Red meat e.g. beef, mutton, pork (Eat meat but remove visible fat)	0.12	0.75	p=0.009
Red meat e.g. venison & ostrich	0.08	0.75	p=0.022
Chicken / turkey: with skin	1.85	0.50	p=0.001
Chicken / turkey: without skin	0.08	1.16	NS
Fried fish in any fat or oil, with or without butter/ crumbs.	0.43	0.81	p=0.006
Fish : steamed, grilled, braaied (fire)	0.10	0.69	NS
Fish : tinned sardines, pilchards salmon, tuna	1.37	0.67	NS
Sausages: Vienna's, Russians, Frankfurter	1.07	0.99	NS
Cold meat: polony, salami, etc. & bacon	1.30	1.06	NS
Organ meat e.g. liver, kidney, tripe	1.86	1.06	NS
Eggs: cooked or poached	0.97	1.14	p=0.048
Eggs: scrambled, baked, omelettes	0.36	0.98	NS
Soft margarine (in a tub)	1.61	1.33	NS
Butter/hard margarine, ghee	1.27	0.91	NS
Cooking oil e.g. sunflower oil	4.14	1.82	p=0.001
Dripping	0.24	0.34	NS

* Statistically significant $p \leq 0.05$; NS = no significant difference

Table 4.5 Food frequency intake scores for geophagia and control group (cont.)

Fat e.g. Holsum	0.45	0.41	NS
Salad dressing, Mayonnaise: normal fat	0.58	0.69	NS
Salad dressing, Mayonnaise: lite /low fat	0.16	1.14	p=0.003
FAST FOODS AND TAKE AWAYS			
Pizza	0.12	0.69	NS
Pies & sausage rolls	0.38	0.47	NS
Potato chips(french-fries)	1.06	0.67	NS
Kentucky fried Chicken	0.65	0.41	NS
Nandos	0.10	0.34	p=0.046
Chicken lickin/chicken king	0.15	0.30	NS
Fried fish	0.55	0.59	NS
Bunny chow	0.12	0.36	NS
Hot dogs	0.33	0.45	NS
Hamburgers (=bun and meat or chicken patty)e.g. Mcdonalds,steers,Wimpy,Spur,other restaurants etc.	0.15	0.39	NS
OTHER			
Vetkoek (amagwinya), samoosas,koeksister,doughnuts etc.	1.82	0.56	p=0.005
Muffin,Scones,cake,tart	0.36	0.55	NS
Rusks: commercial or homemade e.g. bran, buttermilk, white, whole wheat etc.	0.16	0.57	NS
Cookies: commercial or homemade:e.g. oat, crunchies,shortbread	0.21	0.54	NS
Chips, Niknaks,Lays,Simba etc.	0.79	0.98	NS
Energy bars, health bars, breakfast bars	0.31	0.75	NS
Chocolate	0.88	0.85	NS
Ice cream	0.54	0.99	NS

Table 4.5 Food frequency intake scores for geophagia and control group (cont.)

Cheese sauce, white sauce, meat sauce	0.19	0.55	NS
Tomato sauce, chutney,mustard,sweet chilli sauce	0.83	0.67	NS
Sweets. jelly tots, sour worms, super-C's etc.	0.20	0.71	p=0.025
Nuts and peanuts	0.55	1.19	NS
Peanut butter	1.70	0.95	NS
Chocolate spread	0.39	0.44	NS
Jam,syrup,honey	1.79	0.54	p=0.028
DRINKS			
Wine: red or white	0.08	0.30	NS
Port, sherry, liqueur	0.08	0.37	NS
Beer,cider,coolers e.g. castle, black label, hunters dry, savanna, Smirnoff etc.	0.25	0.27	NS
Beer, cider, coolers diet/ light e.g. savanna light.	0.08	0.37	NS
Spirits:e.g.brandy,whisky,rem,vodka,gin	0.08	0.08	NS
Cocktails	0.07	0.12	p=0.039
Shooters	0.08	.1568	NS
Fizzy soft drink,e.g. coke ,Fanta	1.32	0.80	NS
Fizzy diet soft drink, e.g. coke lite etc.	0.28	0.71	NS
Energy drinks e.g. Energade,Powerade	0.18	1.10	p=0.013
Milkshake	0.22	0.82	p=0.042
Drinking yoghurt	0.34	1.01	p=0.043
EATING PLACES			
In general, how often do you eat out e.g. restaurants, take aways,hotel,prepared food/meals from Spar, Checkers etc.	0.19	0.59	NS
If you work during the day (away from your home), how often do you take food from your home with you to eat during the day?	2.39	1.57	NS
If you work during the day (away from home), how often do you buy food to eat during the day?	0.22	0.82	p=0.010

* Statistically significant $p \leq 0.05$; NS = no significant difference.

Both groups geophagia and control respectively indicated the average scores of Potato: cooked, baked, mashed 0.29 and 0.81, they further indicated the following scores for geophagia group 0.61 and for the control group 1.33 for the following food items Potato: Cooked, baked, mashed with fat e.g. margarine added or potato salad.

The geophagia group indicated the average score of 0.49 and 0.92 for the control group in food items like legumes. e.g. Baked beans, lentils, Dahl, haricot beans, split peas, broad beans, kidney beans, sugar beans, dried bean salad/ soup, Soya mince.

There was a significant difference of the following foods the geophagia group consume more of the following food items legumes ($p=0.001$), mixed salads ($p=0.003$), full cream milk ($p=0.006$), coffee creamer ($p=0.028$), red meat visible fat ($p=0.035$), chicken with skin ($p=0.001$), cooking oil ($p=0.001$), vet koek (0.005) and jam syrups ($p=0.028$).

The results of the findings indicated that there was a significant difference in the consumption of the following food groups by the control groups dried fruits ($p=0.004$), tinned fruits (0.003), low fat/ skimmed milk (0.006), schnitzel ($p=0.003$), red meat removed fats (0.009), red meat ostrich (0.002), fried fish ($p=0.006$), poached ($p=0.048$), dripping ($p=0.003$), potato chips ($p=0.046$), sweet jelly tots (0.025), cooktails ($p=0.039$), energy drinks ($p=0.013$), milk shakes ($p=0.042$), drinking yoghurt ($p=0.043$).

4.10 Summary of the main findings

The study was conducted in two areas uMzinyathi and uMgungundlovu district. Each district had respondents representing a geophagia group and the control group. The majority of respondents in the study were Zulu speaking. There was a significant relationship between geophagia group and marital status ($p=0.003$). A significant number of respondents from geophagia group were married whereas the respondents from the control group were single. The findings also indicated that there was a significant relationship between the geophagia group and the highest level of school completed ($p=.0005$). A significant number from the geophagia group had never been to school whereas the majority of those who did not ate soil had completed grade twelve and only few had completed grade eleven. There was a significant

relationship between geophagia group and occupation ($p=0.005$). A significant number of respondents from the geophagia group were unemployed and some of them were farmers whereas those who did not eat soil worked as professionals. The findings indicated that for a significant number from the geophagia group their source of income were grants and non-wage employment and for the control group their source of income was wage employment.

The findings indicated that most respondents had been in the soil eating practice for two years, and the practice of geophagia was reported to be common in both districts. Most respondents were found to eat soil more than once a day. The most consumed type of soil in both districts was clay and its local name was Ibumba. The preferred colour was Khakhi and the findings indicated that the reason for the preferred colour was based on taste of the soil. The preferred soil was obtained locally and it was free, most of respondents used digging as their collection method. The findings showed that most of the respondents ate soil because they craved it whereas others were not sure why they consumed soil. There were different beliefs for consuming soil some believed that soil would provide them with nutrients; others believed that soil would give them a lighter skin complexion. The study revealed that they were other nonfood substances that were eaten other than soil, including wood coal and ice even though not all participants consumed those substances. The findings revealed that soil consumers had friends who knew about their soil eating habit.

The findings of the study showed that there were health implications associated with geophagia. Most respondents who were geophagist indicated problems of tooth decay; others were diagnosed with iron deficiency while others were experiencing the problem of constipation.

The findings of the study showed that both groups had good food security knowledge, even though the BMI calculations indicated that most of the respondents from both groups were obese. When looking at the nutrition knowledge and BMI of both groups, most of the respondents 62.5% from the obese group had very good nutrition knowledge and 50% from the overweight their nutrition knowledge was very good and 50% from a normal weight their nutrition knowledge was very good

Looking at the food security status the findings indicated that there was a significant relationship between the control group and a problem of not having different kinds of foods ($p = 0.003$). A significant number of participants from the control group experienced the problem of not eating different kinds of food they preferred because they lack money as compared to the geophagia group.

The findings of the study indicated that there was a significant difference in the consumption of the following foods by the control group as compared to the geophagia group dried fruits ($p=0.004$), tinned fruits (0.003), low fat/ skimmed milk (0.006), schnitzel ($p=0.003$), red meat removed fats (0.009), red meat ostrich (0.002), fried fish ($p=0.006$), poached ($p=0.048$), dripping ($p=0.003$), potato chips ($p=0.046$), sweet jelly tots (0.025), cocktails ($p=0.039$), energy drinks ($p=0.013$), milk shakes ($p=0.042$), drinking yoghurt ($p=0.043$). The findings indicated that the geophagia group consumed more starch compared to the control group.

CHAPTER 5: DISCUSSION

5.1 Introduction

In this chapter the results that were derived and observed from the research conducted amongst women practicing and not practicing geophagia will be discussed and compared with relevant literature.

5.2 Socio Demographics information

The study was conducted in two areas of KwaZulu-Natal, both areas were rural. According to the study conducted by (Woywodt and Kiss, 2002) showed that geophagia was more common in rural communities. A total number of 62 female respondents participated in the study, 32 of those women were involved in the practice of geophagia and 30 of them were not practicing geophagia. This study was in agreement with other studies conducted in various parts of the world that discovered that geophagia was more common among women. The age of respondents that participated in the study was between 18 to 45 years, the mean age of the geophagia group was 33.03 years and the mean age for the control group was 37.03 years. The geophagia group were significantly younger ($p=0.014$) and had fewer years of formal education $p<.0005$ compared to those who did not eat soil. The study conducted by Woywodt (1999) showed that the practice of geophagia was not limited to a particular age group. None of the participants were pregnant whereas the findings of the study conducted by Luoba *et al.* (2004) revealed that geophagia was more common among pregnant women.

The study showed that all participants who practiced geophagia were Zulu speaking women. Findings of the study conducted by (Abrahams, 2002) showed that geophagia was the practice that was common among people of all races and ethnic groups. Findings of this study showed that the most of the women who did not ate soil (27%) were Zulu speaking, followed by 6.7% who were Xhosa speaking and 3.3% who were Afrikaans speaking.

The findings of this study showed that the majority of women 65.6% who ate soil were married and most of the women from the control group were single. A study conducted in Tanzania

showed no significant difference in marital status between women practicing geophagia and those who did not practice geophagia (Young *et al.*, 2010). The findings also showed that the 31.3% of geophagic women were making a living out of grants, non-wage employment and only 56.3% were on wage employment, as opposed to non-eaters who were all on wage employment. The studies conducted by Hooda *et al.* (2004) and Woywodt & Kiss (1999) revealed that geophagia was more common in people living under poverty. The findings of this study were in contrast with the findings of the study conducted in Ghana where it was found that geophagia was present in both male and female. The finding from Ghana also indicated that geophagia was not caused by poverty or lack of formal education or the presence of gainful employment (Norman *et al.*, 2015). Most of the geophagic women interviewed in this study were married but were not staying with their husbands, as their husbands were working away in cities and they only came home once or twice a year. Literature also showed that geophagia was usually practiced by women living under poor socio-economic backgrounds (Horner *et al.*, 1991; Simon, 1998).

The study revealed that the majority of women from the control group were working as professionals and only 23.3% who were working as general workers; the geophagia group 21.9% were unemployed, 34.4% worked as general workers, 28.1% worked as professionals and 15.6% worked as farmers. The study conducted in the Free State and Limpopo also showed that the majority of geophagic women were unemployed and most of them had spent twelve years in formal education (Songca *et al.*, 2010).

5.3 Anthropometric nutritional status

Measurements to calculate BMI and WHR were taken from both groups. There were no significant differences in BMI and WHR of both groups (geophagia and the control group). In agreement with the study conducted in QwaQwa, Free State where there were no significant differences in BMI (Van Onselen *et al.*, 2015). The current study showed that the majority of participants from both groups fell under the obese group. The mean BMI of respondents of both geophagia and control group BMI of between 18.5 and 24.9 was normal whereas BMI

between 25.0 and 29.9 was defined as overweight and BMI greater than 30.0 was considered obese (Van Wyk *et al.*, 2013).

The mean WHR of the geophagia group was .8189 and .8227 for the control group. The Findings of this study showed that there were no significant differences between the BMI and WHR measurements for both groups.

5.3.1 Correlation between BMI, WHR and Food insecurity

There was no significant correlation between food insecurity and BMI the current study showed that 50% of respondents with normal weight, and 50% from overweight had very good nutrition knowledge. The majority of obese respondents had very good nutrition knowledge. The results of study conducted by O'Brien and Davies (2007) indicated that obese individuals and those of normal or healthy weight had Comparable levels of nutrition knowledge. There were many factors and reasons aside from nutrition knowledge that accounted for the higher BMI of the overweight and obese respondents (O'Brien and Davies, 2007). Nutrition education is important but not the only strategy needed for behavior change because of its failure to deal with personal and environmental barriers to dietary behavior change weapon for behavior change (O'Brien and Davies, 2007). There was a significant positive correlation between BMI and WHR. There was a significant negative correlation between knowledge score and HFIAS. Thus higher scores on knowledge were associated with lower scores on HFIAS.

5.4 Nutrition knowledge of the two groups (Geophagia and control group)

Nutrition knowledge of respondents was tested by asking different question related to nutrition. The findings revealed that 6.3% of the respondents from geophagia group had very poor food security knowledge and no one from the control group had very poor nutrition knowledge. The total of 12.5% of respondents from geophagia group had fair knowledge as opposed to 20% of

respondents from the control group who had fair knowledge. The findings showed that 18.8% of geophagist had good food security knowledge as opposed to 23% of respondents from control group who had good knowledge. The majority of respondents 62.5% from geophagia group had a very good nutrition knowledge, and 53% of the respondents from the control group had very good nutrition knowledge. A total of 3% of the respondents from the control group had excellent food security knowledge. In this study when women were asked about the nutrition knowledge of certain foods and it was found that there was a significant relationship between the eating disorder or practice of geophagia and the knowledge of consuming starches ($p=0.018$). More people showed the knowledge than expected of those who practice geophagia.

The mean knowledge percentage of geophagia group was 56.9%, whereas the mean knowledge percentage of control group was 56.8%. There was no significant difference in nutrition knowledge between the geophagia group and control group.

5.4.1 Food insecurity

This study revealed that the majority (98%) and (76.7%) of women from geophagia group and control group respectively have never experience the problem of not having enough foods. It was also indicated that 90.6% and 56.7 % of respondents from geophagia and control group respectively have never had a problem of not being able to eat the kind of foods they preferred because of a lack of money. A study conducted in Ghana also proved that geophagia is not the result of food insecurity, the study showed that even in the farming communities of Ghana where the average household has access to food grown on their own farms geophagia was practiced irrespective of food availability or not (Norman *et al.*, 2015).

There was a significant relationship between the control group and problem of not having different kinds of foods $p = 0.003$. A significant number from the control group experienced the problem of not eating different kinds of food they prefer because they lack money as compared to the geophagia group. The findings of the current study indicated that there was a significant relationship between the control group and the problem of having to eat fewer meals

in the day because there was not enough food to eat ($p = 0.029$). A significant number from the control group experienced the problem of having fewer meals in the day because there was not enough food. Analysis of this study showed that there was no significant difference in mean food insecurity scores between the two groups.

5.5 The prevalence of geophagia

All geophagic respondents interviewed reported that they craved soil. The majority of respondents craved soil daily only few respondents craved soil weekly. The frequency of consumption varied as 50% of respondents indicated that they consume soil more than once a day, followed by 34.4% who consumed soil once a day and only 15.6% reported to consume soil once a week.

The study conducted in the Eastern Cape showed that 11.7% consumed soil daily, 45.5% weekly and 41.6% consumed soil monthly (George *et al.*, 2012) This study indicated that other woman started eating soil when they were pregnant, which was in agreement with the literature (Abrahams & Parsons, 1996, Edwards et al., 1994, Grigsby, Thyer, Waller, & Johnston, 1999,) geophagia is associated with pregnancy and child bearing. The current study indicated that geophagia was the result of craving and other reasons. Some of the findings in this study were in agreement with the findings in India which indicated that many pregnant women consumed geophagic materials as a result of craving (Stiegler, 2005). According to the literature there were many reasons for the practice of geophagia. The practice of geophagia can be cultural, medicinal, religious and mineral deficiency (Magongoa *et al.*, 2011). In contrast with the findings by (George and Abiodun, 2012) that indicated that the reasons for soil consumption were “mainly due to liking of the smell, texture and to curb morning sickness and salivation”.

Most of the respondents 84.4% reported that they did not eat other non-food substances whereas only 15.6% reported that they ate other no-food substances. Individual choices of non- food consumed varied in type and frequency. The findings of this study showed that a certain percentage of women indicated that they consumed ice whereas others were consuming wood

coal. This was in contrast with the study conducted in Zanzibar which showed that consumption of non-food substances was very common among slaves who used to consume other non-food items such as clay as well as chalk, ash, grass, starch and spices Henry et al. (2003). Non-food items consumed in Mexico were bean stones, dirt and magnesium carbonate (Simpson et al., 2000). The frequency of consumption of non-food also varies. Some of the respondents 12.5% indicated they ate non-food substance daily whereas 3.1% consumed it monthly.

The total of 75% of respondents reported that there were people who were aware of their habit of geophagia and 25% were not sure if anyone was aware of their geophagic behavior. Majority of respondents reported that their family members, friends and their extended family were aware of their habit and that they had encountered both positive and negative views about their habit. This was in agreement with the study conducted in Johannesburg that showed that three quarters of the participants reported that their family members and friends were aware of their habit and they reacted differently others approved and others disapprove the habit (Mathee et al., 2014). Different views were obtained when participants were asked if the practice of geophagia was common among other community members. 43.8% reported that the practice was common among friends and other community members whereas the majority of 56.3% said they didn't know if the practice was common or not.

Most of the respondents (81.3%) reported that they consumed clay, 15.6% consumed soil from termite mounds and only 3.1% consumed soil. All respondents reported that they ate dry soil; obtained from the nature for free this was in contrast with the finding of the cross sectional study conducted in Johannesburg where 83.3% of geophagist purchased soil from street vendors.

The findings of the present study were in contrast with the study conducted by Pemba in Zanzibar Tanzania the local names of soils consumed were udonga, ufue, vitango pepeta and Mmhanga (Young, 2007). The local name of soils consumed by women in Bondo district in Kenya was called Odawa (in a form of soft stone) (Luoba et al., 2004). The study conducted in Tanzania showed that the local names of the most consumed soil were Pemba which was purchased from the local shops and kichuguu (Nyanza *et al.*, 2014).

In this study all respondents indicated that they obtain their soil from nature and there was no price paid for the soil. In contrast with the findings from Qwa-Qwa where it was mentioned that the soil was obtained from the nature by street vendors and it was processed, packaged and sold to geophagists where price ranged from R1.50 –R3.00 (Smit, 2011).

Most of the respondents (43.8%) indicated that they preferred to consume soil that was Khakish in colour followed by 21.9% who preferred soil that was reddish, 15.6% preferred whitish, 12.5% preferred blackish and 6.2% preferred to consume soil that was yellowish in colour. These findings were in contrast with the findings of the study conducted in Uganda that showed that the preferred soil colour was greyish (Abrahams, 1997). Some of the findings from this study were in agreement with the study conducted in Limpopo and Free State where most people preferred to consume red soils (Songca et al., 2010)

A study conducted in Limpopo and Free State Provinces revealed that geophagists consumed red, yellow, white, Khakhi and black coloured clays but the preference was soft white and Khakhi (Ekosse et al., 2010). According to Nchito et al. (2004) in Zambia geophagic school children preferred brown earth and white clay. In Pemba (Zanzibar Tanzania) the favoured colours of soil consumed was white, brownish and red (Young et al., 2010). In Uganda the soil that was consumed was dark brown in colour (Hooda et al., 2002). Smit (2011) indicated the soils that were mostly consumed in Qwa-Qwa were pale red, light white, white, very pale brown and light grey in colour.

The majority of geophagists reported that they preferred to consume soils of certain Colours because of the taste of the soils, followed by 12.5% who consumed soil of a specific colour because it was easily accessible whereas 6.3% ate soil of specific colour because it was a traditional belief. This was in contrast with the study conducted in Uganda where greyish soil was consumed because it was believed that it has a healing power (Abrahams, 1997).

In the present study 43.8% of respondents reported that they stored their geophagic soils in their kitchen cupboards, 25% stored in window seals, 15.6% reported they stored their soils under their beds and another 15.6% stored their geophagic soil in the ovens. During the

interviews one woman mentioned that if she craved soil at night and did not have it she goes to scrape the walls of the neighbor's house without even asking for permission to do so. She further mentioned that she stored her soil everywhere in the house and even in the office. Most of the respondents reported that they stored their geophagic soil for five days.

Geophagists obtain the soil from variety of locations including hills, termite mounds, valley, and pit. Some of these findings were in agreement with the findings of a cross sectional study conducted in Johannesburg that indicated that rural women obtained soil from different locations such as local hills, mountains, gardens, riverbeds, and termite mounds, even though it was also mentioned that urban women mainly purchased soil from street vendors (Mathee et al., 2014).

Geophagists used different methods to collect soils. In the present study the majority of respondents (78.1%) indicated that they dig soil, 12.5% reported that they scrape soil and 9.4% they used scooping or hand grapping as their collecting method. In contrast with the collecting methods used in Qwa-Qwa where majority of geophagist used utensils and bare hands to collect geophagic soil (Smit, 2011). Some of the findings in this study were in agreement with the findings of the study conducted in Limpopo and Free State where the collecting methods were scrapping, digging, hand grapping and hand picking (Ekosse *et al.*, 2011).

Most of respondents used digging as their collecting method, and 25% of respondents were not sure how deep they were digging before they start collecting. More than half of respondents (59.4%) indicated that they dig about five centimetres deep before starting collecting soils for consumption.

Women were asked about the feeling of the soil. Most of respondents 28.1% reported that the soil felt powdery, 21.9% said the soils felt gritty, whereas 25% were not sure about the feeling and another 25% indicated that does not matter how the soil felt. Some of the findings from this study were in agreement with the findings of the study conducted in Swaziland and South Africa which indicated that the soils felt gritty and in contrast with the findings from the study conducted in Democratic Republic of Congo (DRC) the soils felt clayey. (Nyanza *et al.*, 2014).

All of the respondents indicated that they only collect dry soil for consumption. This was also in contrast with the findings from the study conducted in Qwa-Qwa which showed that the majority of geophagic soil was collected wet and dried before used or packaged for marketing purposes (Smit, 2011).

More than half of the respondents (59.4%) indicated that they did not process soil before consumption, whereas 6.3% indicated that they processed the soil and 34.4% indicated that they sometimes processed the soil before consumption. The processing methods that were used in this study were grinding, pounding, sieving and drying.

Different researchers had investigated about the processing of geophagic materials. In the United States dirt and clay were processed by cooking and baking and were sold in health food stores and rural flea markets (Abraham, 1997). The study conducted by Smit (2011) in Qwa-Qwa showed that the soil was processed by placing it in the sun or coal stove to dry before it was packaged into small non-sterile plastics bags for selling. Other vendors from the study conducted in Qwa-Qwa mentioned that they break soil into smaller pieces with scissors before packaging them for sale whereas other street vendors did not apply any processing methods on the soil, they just package and sell them (Smit, 2011). Furthermore soil in Uganda was mixed with herbal additives before moulding it and marked, and some soils were air dried and smoked onto cylindrical shapes as part of its preparation for the market (Abrahams, 1997).

Most of the respondents (75%) indicated that there was no treatment applied to geophagic materials, whereas 21.9% indicated that they bake and 3.1% they burn their soil before consumption. In contrast with the findings of the study conducted in Tanzania where heat treatments were used to reduce microbial infections they used pan heating, sun drying and brushing (Young, 2007)

Most of the respondents 75% indicated that soil consumption could result in a number of health problems including constipation, poisoning of the body, causing tooth decay and small worms. Geophagia has various health implications in the human body which includes constipation,

cramping, pain perforation from sharp objects like rocks or gravel contamination Oliver (1997). Geophagic soil may expose humans to parasitic infestations (George and Ndip, 2011).

Most of the respondents reported not to have undergone any surgery as a result of geophagia, even though 3.1% have undergone surgery to remove gallstone as a result of the practice of geophagia. In contrast with the study conducted by Partners in Development (2014) one woman had frequent stomach cramps which were believed to be associated with the practice of geophagia and had operation.

There were conflicting views when respondents were asked if the soils they consume have any harmful elements. The majority 71.9% do not believe that the soils they consume contain any harmful elements or parasites, whereas 28.1% believed that there are harmful elements present in the soils they consume. The findings of the current study revealed that the minority of which was 28.1% believed that the soils they consumed had harmful elements was in agreement with the findings by Partners in Development (2014) which indicated that some respondents remove the top soil before collecting the soil to avoid contamination.

Majority of respondents (96.9%) indicated that they don't know the components of the substances they consume. Only few indicated that the soil they consume contain vitamins. It was assumed that geophagia may supplement nutrients such as iron and zinc (Hooda *et al.*, 2002). Geophagic samples obtained from Uganda, Tanzania, Turkey and India were tested for nutrient content and the results showed large amounts of iron (Fe) and zinc(Zn) (Hooda *et al.*, 2002).

Respondents gave different reasons for consuming the geophagic substances ranging from adding nutrients 12.5%, craving 9.4%, cleaning the body 6.3% and lighten complexion, whereas the majority indicated that they don't know why they consume the geophagic substances.

In contrast with the study conducted by Partners in Development (2014) soil vendors indicated that their clients claim that soil helps with constipation problem as it act as a laxative; others

claim that brown soil act as a contraceptive. The findings from the same study revealed that other women believed that soil act as a stress reliever Partners in Development (2014).

Some respondents (6.3%) reported that they were often ill, the frequency of their illness 3.1% of respondents reported that they get ill more than once a month and another 3.1% said twice a year. There are many possible human health problems associated with geophagia, including dental enamel damage and perforation of the sigmoid colon (Ngole *et al.*, 2010)

More than half of respondents indicated that they ate soils even if they were ill, only 25% who indicated that that they did not eat soil when they were sick. Only 3.1% of respondents indicated that they were diagnosed with iron deficiency and another 3.1% had been diagnosed with constipation. In contrast with study conducted by Haoui *et al.* (2003) which indicated that “all patients presented other associated psychiatric troubles including severe mental impairment and disharmonic development and schizophrenia”. According to literature in chapter 2 geophagia is defined as a psychiatric diseases (Woywodt and Kiss, 1999).

The current study showed that 34.4% of the respondents had experience the problem of stillborn. Some of the findings in this study were in agreement with study conducted by Nyanza *et al.* (2014) exposure to chemical elements found in soil has been associated with risk of many different developmental effects and high neonatal and post-natal mortality lowered birth weight, spontaneous abortion, increased number of stillbirths and congenital malformation. All respondents from the current study had never experience the problems of miscarriages. In contrast the presence of lead to soil is associated with a high risk of lead toxicity which can damage the brain and kidneys in adults and children and may even cause miscarriage and cause death (Nyanza *et al.*, 2014).

The current study revealed that 96.9% of the respondents indicated that they had no children with disabilities only 3.1% indicated they had children with deaf problem. Mothers who were practicing geophagia or pica during pregnancy their babies were on high risk of low birth weight, premature, born with physical abnormalities or even death of the newborns (Bhatia and Kaue, 2014).

5.6 Food frequency intake scores for geophagia and the control group

The findings of this study revealed that both groups (geophagia and control) consumed different types of foods, even though there was a significant difference in the consumption of starchy foods where the geophagia group consumed more than control group. The current study indicated that the consumption of high fibre foods and high fibre cereals was significantly high in control group than geophagia group. The consumption of legumes for the geophagia group was significantly higher than control group. The consumption of the following foods were significantly higher in geophagia group than in control group, mixed salad, full cream milk, coffee creamer, red meat with visible fats, Chicken with skin, cooking oil / sunflower ,vetkoek and jam and syrups .

This was in contrast with the some of the findings of study conducted in Tanzania in pregnant women, because most of the foods avoided by pregnant women in Tanzania were the foods that were mostly consumed by geophagic women of the current study. The following foods were the foods that were avoided by pregnant women in Tanzania rice, meat, fish, eggs, beans and stiff porridge (Myaruhucha, 2009).

The current study revealed that the consumption of the following foods by the control group were significantly higher than the geophagia groups, Dried fruits, tinned fruits, low fat/ skimmed milk, schnitzel , red meat removed fats, red meat / ostrich, Fried fish, Poached egg, dripping, potato chips, sweet jelly tots, cocktail, energy drinks, milk shakes and drinking yoghurt. The average frequency score of buying food during the day for the control group was significantly higher than that of geophagia group, the study revealed that the majority of geophagist were not working as opposed to the control group where the larger percentage spent lot of time outside that could be the reason for high score for buying food during the day. To conclude the findings of this study revealed that larger percentage of respondents from the control group seems to eat healthier than the geophagia group.

CHAPTER 6: CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

In this chapter the conclusion and recommendations of the study are discussed. The aim of the study was to investigate the prevalence and nutritional status of woman between the ages of 18 to 45 years, practicing Geophagia in KwaZulu-Natal under uMzinyathi and uMgungundlovu Districts.

The research objectives were:

- To determine the socio demographic status of women from uMgungundlovu and uMzinyathi district practicing and not practicing geophagia.
- To determine the nutritional status (anthropometric measurements) of women from uMgungundlovu and uMzinyathi district practicing and not practicing geophagia.
- To determine the food security status of woman from uMgungundlovu and uMzinyathi district practicing and not practicing geophagia.
- To determine the types and composition of soils consumed by woman from uMgungundlovu and uMzinyathi district practicing geophagia.

6.2 Conclusion of the study

6.2.1 Socio demographic status

The findings indicated that geophagia was more commonly practiced by women with low educational levels and low socio economic status. The findings also revealed that women who practice geophagia were older and married than those who don't practice geophagia who were younger and single. The mean age geophagic group was 37 years and 33 years for the control group. The findings of the study indicated that majority of respondents from the control group

worked as professionals, whereas the majority of respondents from the control group worked as general workers and have spent little years in formal education.

6.2.2 Anthropometric nutritional status

There were no significant differences in BMI of both groups (geophagia and the control group). The BMI of both groups fell under obese category. There was a significant positive correlation between BMI and WHR ($r = 0.381$, $p=0.002$). There was a significant negative correlation between knowledge score and HFIAS. Thus higher scores on knowledge are associated with lower scores on HFIAS. The findings of this study were in agreement with the findings of the study conducted in Qwa-Qwa that showed that there were no significant differences in the BMI and waist circumference between geophagia group and control group. The findings of this study showed that the BMI of both groups fell under the obese category.

6.2.3 Food security

According to the analysis of this study there was no significant difference in mean food insecurity scores between the two groups. The findings indicated that the control group have experienced problem of not having different kinds of foods they prefer because they lack money. There was also no significant difference in nutrition knowledge between the geophagia group and control group. The study indicated that people who do not eat soil lack money to buy different types of food they prefer to eat. The findings also indicated that respondents from geophagia group had poor food security knowledge.

6.2.4 Types of soils consumed

The findings indicated that the traditional names of the substances that were consumed were Ibumba, followed by Umcake Ukhetha and Umuhlwa. The findings showed that the majority of geophagists preferred soil that was Khakhi in colour, followed by reddish, whitish, black soil and yellowish colour. The study showed that the geophagic soil was obtained from nature for free.

6.3 Study limitations

The limitation of this study was that geophagia is not openly practiced, it made it difficult for people to give their consent to participate in research. This was overcome to ensure the participants that all the information will be confidential and no names will be disclosed.

One of the objectives of the study was to determine the types and composition of soils consumed by women from uMgungundlovu and uMzinyathi district practicing geophagia. Due to financial and time constraints the composition of the soils could not be done in this study, but the type of soil consumed by the women practicing geophagia was determined.

6.4 Recommendations

6.4.1. Geophagia in pregnancy

This study showed that soil is consumed amongst women and should be identified during vulnerable phases such as pregnancy.

6.4.2 Geophagia in vulnerable groups

Geophagia is more common in children, women and mental retarded group. Education and awareness need to be made available and accessible to care givers.

6.4.3 Education

Strategies to encourage people to take education seriously, as most of the geophagist in this study had a low educational status.

6.4.4 Nutrition Education

The prevalence and practice of geophagia should be made available to nutritionists and dieticians to identify these practices during consultations with patients or clients.

6.4.5 Health Education

Health education also needs to be promoted as many participants from the study were obese and with poor nutrition knowledge.

6.5 Recommendations for further research

Further research in larger sample sizes are recommended especially the link between geophagia and food security need to be investigated. Especially in South Africa where many households are affected by food insecurity.

Few studies have been done and further research is needed to investigate the impact of geophagia on nutritional status and the prevalence of geophagia in other areas in KwaZulu-Natal should be determined.

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APPENDIX A

Socio-demographic questionnaire

Appendix A			
QUESTIONNAIRE RELATED TO HUMAN GEOPHAGIA: women			
INTRODUCTION			
The questionnaire aim is to determine the prevalence and nutritional status of women practicing Geophagia in KwaZulu-Natal under Umzinyathi and Umgungundlovu Districts between the ages of 18-45years			
Date of interview: _____(dd/mm/yy)			
Name of interviewee (optional): _____			
Country:	RSA		
Region:	KwaZulu Natal		
District:	Umgungundlovu		
	Umzinyathi		
A. DEMOGRAPHIC INFORMATION			
1. Geographic Information			
1. Location:	Rural	Suburban	Urban
2. Specify town or area: _____			
2. Personal and Demographic Information			
3. Gender	Male	Female	
4. Age: _____(years)			
5. Ethnic Group:		Afrikaans	
		English	
		Sesotho	
		Setswana	
		siSwati	
		isiXhosa	
		isiZulu	
		Other, please specify: _____	
6 Marital status:		Married	Divorced
			Single
7 Income source:		Wage employment	
		Non-wage employment	
		Other, please specify: _____	
8 Occupation: _____			

	9 Monthly income: R/Pula _____				
	10 Highest educational level attained:				
					No schooling
					Primary
					Secondary
					Tertiary
	11 Highest grade/standard completed successfully:				
					(if GRADE is applicable)
					(if STANDARD is applicable)
	12 Number of years in formal education:				
	11 Highest grade/standard completed successfully:				
					(if GRADE is applicable)
					(if STANDARD is applicable)
	12 Number of years in formal education:				

APPENDIX B

Anthropometric Questionnaire

Respondent Number: _____

Interviewer _____

Weight (kg) _____

Height (cm) _____

Circumference (cm)

Waist _____

Hip _____

APPENDIX C

Nutrition Knowledge Questionnaire (Food security) (Please circle the correct answer)

1. **You should eat a lot of sugar to have enough energy** True/False

2. **What a pregnant woman eats during pregnancy has no effect on her health and the health of her unborn baby** True/False

3. **You should not have starches at most meals because:**
 - a) They are not important for your health
 - b) Even eating small amount can cause weigh gain
 - c) They cause diseases
 - d) None of the above

4. **How much water should you drink a day**
 - a) You don't have to drink water everyday
 - b) 1 to 3 glasses
 - c) 4to 6 glasses
 - d) 7 to 9 glasses

5. **You should add extra salt to your cooked food before you even eat it** True/ False

6. **From which group of foods should you eat the most every day?**
 - a) Bread, samp, rice, porridge
 - b) Apples, bananas, spinach, carrots
 - c) Milk, yogurt, cheese
 - d) Chicken, fish, beans, eggs

7. **Which one of the following is not healthy for a pregnant woman to do?**
 - a) Be physically active
 - b) Eat different kinds of foods
 - c) Sleep most of the day
 - d) Drink lots of water

8. People who are overweight should not be physically active True/False

9. The healthiest snack is

- a) A glass of milkshake
- b) A tub of unbuttered popcorn
- c) A slab of chocolate
- d) 2 and 3 above

10. The key to a healthy way of eating is to:

- a) Eat many different kinds of food
- b) Eat some foods more than other foods
- c) Eat certain kinds of foods in moderate or small amount
- d) All of the above

11. The following foods must not be eaten at all when one is trying to lose weight

- a) Bread and rice
- b) Meat and fish
- c) Margarine
- d) None of the above

12. If you were trying to increase the amount of fibre in you diet, which one the following foods should you eat more of?

- a) Cake and biscuits
- b) Apples and carrots
- c) Chips and pies
- d) Chicken and fresh fish

13. Which of the following choice of foods prevent certain diseases?

- a) Fish, Chicken without skin, and lean meat
- b) Beef sausage, and lean mince
- c) Fried fish, fried chicken, and regular mince
- d) All of the above

14. Which foods contain a lot of fibre?

- a) Oats, apples, beans
- b) Milk, yoghurt, cheese
- c) Beef, Chicken, mutton
- d) Butter, margarine

15. How many fruits and vegetables should be eaten?

- a) 1 fruit and vegetable a day
- b) 3-4 fruits and vegetables a day
- c) 5 or more fruits and vegetables everyday
- d) There is no need to eat fruits and vegetables daily

16. If you are eating a healthy diet there is no need for you to be physically active

True/False

17. You can drink as much wine, beer, ciders as you want provided you have eaten first

True/False

18. Your body only needs a little bit of salt to be healthy True/False

19. A well- balanced diet

- a) Consists mostly of meat, with smaller amounts of starch, vegetables, and dairy products
- b) Consists mostly of vegetables, and smaller amounts of meat and dairy products
- c) Consists mostly of starches, vegetables and fruits, with smaller amounts of meat and dairy products
- d) None of the above

20. Sugar and foods that contain sugar should be eaten in small amounts True/ False

21. Eating a lot of different kinds of foods is healthier than eating only few kinds of foods: True /False

22. It is impossible to get all vitamins and minerals you need from food; you need to take a vitamin and mineral pill True/False

23. Overweight women should try to lose weight when they are pregnant True/ False

24. Sugar contains lot of vitamins and minerals True/ False

25. Which one of the following groups of nutrients are found in large amount in fruits and vegetables?

- a) Fibre, Vitamin A
- b) Starches, Fat, Vitamin D
- c) Fats, Iron, Calcium
- d) None of the above

26. Which one of the following breakfast menus contain little fat?

- a) Whole-wheat toast with thinly spread margarine
- b) Weet-a-Bix with 2% fat milk
- c) Bacon and egg
- d) None of the above

27. It is important for pregnant women to avoid eating different kinds of foods: True/ False

28. All water is safe to drink: True/False

29. Drinking boiled water is a good way to lose weight True/ False

30. Eating bread always causes weight gain True/False

31. Which food has the most fibre?

- a) White rolls

- b) Brown bread
- c) White bread
- d) Whole wheat bread

32. To make sure that you stay healthy you should eat:

- a) Lean meat, fruits and vegetables, low fat dairy products, and bread and cereals
- b) Fruits and vegetables only
- c) Bread cereals, fruits and vegetables only
- d) Low fat dairy products and lean meat only

33. Which one of the following foods are the lowest in fat:

- a) Corn flakes and full cream milk
- b) Grilled lean steak and boiled carrots
- c) Pizza and milk shake
- d) Fried lamb chops and creamed spinach

34. Being physically active means:

- a) Going to gym
- b) Walking a lot
- c) Playing sports like soccer and netball
- d) all of the above

35. To protect yourself from diseases you should avoid eating many different kinds of foods True/ False

36. It is healthy to snack on foods that contain a lot of sugar True/ False

37. Which of the following should a pregnant woman eat more of?

- a) Milk, cheese, Maas
- b) Meat, chicken, fish
- c) Fruits and vegetables
- d) All of the above

38. Which of the following is a low fat snack?

- a)“Samba” chips

- b) Popcorn
- c) Fried chips
- d) Niknaks

39. Dry beans, peas, and lentils should be eaten often True/False

40. You can eat as much meat as you want every day: True/ False

41. Dry peas, lentils are healthy choices to eat in place of meat: True / False

42. The reason why beans, peas and lentils are good for you is that:

- a) They contain only small amount of fats
- b) They contain a lot of fibre
- c) They can protect you from some diseases
- d) All of the above

APPENDIX D SOIL IDENTIFICATION

1. Geophagic Habits

13 Are you presently in the habit of eating soil?

	Yes	No	
--	-----	----	--

13.1 If **YES**, how often do you eat soil?

	Once a month
	Once a week
	Once a day
	More than once a day

13.2 If **YES**, for how long have you been eating soil? _____ (years)

14 What is/are your reason(s) for eating soil?

	Standard practice (cultural, traditional, spiritual)
	Craving
	Medicinal value
	Supplement diet
	Ritualistic
	When hungry
	When pregnant
	Don't know
	Other, please specify: _____

15 Do you ever crave soil?

	Yes	No	
--	-----	----	--

15.1 If **YES**, how often?

	Regularly - Monthly
	Regularly - Weekly
	Regularly - Daily
	Only when pregnant

16 When do you crave soil?

	Pregnant
	Lactating
	Both pregnant and lactating
	Having trouble sleeping

Nauseous, but
Constipated
Feeling weak

17 When **pregnant**, how often do you eat soil?

	Once a month
	Once a week
	Once a day
	Other, please specify: _____

18 Do you eat any other non-food substance? YES NO

18.1 If **YES**, name the substance: _____

19 How often do you eat this substance?

20 How much of the soil do you eat?

Daily	1	2	3	4	5
More than once a day	1	2	3	4	5
Weekly	1	2	3	4	5
Monthly	1	2	3	4	5

21 Do other people know that you eat clay?

21.1 If **YES**, who knows about it?

Family members
Extended family members
Friends
Other, please specify: _____

22 How do people perceive this habit of eating non-food substances?

Positive
Negative
Indifferent
Don't know

23 Is this practice of eating soil more common among certain members of the community?

Yes	No	Don't know
-----	----	------------

23.1 If **YES**, specify: _____

24 Which substances are eaten?

	Soil
	Clay
	Soil from termite mounds
	Other, please specify:

25 How are the substances eaten?

	Dry
	With other food
	Other, please specify:

26 What are the traditional names of the substances consumed?

27 Where do you obtain your preferred substance?

		From nature	
		Buy it	
		Am given it	
		Other,	please specify:

27.1 If you **BUY** it, give the brand name: _____

27.2 If you **BUY** it, indicate the price per handful: R/Pula _____

28 What is the colour of your preferred substance?

		Reddish	<input type="checkbox"/>	Yellowish
		Whitish	<input type="checkbox"/>	Khaki
		Blackish	<input type="checkbox"/>	Other, please specify: _____

29 Why do you prefer to eat a substance of that specific colour?

		Taste	
		Tradition / belief	
		Easily accessible	
		Other,	please specify:

30 Where do you store the substance?

31 For how long do you usually store the substance? _____ (days)

32 Where can your preferred substance be found?

		Hill / mountain	
		Riverbed	
		Termitaria / termite mound	
		Valley	
		Pit / excavation	
		Other,	please specify:

32.1 If a **termitaria/ termite mound**, from where specifically is the substance collected?

		From the outer surface of the mound
		Inside the mound <u>above</u> the surface of the soil
		Inside the mound <u>below</u> the surface of the soil
		Does not matter
		Not sure

33 Is your preferred substance found close to rocks?

Yes	No	Not sure	
-----	----	----------	--

33.1 If **YES**, what type of rock?

		Very hard
		Hard
		Soft

		Very soft
--	--	-----------

34 Substance-collection method

<input type="checkbox"/>	Digging
<input type="checkbox"/>	Scooping handfuls
<input type="checkbox"/>	Scraping
<input type="checkbox"/>	Selective hand-picking
<input type="checkbox"/>	Other, please specify: _____

34.1 If **digging**, how deep? _____ cm

35 How does the substance feel?

<input type="checkbox"/>	Gritty
<input type="checkbox"/>	Silky
<input type="checkbox"/>	Powdery
<input type="checkbox"/>	Does not matter
<input type="checkbox"/>	Don't know

36 In what condition is the substance collected?

	Wet	Dry
--	-----	-----

36.1 If **collected wet**, how does the substance feel?

<input type="checkbox"/>
<input type="checkbox"/>
<input type="checkbox"/>
<input type="checkbox"/>
<input type="checkbox"/>

37 Is the substance processed before being eaten?

	Yes
--	-----

37.1 If **YES**, how is it processed?

<input type="checkbox"/>	Grinding
<input type="checkbox"/>	Pounding
<input type="checkbox"/>	Sieving
<input type="checkbox"/>	Slurrying
<input type="checkbox"/>	Other, please specify: _____

38 Is there any heat treatment of the substance before it is eaten?

38.1 If **YES**, specify the type of heat treatment:

<input type="checkbox"/>	Baking
<input type="checkbox"/>	Boiling
<input type="checkbox"/>	Burning
<input type="checkbox"/>	Combination, please specify: _____
<input type="checkbox"/>	Other, please specify: _____

D. HUMAN HEALTH ASSOCIATED WITH GEOPHAGIA

39 What is your height? _____(cm)

40 What is your weight? _____(kg)

41 Do you think that the substance could be harmful?

	Yes	No
--	-----	----

41.1 If **YES**, in what way? Constipation
Abdominal pains
Poisoning the body
Causing tooth decay
Other, please specify: _____

42 Have you ever undergone surgery for a stomach ailment? Y
e
s

42.1 If **YES**,
How many times? _____

For what reason? _____

43 Do you think there are harmful elements / parasites present in the substance?
_____ Yes No

44 Do you know the components of the substance? Yes No

44.1 If **YES**, name these components:

		Vitamins
		Calcium
		Iron
		Salt
		Other, please specify:

45 Why do you eat the substance(s) you do? To clean your body
For additional nutritional value
To protect against infections
Don't know
Other, please specify:

46 Are you often ill (infections like colds, flu, etc.)? Yes

46.1 If **YES**, how often? More than once a month
Once a month
Once every three months
Twice a year
Once a year

47 Do you eat these substances when ill? Yes No

48 Any medical condition diagnosed/experienced Yes No

48.1 If **YES**, which of these? Constant headaches
Dizziness
Blood in stool
Fatigue
Chest pains

Coughs
Muscle pains
Tremors
Blood in urine
Nosebleeds
Iron deficiency
High Blood pressure
Constipation
Other, please specify

49 Number of stillborn children (full time)?

50 Number of miscarriages?

51 Number of children born with abnormalities?

52 Name the abnormalities.

APPENDIX E

Household food insecurity Access Scale (HFIAS)

(Please circle the correct answer)

1. in the past four weeks, did you worry that you would not have enough food?

-0=No (skip to Q2)

-1= Yes

How often did this happen?

1= rarely (once or twice in the past four weeks)

2= Sometimes (three to ten times in the past four weeks)

3= often (more than ten times in the past four weeks)

2. In the past four weeks, were you not able to eat the kinds of foods you preferred because of a lack of money?

-0=No (skip to Q3)

-1= Yes

How often did this happen?

1= rarely (once or twice in the past four weeks)

2= Sometimes (three to ten times in the past four weeks)

3= often (more than ten times in the past four weeks)

3. in the past four weeks, did you have to eat limited variety of foods due to lack of money?

-0=No (skip to Q4)

-1= Yes

How often did this happen?

1= rarely (once or twice in the past four weeks)

2= Sometimes (three to ten times in the past four weeks)

3= often (more than ten times in the past four weeks)

4. in the past four weeks, did you have to eat some foods that you really did not want to eat because of a lack of money to obtain any other types of food?

-0=No (skip to Q5)

-1= Yes

How often did this happen?

1= rarely (once or twice in the past four weeks)

2= Sometimes (three to ten times in the past four weeks)

3= often (more than ten times in the past four weeks)

5. in the past four weeks, did you have to eat a smaller meal than you felt you needed because there was not enough food?

-0=No (skip to Q6)

-1= Yes

How often did this happen?

1= rarely (once or twice in the past four weeks)

2= Sometimes (three to ten times in the past four weeks)

3= often (more than ten times in the past four weeks)

6. in the past four weeks, did you have to eat a fewer meals in the day because there was not enough food?

-0=No (skip to Q7)

-1= Yes

How often did this happen?

1= rarely (once or twice in the past four weeks)

2= Sometimes (three to ten times in the past four weeks)

3= often (more than ten times in the past four weeks)

7. in the past four weeks, was there ever no food to eat of any kind in your household because of lack of money to get food?

-0=No (skip to Q8)

-1= Yes

How often did this happen?

1= rarely (once or twice in the past four weeks)

2= Sometimes (three to ten times in the past four weeks)

3= often (more than ten times in the past four weeks)

8. in the past four weeks, did you go to sleep at night hungry because there was not enough food?

-0=No (skip to Q9)

-1= Yes

How often did this happen?

1= rarely (once or twice in the past four weeks)

2= Sometimes (three to ten times in the past four weeks)

3= often (more than ten times in the past four weeks)

9. in the past four weeks, did you go a whole day and night without eating anything because there was not enough food?

-0=No

-1= Yes

How often did this happen?

1= rarely (once or twice in the past four weeks)

2= Sometimes (three to ten times in the past four weeks)

3= often (more than ten times in the past four weeks)

APPENDIX F

Food Frequency Questionnaire.

Instructions

- Look at the food item list (column I)
- Think back carefully over the past month, and determine how often you ate each item
- If you eat / drink a specific item less than once a month, mark the Never/<1/ month column
- If you do eat/drink it more regularly, decide how often you eat it per month, OR per week, OR per day and make a cross (X) in a column which best applies to each in the food list.
- Only make one cross (X) for each item in the list e.g. for each row in the table

Column1	Never/ <1/ month	1- 3/mont h	1/week	2-4 / week	5-6/ week	1/day	2-3/ day	4-5/ day	6+/ day
STARCHES									
White or brown bread and /or buns/rolls									
Whole wheat,healthy,low GI, seed bread and/ rolls etc.									
Breakfast cereals or porridges such as All Bran, High Bulk Bran, Muesli, Weet-bix,Pronutro,Oats etc.									
Breakfast cereals such as Rice Crispies,Cornflakes,Coco pops, fruit loops ,Maize meal porridge,morevite etc.									
Rice, mealie rice,samp,phutu,pap,jeqe(steamed bread)									
Pasta: macaroni,spaghetti,noodles									
Potato: cooked ,baked, mashed									
Potato: cooked ,baked, mashed with fat e.g. margarine added or potato salad									
Legumes. E.g. baked beans,lentils,dahl, haricot beans, split peas,broad beans, kidney beans, sugar beans, dried bean salad/ soup, Soya mince etc.									

VEGETABLES									
Cooked vegetables: any type.(no sugar /fat/ sauce added)									
Vegetables: any type prepared with sugar/ fat/sauces e.g. white sauce.									
Mixed salad: lettuce, cucumbertomato,peppers,onion,mushrooms,carrots in any combination or alone									

Column1	Never <1/month	1-3/ month	1/week	2-4 week	5- 6week	1/day	2- 3day	4- 5day	6+/ day
FRUIT									
Fresh fruit (any type)									
Dried fruit (any type)									
Fruit juice									
Fruit salad: fresh or tinned									
MILK YOGHURT AND CHEESE									
Full cream: milk,yoghurt,sour milk(maas), powerered milk(e.g. Nespray,Klim)									
Skimmed/ low fat 2%: milk yoghurt, sour milk(maas)									
Coffee creamer: in tea/ coffee e.g. cremora									
Milk drinks: Milo,Nesquik,Horlicks									
Cheese: gauda,cheddar,camembert,brie, **edam (except low fat/ fat-free cottage cheese) cheese spread									
MEAT, FISH ,CHICKEN									
Schnitzels,Cordon Bleu									

Red meat e.g. beef, mutton,pork (Eat meat and visible fat)									
Red meat e.g. beef, mutton,pork (Eat meat but remove visible fat)									
Red meat e.g. venison & ostrich									
Chicken / turkey: with skin									
Chicken / turkey: without skin									
Fried fish in any fat or oil, with or without butter/ crumbs.									
Fish : steamed, grilled,braaiied(fire)									
Fish : tinned sardines,pilchardssalmon,tuna									
Sausages: Vienna's, Russians,Frankfurter									
Cold meat: polony,salami,etc. & bacon									
Organ meat e.g. liver, kidney, tripe									
Eggs: cooked or poached									
Eggs: scrambled, baked, omelettes									

Column1	Never /<1/month	1-3/ month	1/week	2-4 week	5-6 week	1/day	2-3day	4-5 day	6+/day
Soft margarine (in a tub)									
Butter/hard margarine, ghee									
Cooking oil e.g. sunflower oil									
Dripping									
Fat e.g. Holsum									
Salad dressing, Mayonnaise: normal fat									
Salad dressing, Mayonnaise: lite /low fat									
FAST FOODS AND TAKE AWAYS									
Pizza									
Pies & sausage rolls									

Potato chips(french-fries)									
Kentucky fried Chicken									
Nandos									
Chicken lickin/Chicken King									
Fried fish									
Bunny chow									
Hot dogs									
Hamburgers (=bun and meat or chicken patty)e.g. Mcdonalds,steers,Wimpy, Spur,other restaurants etc.									
OTHER									
Column1	Never/<1/month	1-3/month	1/week	2-4 week	5-6week	1/day	2-3day	4-5day	6+/day
Vetkoek (amagwinya), samoosas,koeksister,doughnuts etc									
Muffin,Scones,cake,tart									
Rusks: commercial or homemade e.g. bran, buttermilk, white, wholewheat etc.									
Cookies: commercial or homemade:e.g. oat, crunchies,shortbread									
Chips, Niknaks,Lays,Simba etc.									
Energy bars, health bars, breakfast bars									
Chocolate									
Ice cream									
Cheese sauce, white sauce, meat sauce									
Tomato sauce, chutney,mustard,sweet chilli sauce									

Sweets, jelly tots, sour worms, super-C's etc.									
Nuts and peanuts									
Peanut butter									
Chocolate spread									
Jam, syrup, honey									
DRINKS									
Wine: red or white									
Port, sherry, liqueur									
Beer, cider, coolers e.g. castle, black label, hunters dry, savanna, Smirnoff etc.									
Beer, cider, cooler diet/light e.g. savanna light									
Spirits: e.g. brandy, whiskey, rum, vodka, gin									
Cocktails									
Shooters									
Fizzy soft drink, e.g. coke, fanta									
Fizzy diet soft drink, e.g. coke lite etc									
Energy drinks e.g. Energade, Powerade									
Milkshake									
Column1	Never/<1/month	1-3/month	1/week	2-4 week	5-6 week	1/day	2-3 day	4-5 day	6+/day
Drinking yoghurt									
EATING PLACES									
In general, how often do you eat out e.g. restaurants, take-aways, hotel, prepared									

food/meals from spar, checkers etc.									
If you work during the day (away from your home), how often do you take food from your home with you to eat during the day									
If you work during the day (away from home), how often do you buy food to eat during the day.									

APPENDIX G

Informed Consent Document

Participant code: _____

Consent to participate in a research study

TITLE OF RESEARCH PROJECT:

The Prevalence and Nutritional status of women between the ages of 18 to 45 years, practicing Geophagia in KwaZulu Natal under uMzinyathi and District

PRINCIPAL INVESTIGATOR:

Lindokuhle Happiness S'khosana
Discipline of Dietetics and Human Nutrition
School of Agriculture, Earth and Environmental Sciences
University of KwaZulu-Natal
Pietermaritzburg

CONTACT DETAILS:

Phone/ cell: 0829283070
Fax: 086 2120036
E-mail: lindokuhleskhosana@gmail.com

You are hereby invited to participate in the above study conducted by Lindokuhle S'khosana from University of KwaZulu Natal Pietermaritzburg campus, under the Department of Dietetics and Human Nutrition. This study aims to investigate the prevalence and nutritional status of woman between the ages of 18 to 45 years, practicing Geophagia in KwaZulu Natal under uMzinyathi and District.

Why have you been invited to participate?

The study will include a sample of 50 women between the ages of 18-45 who are practicing geophagia.

What procedures will be involved in the study?

All participants will be required to complete the following questionnaires that are estimated to take up no more than 30 minutes of your time:

- Socio demographic questionnaire (Appendix A)
- Anthropometric questionnaire (Appendix B)
- Nutrition Knowledge(Food security) questionnaire (Appendix C)

- Soil identification questionnaire (Appendix D)

There are a few things we would like you to know:

1. This project was approved by the relevant ethics committee at UKZN to assure that the research is acceptable (relevant reference will be quoted once ethics approval is obtained).
2. Your opinion will be treated as private and confidential as the researcher will identify you with a code number only.
3. Your participation is voluntary.
4. The results of this study could be published for scientific purposes but will not reveal your name or include any identifiable reference to you.

If you have any questions or concerns regarding the research, please feel free to contact Dr. Annette Vanonselen

APPENDIX H

Declaration by participant

By signing below I (full name) _____ agree to take part in this study. I understand that I can withdraw from the study at any time without any negative consequences.

I declare that I have read this information and consent form. I have had a chance to ask questions and all my questions have been adequately answered. I understand that participation in this study is voluntary and I have not been pressurised to take part.

Signature of participant

Signature of witness

Date

APPENDIX I

Information and Consent Document

I volunteer to participate in a research project conducted by Lindokuhle Happiness S'khosana from University of KwaZulu Natal. I understand that the project is designed to gather information about the prevalence and nutritional status of woman practicing geophagia in KwaZulu Natal under uMgungundlovu and uMzinyathi district between the ages of 18 to 45 year. I will be one of approximately 45 people being interviewed for this research.

1. My participation in this project is voluntary. I understand that I will not be paid for my participation. I may withdraw and discontinue participation at any time without penalty. 2. I understand that most interviewees in this study will find the discussion interesting and thought-provoking. If, however, I feel uncomfortable in any way during the interview session, I have the right to decline to answer any question or to end the interview.

3. Participation involves being interviewed by researchers from University of KwaZulu Natal. The interview will last approximately 10-15 minutes. Notes will be written during the interview.

4. I understand that the researcher will not identify me by name in any reports using information obtained from this interview, and that my confidentiality as a participant in this study will remain secure. Subsequent uses of records and data will be subject to standard data use policies which protect the anonymity of individuals and institutions.

5. I have read and understand the explanation provided to me. I have had all my questions answered to my satisfaction, and I voluntarily agree to participate in this study.

6. I have been given a copy of this consent form.

My Signature Date (interviewee)

Lindokuhle Happiness S'khosana

My Printed Name Signature of the Investigator

For further information, please contact: Lindokuhle S'khosana
(0829283070)lindokuhleskhosana@gmail.com principal researcher

Or

[Dr. A. van Onselen](#)(supervisor)

Dietetics and Human Nutrition

University of KwaZulu-Natal

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Or

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APPENDIX K

ETHICAL CLEARANCE



06 October 2014

Mrs Lindokuhle Happiness S'khosana (9805195)
School of Agricultural, Earth & Environmental Sciences
Pietermaritzburg Campus

Protocol reference number: HSS/0787/014M

Project title: The prevalence and nutritional status of woman between the ages of 18 to 45 years, practicing Geophagia in KwaZulu-Natal under UMzinyathi and Umgungundlovu Districts

Dear Mrs S'khosana,

Full Approval – Expedited Application

In response to your application dated 22 May 2014, the Humanities & Social Sciences Research Ethics Committee has considered the abovementioned application and the protocol have been granted **FULL APPROVAL**.

Any alteration/s to the approved research protocol i.e. Questionnaire/Interview Schedule, Informed Consent Form, Title of the Project, Location of the Study, Research Approach and Methods must be reviewed and approved through the amendment/modification prior to its implementation. In case you have further queries, please quote the above reference number.

PLEASE NOTE: Research data should be securely stored in the discipline/department for a period of 5 years.

The ethical clearance certificate is only valid for a period of 3 years from the date of issue. Thereafter Recertification must be applied for on an annual basis.

I take this opportunity of wishing you everything of the best with your study.

Yours faithfully

.....
Dr Shenuka Singh (Chair)

/ms

Cc Supervisors: Dr Annette van Onselen and Dr Pauline Chivenge
Cc Academic Leader Research: Dr O Mutanga
Cc School Administrator: Ms Marsha Manjoo

Humanities & Social Sciences Research Ethics Committee

Dr Shenuka Singh (Chair)

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