PREVALENCE OF PICA CONSUMPTION AMONG PREGNANT WOMEN FROM LOWER AND HIGHER ECONOMIC GROUPS.

BY

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A thesis submitted in partial fulfilment of the degree of Master of Science

in Applied Human Nutrition in the department of Food Technology and Nutrition.

University of Nairobi.

August 1993.

DECLARATION

I, MARY MBATI-MWAKA, hereby declare that this thesis is my original work and has not been presented for a degree in any other University.

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DEDICATION

This thesis is dedicated to my father , Mr. Elkanah Mbati, and my late mother, Mrs Rodah Awinja Mbati, for their commitment to my education.

ACKNOWLEDGEMENTS

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ABBREVIATIONS AND DEFINITIONS

ABBREVIATIONS

SES- Socio economic status

HSES- Higher socio-economic status

LSES - Lower socio-economic status

NRC - National Research Council

RDA - Recommended daily allowance

NCCK - National Council of Churches of Kenya.

NDDP - Nakuru District Development Plan.

DEFINITIONS

PICA - The word pica is derived from the Latin word, "magpie", meaning a which eats anything.

CAUL - thin skin enclosing the foetus.

TUFF - a geological name given to volcanic soil which is solidified

PLUMBISIM - mild blood level elevation usually > 30 μg/dl.

MAHTI - volcanic soil imported from India and sold mainly in Asian shops

JIKO - charcoal cooker.

MATATU - Public transport vehicles.

NYAYO BUSES- Public transport buses introduced by president Moi to help ease transportation problems.

ABSTRACT

An interesting phenomenon has been observed amongst pregnant women world wide, spanning over a number of decades. This is the consumption of non food substances like soil, clay, chalk and many others. This practice is known as pica. A cross sectional study was carried out in Nakuru Municipality to determine the prevalence of pica consumption amongst pregnant women of different socio-economic groups. The factors considered in the study were:- Socio-economic status (SES), dietary patterns, types of substances consumed, mineral elements present in these substances, reasons for consumption, amounts ingested and problems associated with pica consumption.

A total of 422 pregnant women at all stages of pregnancy, were identified and studied. The investigation involved administration of a questionnaire and analysis of mineral contents of selected pica samples. The overall prevalence of pica consumption amongst the pregnant women in the study area was 45%. There was no relationship between socio-economic status and pica consumption, nor was consumption influenced by previous exposure. Results showed that pica consumption begins mainly during the second trimester, a time when maternal nutritional needs are said to be on the increase. The types of substances consumed were mainly earth substances and the most common were loose soil, roasted clay, termite clay and construction stones dug out of quarries. On analysis, these substances yielded some mineral elements that could be of use to the body like calcium, iron and potassium among others. From the reasons given by the women as to why they consume pica substances, it was not easy to establish the real cause for this practice and therefore more research is needed in this area.

CHAPTER 1.

Introduction.

Pica or the compulsive eating of none - food substances is a phenomenon that has provoked the curiosity of both the lay public and scientists for centuries. References to the widespread consumption of dirt ,clay, and charcoal date back to 1000 A.D. (Whitney 1987.) This is a worldwide phenomenon and has been reported to be a common practice among pregnant women (Christian and Greger,1988).

1.1 *Statement of the problem.*

Maternal nutrition is critically important to both mother and foetus. Therefore, the importance of specific behaviours affecting maternal nutrition during pregnancy, and the subsequent pregnancy outcome cannot be over emphasized. Behaviours associated with maternal diet have the potential to produce different pregnancy outcomes, influence maternal health and nutritional status, and bring about complications during labour. Such behaviour therefore needs to be investigated..

Although pica consumption has been practiced for decades, some harmful effects have been reported (Worthington and Vermeersch).These include intrference with normal food intake, toxicity, parasitic infections and complications during labour. These include interference with normal food intake, toxicity, parasitic infections and complications during labour.

Despite the problems and complications associated with pica, it is simply dismissed as a habit during pregnancy and a cultural practice, without realizing its consequences. Many health workers may not be aware of this because not enough attention and focus has been given to the issue. Health workers should be aware of pica whenever a pregnant woman seeks advice for physical abdominal complaints or any other related problem.

In many public and private ante-natal clinics in Kenya, little or no information is collected from pregnant women on their consumption of pica, and hence this practice of pica is not

impression that pica practice is only common in this group. Studies are required to establish to what extent pica practice is prevalent in all groups.

The modern search for explanation of the compulsions of pica has led to investigations into the contentts of the pica substances , especially mineral elements that may be associated with this practice. This has been inconclusive, and hence the need for more research.

1.5. *Expected Benefits of the study*

It is expected that by highlighting gaps in knowledge in maternal consumption of pica, as well as identifying those factors associated with pica practice, this investigation might aid in improving the quality of maternal nutrition. The findings of this investigation are expected to be of use primarily to the ministry of health and non governmental organizations whose programmes focus on improving maternal health and nutrition.

1.6 *Scope and limitations*

This is maily a descriptive study that focused on the extent to which pregnant women of different socio-economic status (SES) pica substances and the factors associated with pica consumption.

Nakuru Municipality was chosen because of its central location in the country (see section 3.) Since the study is also focused on socio-economic status, Nakuru Municipality, being an uban centre, was an ideal choice that offered a broad spectrum of all the socio-economic groups

The study was limited to only pregnant women because studies have shown that pica consumption is more prevalent in this group, (Section 2.1).

One major limitation of this study was that it was carried out during normal ante-natal visits by the pregnant women, who had to wait on the long ques and were also in a

hurry to get back home to their household duties. Because of this, it was not possible to carry out a detailed study, and the questionnaires had to be made as short as possible, lest the women become impatient.

CHAPTER 2

LITERATURE REVIEW

2.0   Introduction

From the literature search, it was evident that not much research has been carried out on this topic. At the time of the literature search , the author identified very few studies that have been carried out on pica consumption in Kenya. The literature has been reorganized into sections for easier understanding.

2.1.   Types of pica substances consumed.

Studies carried out around the world indicate that quite a variety of substances are consumed. These has been classified as follows:

> Geophagia   this involves consumption of earth substances like clay, soil,
>
> stones and gravel, charcoal and ash (Reed, 1980).
>
> Amylophagia -involves eating of starch for example laundry
>
> and corn starch (Worthington and Vermeersch, 1985).
>
> Pagophagia - involves mainly ice eating (Krause and Mahan, 1979).

Other reported substances are anti acid tablets, milk of magnesia, baking soda, chalk, egg and oyster shells, burnt matches, hair, cigarette ash, coffee grounds, tire inner tubes, newspapers and paint clips (Worthington and Vermeersch, 1985).

2.2.   Studies on pica practice and its prevalence

Most studies have shown that pica practice is more prevalent amongst pregnant women although it has also been documented amongst children and other adults (Theuri et al., 1982; Fieldhouse, 1986; Christian and Greger, 1988). Surveys in the Southern United

States provided some of the first data to identify current pica practice. A study in 1950 indicated that 68% of 331 pregnant black women in rural Mississippi consumed pica substances, namely starch and clay. Of thirty whites interviewed, 10% and 7% reported starch and clay consumption respectively. A 1959 survey of 86 patients in an Alabama hospital showed that pica consumption was reported by 56% of the patients. In other studies, as many as 75% of women attending health department clinics in the south consumed starch and 50% consumed clay (Worthington and Vermeersch, 1985).

In Kenya, a study carried out in 1982 among 239 pregnant women in rural Machakos revealed that 49% of these women admitted to having consumed either stones, soils and ashes. Twenty nine percent had ingested the substances in at least one previous pregnancy and 24% had experienced pica in all their previous pregnancies. Eight percent reported they had not practiced pica before (Jansen et al., 1987).

Worthington and Vermeersch (1985) observed that the practice is not limited to anyone geographical area, race, creed, culture, sex or status. Although Pica practice appears to be most common among pregnant black women, it is also reported to occur among other ethnic groups in the United States and elsewhere (Lackey et al., 1973). On the other hand, there is a school of thought which argues that pica practice is limited to some groups, especially the low socio economic status (Christians and Greger, 1988). They point out that pica is practiced by some members of certain socio-economic and racial groups, especially black women from the rural South of the United States. On pica practice in children, Suitor and Crowley (1984) observed that it was more prevalent in children from lower socio-economic groups who live in emotionally impoverished environments. He further states that plumbism (blood lead level elevation > 30 $\mu g/dl$) in

children who eat paint, is more prevalent in low socio-economic groups living in urban areas with low income blacks reportedly at greater risk.

A study carried out in Machakos, Kenya, showed that pica practice is not influenced by age or parity (Theuri et al., 1982) It was also observed that pregnant women consumed pica substances ranging from 10 grams to 520 g per day. Most of the women ingested less than 100 grams per day. The average time of consumption was four months

2.3. *Etiology and theories on pica practice.*

2.3.1. *Etiology*

The occurrence of dietary cravings and aversions during pregnancy is well known, yet relatively little is known of the etiology and epidemiology of pica practice. Little information of quantitative nature has been published on the subject. There is therefore little detail on the time of onset and termination of the symptoms or on their duration (Robson, 1985).

Most women when asked why they practice pica, say that they just crave for substances but do not know why.(Gachago,1990). It has been reported that some women get so drawn to the practice that they actually get addicted to pica and can even smell the stuff from a distance

When prenatal patients were questioned concerning pica practice, a variety of answers were given (Fieldhouse, 1986). These include:

- A taste for clay

- Keeping the baby from being marked at birth

- Relief of nervous tension

- Helping the baby to slide out more easily during delivery when
  starch is eaten.
- Quietening of hunger pains by clay.
- A pleasant feeling when clay and starch are chewed.
- Social approval of pica practice.

Other reasons which have been given by pregnant women include relief of nausea, social approval, tradition and expected physical effects on the baby. (Fieldhouse,1986) Some women believed that craving for starch and clay portrayed a dietary need, but thought that taking too much would cause the child to be born covered with excess caul (Fieldhouse, 1986). The same author reported that it is believed that consuming pica is used as a strategy for commanding attention.

Gachago (1990) reported that women who chew tuff (a geological name of a solidified volcanic soil) feel thirsty until they eat some. The women do not exactly know why they eat the tuff, but claim that they feel elevated after consumption. In the same report he talks of a doctor in Nairobi who recounts an experience that puzzled him. It was the case of a woman who had fibroids. She had an extreme craving for soil. It was recommended that the uterus be removed. Once it was removed, the urge immediately ended, but the real cause remained unknown. This may imply that physiological needs are met.

2.3.2. *Theories on pica practice.*

A few theories have been advanced as to the cause of pica. They are discussed below:

Relief of nausea and vomiting.:   Ingestion of pica has been suggested to relieve nausea and vomiting. Hochstein, (1968) gives the example of a dog who will eat dirt or grass (i.e.pica) during illness, thus preventing nausea and vomiting.. He also believed

that clay eating decreases uterus movements and intestinal mobility thus reducing nausea, and hunger.

Metabolic changes: Metabolic changes and have been suggested to alter olfactory and taste sensitivity during pregnancy, leading to craving for pica substances. Closely related to this is the view that pica reduces the amount of saliva in the mouth which is a problem for some pregnant women (Robson, 1985).

Culture: Pica is associated with superstition and tradition. It was reported that the tradition of ice eating was so ingrained in African ancestors of Southern U.S. Negroes that its continuation was necessary for psychological well being.(Huntre,1973). This practice was transplanted via the slave trade to the U.S. where cultural substitutes for the clay were found. Laundry starch, baking soda, wheat flour and dried powdered milks may have been used as replacements. It was also believed that Pica quietened hunger pains during times of famine.(Hunter,1973). Pica practice was seen as a traditional behaviour taught by mothers to daughters during the process of gardening and food preparation (Hunter, 1973).

Psychological - Psychological behaviour is another factor that can cause pica practice. It was observed that women ate pica to attract the attention of their spouses (Hochstein, 1968). Women hoped that by eating something out of the ordinary like pica substances, their husbands would notice this ,thus giving them the attention they so much needed.

Microbial Influence- It is suggested that pica favours growth of microorganisms and discourages growth of pathogens and also influences acidity in the intestinal tract (Hochstein, 1968).

Nutritional need - There is a popular view held by many researchers that cravings may represent a physiological response to maternal and/or foetal nutritional needs. It has been claimed that pica is a physiological response to a nutritional deficiency. Twenty seven patients with a craving for ice cubes were studied. All but 3 of these had hypermenorrhea. Their average consumption was 244 grams per 24 hours. They were treated alternatively with intramuscular saline and iron dextran injections. The subjects were cured of pica in about 5 days (Coltman, 1969). From the observations, it was concluded that pica particularly pagophagia (excessive ice eating) may be indicative of iron deficiency and seems to resolve itself after supplementation with iron. It was further stated that the reason behind the craving for pica is that there may be an iron deficiency in the blood. Since the woman is catering for her needs and that of the baby, she needs a higher supply. Although this may be the case, this theory has not been proved sufficiently. None of the above hypotheses is adequately convincing. Thus it is difficult to establish the exact cause of pica practice, except pointing out that it is associated with pregnancy.

2.4 Problems associated with pica practices

It has been documented that massive amounts of clay may cause abdominal discomfort (Muller et al., 1977), intestinal obstruction, and may lead to unnecessary appendictomy (Harder and Sella, 1979). Toxic substances may also be present in the items consumed, as is true of lead based paints which may result in lead poisoning, or plumbism (blood lead level > 30 µg/dl) seen primarily among young children, who practice pica. Dangerously high levels of lead have been reported in clay and chalk. Findings indicate that about 4% of all American children 6 months to 5 years of age have plumbism (Suitor and Crowley, 1984). This is of considerable concern since lead intoxication can have serious effects on the nervous system, kidney and bone marrow, sometimes leading to

death. Chronic mild blood level elevation may impair psychological, behavioural and intellectual function of children (Suitor and Crowley, 1984).

Syndromes including anaemia, dwarfism, immature sex organs, enlarged spleen and edema have been linked to pica practice (Reed, 1980). Gachago, (1990) enumerated several problems that could arise as a result of pica consumption; he reported that consumption of soil can lead to a form of elephantiasis which is associated with excess consumption of silica .and that metals like lead and mercury mixed with the soil can lead to toxicity. He further stated that chromium, above its useful limits can cause lung and liver cancer and that iron in high concentrations leads to liver cirrhosis and lung siderosis (fibrosis of the lungs). Finally, there's also the danger of getting parasitic infections from ingestion of contaminated soil or clay.(Gachago,1990).

Other less commonly reported complications of pica consumption observed by Worthington and Vermeersch (1985) are:

- Congenital lead poisoning secondary to maternal pica for wall plaster.

- Tender, irritable uterus with dystocia associated with fecal impaction from clay ingestion

- Foetal haemolytic anaemia caused by maternal ingestion of mothballs and toilet air freshener

- Parotid enlargement

- Gastric and small bowel obstruction from ingestion of excessive laundry starch

That there are many more varied problems associated with pica consumption is reflected in the case studies below. (Worthington and Vermeersch, 1985).

Case I

In England a 21 year old woman was hospitalized at 38 weeks' gestation because of severe anaemia. She was generally tired and occasionally dizzy and had edema of the ankles and mild anorexia. After 3 weeks of concentrated treatment with iron and folic acid she showed no improvement. Through further questioning it was found that throughout her pregnancy, the woman had been eating toilet air freshener blocks at the rate of 1 to 2 per week. Cessation of this practice led to immediate improvement.

Case II

A 16 year old pregnant patient was admitted to the hospital with signs of complicated labour. During an operation, it was found that she had a fecal impaction leading to obstructed labour with poor descent of the foetal head. Through questioning the physicians found that she practiced pica ,and that she, ingested clay at an excess of 1 quart per day.

Case III

At a routine dental examination the dentist found evidence of severe abrasion and wear to the patient's teeth. In some places the dentin was exposed. There was no other apparent problem like carries in the oral cavity. Through questions, the dentist found that his patient was the mother of seven. During each pregnancy she craved clay and ate about a shoe box full each week. It was deduced that this caused the permanent wear on her teeth. The woman claimed that this craving for clay was always the first clue to her pregnancies.

Case IV

A 31-year-old black woman was admitted to a rural emergency room with extreme weakness, severe nausea, vomiting, and fever. The patient reported no bowel movements during the preceding 2 weeks. On examination she was lethargic and appeared critically ill. Within 10 minutes of arrival the patient experienced a grand mal seizure followed by cardiorespiratory arrest. Efforts at resuscitation were unsuccessful, and the woman died. Autopsy findings included 3 litres of pus within the peritoneal cavity and a 4 cm perforation of the sigmoid colon. Free within the cavity were stones measuring 2.5 cm in diameter and a clay ball measuring 5 cm diameter which she had been ingesting.

CHAPTER 3

DESCRIPTION OF THE STUDY AREA

3.1. *Location*

Nakuru district, wherein the study site is located is one of the 13 districts of Rift Valley Province. It covers an area of 7200 square kilometres and is situated between 35 degrees 28' and 36', 35' degrees East and 0 degrees 13' North and 1 degree 10' South (Nakuru District Development plan, N.D.D.P 1989-1993).

Nakuru town, which was selected as the study site is situated on the main Nairobi-Eldoret highway and has a good communication link with the five major urban centres in the country. It is the fourth largest town in the country. Nakuru municipality is an administrative unit within the town and is one of the dominant urban centres within the district.

3.2. *Population*

According to the 1979 population census, (N.D.D.P., 1989-1993) Nakuru district had a population of 522,709 which was projected to rise to 932,580 by 1990. According to the same census, Nakuru municipality had a population of 92,851 and it was projected that in 1992 it would have risen to 182,124. Nakuru municipality holds almost 18% of the total district population.

3.2.1. *Ethnicity*

During the 1979 population census, over half of the population in Nakuru town were born elsewhere, namely, Central Province, other parts of the Rift Valley, Western and Nyanza provinces. In the same year, the Kikuyus comprised 60.8% of the total population, the Kalenjin 15.6%, Luo 6.93%, Luhya 6.91 and Kisii 2.30% (N.D.D.P.1989-1993).

3.3. *Housing*

The Municipality has provided many low cost housing estates to its residents. These estates serve mainly the middle income group. Most of the low income population is concentrated

in the major slum area of Rondah Estate, while the higher income groups reside mainly in Milimani, Section 58 and Gilani Estates where most have built their own personal houses or reside in government houses. The Municipality also allocates plots on which individuals put up their own houses.

3.4. *Transportation*

Most of the roads within the town centre and those leading out of the town are tarmacked while the rest are either murram or earth roads. The municipality too has a good network of public transport (*matatus*, *nyayo* buses and taxis) serving almost all the residential areas. The main Trans saharan highway and railway line passes through Nakuru town. The train travelling from Mombasa to Western Kenya passes through the town. Thus Nakuru is centrally located making it a major communication centre in the country.

3.5 *Water Supply*

Nakuru district relies almost equally on surface and ground water for its water supply. Most of the operating water supplies are over utilized because of phenomenal growth in population as a result of immigration into both rural areas and towns. Because of lack of sufficient surface water sources, there has been great reliance on ground water sources. There were many boreholes that were drilled and are now disused needing rehabilitation. As at 1988, the water distribution points for Nakuru Municipality were at Lanet, Mwariki, Rulst water supply, Meteroni dam and the Barut boreholes.

3.6 *Health*

Nakuru district is served by one provincial general hospital, 2 district hospitals and 14 health centres. The provincial general hospital is in Nakuru municipality. The municipality also has one health centre and 4 dispensaries, including a maternity home which charges KShs. 20 per day. There are many private nursing homes and clinics which offer both

general and specialized health care services. These include Menengai Nursing home, Nakuru Nursing home, War Memorial hospital among others.

3.7 Education

There are 40 municipal primary schools with an enrolment of 31,695 students and 20 municipal secondary schools with an enrolment of 8,566 students (The Municipal Council of Nakuru Annual Report 1988/89). These schools cannot accommodate the entire school going child population due to rapid population growth, and so the rest enrol in either private or *Harambee* schools.

3.8 Socio-economic profile

Nakuru district is primarily an agricultural district. Its income is mainly generated from farm related activities, and agro based industries. Nakuru town is one of the most commercialised centres in the country because of its agricultural and industrial potential. It has a good communication link with the five major urban centres in the country. The commercial sector is dominated by small retail businesses dealing in all kinds of merchandise. The commercial activities in the town serve as contact point for suppliers and consumers.

3.8.1. Employment

In the 1979 census, the district labour force comprised 46% out of a total population of 522,709. About 10% of the district population is engaged in wage employment, a majority of whom are in the main urban centres of Nakuru, Gilgil, Naivasha, Njoro, Molo and Elburgon. This is due to the concentration of industries in these centres. Nakuru town, the district capital, generates 30% of the total wage employment in the district.

3.8.2. *Income*

In 1985, 57.8% of the total municipality population were in the lower income bracket, 38.9% in the middle income bracket and 3.3% in the higher income bracket (Table 1).

Table 1.0 Distribution of population (Nakuru Municipality) by monthly income. N = 29,508.

Income bracket (KSh)	Population (n)	%
0 to 1999 (Low income)	17057	57.8
2000 to 5999 (medium income)	11478	38.9
> 6000 (High income).	973	3.3

Source: Nakuru District Development Plan. 1989-1993.

3.9 *Administrative set up*

Nakuru district has five parliamentary constituencies namely, Nakuru town, Nakuru North, Nakuru East, Molo and Rongai. Nakuru municipality is one of the nine administrative units in the district. It has four locations namely, Nakuru West, Nakuru East, Bondeni and Barut. Administratively, the municipality is divided into 16 electoral wards which are under elected councillors. The councillors in turn elect the mayor and deputy mayor. The mayor therefore becomes the political head of the council. The administrative head of the council is the town clerk and his staff. The Municipal council, with the councillors sitting on various committees provide the services needed under different departments like education, public works, health, among others. These departments are headed and manned by professionals in those areas.

CHAPTER 4

RESEARCH DESIGN AND METHODS

4.1. *Summary*

A cross-sectional investigation was carried out in Nakuru municipality over a five month period, from April to August, 1991. A structured questionnaire was administered to pregnant women attending antenatal clinics to establish the overall prevalence of pica practice. Pica samples were weighed and later taken for analysis of mineral elements.

4.2. *Determination of sample size*

Previous studies carried out on pica practice among pregnant women showed an average prevalence of 50% (Worthington and Vermeersch, Jansen et al., 1987)). It was therefore assumed that on average, 50% of pregnant women eat pica. Based on this, the sample size was to determined using the formula:

$$n = Z^2 \, (P \, q) / \, d^2 \quad \text{(Maritim, 1990)}$$

where:

Z = desired confidence ; limit at 1.96

P = proportion of women practicing pica

Q = proportion of women not practicing pica

D = degree of accuracy desired at 0.05

$$n = \frac{(1.96)^2 \, (0.50 \times 0.50)}{0.05}$$

$$n = \frac{3.841 \times 0.25}{0.05^2}$$

$$n = \frac{0.96025}{0.0025}$$

$$n = 384$$

Allowing an attrition rate of 10% the total sample size required added to 422

4. 3 *Sampling method.*

Sampling was carried out based on ante-natal clinics attended by pregnant women within Nakuru Municipality (Fig. 1).

Since this is a study based on socio-economic status (SES), the clinics were stratified into depending on the income and occupations of the women and their husbands. According to the information given by the Medical Officer of health, the County Council clinics and the General Hospital mostly cater for the Lower Socio-economic) (LSES) groups. These County Council clinics were: 1 - Shabab, 2 - Langalanga, 3 - Lanet, 4 - Industrial area.

The provincial general hospital was number 5. The socio economic information was confirmed by the data collected on occupation from the cards and income from the questionnaire. On the other hand, the private nursing homes and clinics were classified as those catering for the Higher Socio-economic (HSE) group. The nursing homes included: 6 - Nakuru Nursing Home, 7 - Menengai Nursing Home. The private clinics 9 - 13 belong to 5 practising obstetrics/gynaecologists. Random sampling was then carried out to select one study group for each SES group. Health facility number 5 the Provincial General Hospital was randomly selected to represent the LSES, while health facility number 10 a private clinic was selected to represent the HSES.

Determination of socio-economic status was based on occupation and income shown in appendix 1. For the purpose of this study, there were only two socio-economic groups, the lower and higher groups. The higher professionals and lower professionals were combined to form the higher socio economic status group with a cut off point of Ksh. 2,000. Anybody in those categories but earning less than Ksh. 2,000 was moved to the LSES group. The skilled workers, clerical staff, unskilled and semi-skilled workers

were grouped as the lower socio-economic group also with a cut off point of Ksh. 2,000
Anyone in these categories earning more than Ksh. 2,000 was moved to the HSES.

The distribution of the women in the two clinics was based on a CBS survey (1993) which
had classified the urban population into different income groups as follows: (See appendix
1) Low Income: 76.77%, Middle income 20.89% and High Income, 2.34 %.

For the purposes of this study, the women were divided into only two groups: The LSES
and the HSES. The middle income earners were combined with the high income earners to
form the HSES, making 23.23%, i.e (20.89 + 2.34)

The total number of women to be interviewed was 422. To get the number of women to be
interviewed in the LSES clinic 76.77% of 422 was calculated, giving a total of 324
women. Likewise, for the HSES clinic, 23.23% of 422 was calculated giving 98 women.
Systematic sampling was then applied, where every third woman was interviewed until the
desired number was obtained

4.4 *The study population*

This comprised of pregnant women residing in and attending antenatal clinics within
Nakuru Municipality. Their ages ranged from 15 to 55 years and they belonged to either
the lower or higher socio-economic status groups (Appendix 1)

| | Lower socio-economic | | Higher socio-economic | | Stratum |

| County Council clinics | Provincial Hospital | Nursing homes | Private Clinic | Sampling Frame |

| 1 2 3 4 | 5 | 6 7 8 | 9 10 11 12 13 | Codes of health Facility |

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        │              │                        │
        ▼              ▼                        ▼
┌────────────┐  ┌────────────┐         ┌────────────┐
│ Pilot study│  │Health facilty│        │ Health      │
│Health facility│ │ Nº 5       │        │ facility Nº 10│     Randomly selected health
│ Nº 2       │  └────────────┘         └────────────┘      facility
└────────────┘        │                      │
                      │                      │
               ┌────┬──────────┐      ┌────┬──────────┐
               │324 │Respondents│      │ 98 │Respondents│    Number interviewed
               └────┴──────────┘      └────┴──────────┘     at every third interval
                     76.77%                 23.23%
```

FIGURE 1 FLOW CHART OF SAMPLING PROCEDURE

4.5 Methods of investigation.

4.5.1 Questionnaire

Data was collected using a structured questionnaire (Appendix 2) which was administered to the respondent during normal antenatal clinic sessions. The questionnaire was divided into three sections. In section A, data was collected to provide a descriptive background of the respondents. These included variables of age, marital status, educational level, occupation and income. Section C provided data on pica practice and included variable like types and sources of substances consumed, when they started eating pica substances, reasons and perceived benefits derived from pica consumption, any problems experienced and solutions sought to solve these problems.

4.5.2 Collection of samples and analysis of mineral content

The women who were found to be consuming pica substances were asked to provide samples and estimated amounts consumed daily during their next ante-natal visit. These were weighed using a normal kitchen weighing scale and the weights recorded. The ten most common samples were sent for chemical analysis of mineral elements.

Method for the preparation of rock samples

The method used was based on the one developed by Mason (1952). About hundred grammes of the representative sample was crushed onto a 250 mesh screen using a grinding machine.

Method for fusion with Sodium Carbonate

1g of various rock samples were placed on to a 30 ml capacity platinum crucible. 5 g of anhydrous sodium carbonate was thoroughly mixed with the various samples and then the crucible was covered. The contents were placed on the tripod stand and heated with a wicker burner. First the crucible was heated with a low flame for the first ten minutes.

Gradually the heat was increased to a full flame. The flame intensity was increased until the bottom of the crucible was a cherry red (about 900 °C). This temperature was maintained for 15 to 20 minutes. During this time the cover was periodically lifted to provide an oxidizing environment. The heat was then increased to about 1000 °C and this was continued for ten minutes. At the end of the said period, the samples completely melted. The crucible with the molten sample was held by tongs and rotated in such a way that the fusion solidified along the sides. 5 ml of 6NHCl was added to the crucible and heated with a low flame to dissolve the cake.

The crucible contents were then transferred into a porcelain casserole and covered. The liquid in the porcelain contained silica in solution as soluble silicic acid. This liquid was evaporated to dryness to render the silicate and therefore separate it from the rest of the elements. A few ml of perchloric acid ($HClO4$) was added to dehydrate the silicate. This solution was filtered in order to separate the silica. The filtrate was diluted with distilled water to a 100 cm^3.

The Atomic Absorption Spectrophotometer (AAS) was then used to analyse the rest of the elements after calibrating the instrument. The concentration of the elements was reported in parts per million (ppm) and percentages.

4.6 Recruitment and training of field assistants

The sister in charge of the antenatal clinic at the Provincial General Hospital selected 6 of her best trainee nurses who were fluent in both English and Kiswahili to help as enumerators. All of them had received a secondary school education upto Form 4. Training involved exposure to the concept of the research, its objectives as well as sampling procedures. The enumerators were also exposed to interviewing techniques, followed by a period of thorough review of questionnaires question by question in order to

ensure that the intent of each question was well understood by all. The questionnaires were translated from English to Kiswahili (the language used for interviewing) and back into English in order to establish that the meaning of the questions had not changed. The enumerators then practiced administering the questionnaire amongst themselves and then later in one of the clinics during the pilot study. Each enumerator was required to record the responses, which were later compared to the others. They were also taught and practiced how to use an electronic weighing scale in order to get accurate results.

4.7 Pilot study

The pilot phase was carried out as part of the training of enumerators,and pre-testing the questionnaires. After a two week period of exposure to research objectives and interviewing techniques, a two week pilot study subsequently followed. One health facility was randomly selected from the sampling frame for carrying out the pilot study. The main aim of this study was to pre-test the questionnaires for validity and reliability. Another reason for pre-testing was to get the respondents' comprehension of the questions and to obtain information on the expected responses to the open-ended questions for coding purposes. Thus the information that was obtained from the pilot study was used to restructure the questions which were not well understood by the respondents and also for pre-coding of responses for ease of data analysis. Some of the questions that were restructured were on dietary intake. Because the study was to be carried out in a clinic context, the questions on quantitative food intake had to be lest out. Also because the women had been waiting in a que and were anxious to get back to their household chores, the questionnaires had to be restructured to be as brief as possible so that the women did not become impatient.

4. 8 Data cleaning, processing and analysis

The questionnaires were carefully checked by the principal investigator and field co-ordinator (sister in charge antenatal clinic - Nakuru General Hospital) on the day the

information was collected, to detect any inconsistencies, errors or incompleteness. The questions which had not been precoded were coded during this exercise. Data was then entered into the computer using statistical package for social sciences (SPSS) Data Entry II. Data cleaning was carried out to ensure that data had been entered correctly into the computer. Simple statistical analysis was carried out using statistical package for social sciences. This gave meaningful frequency tables, cross-tabulations and chi-square values.

CHAPTER 5

5.0 RESULTS

5.1 *CHARACTERISTICS OF THE STUDY POPULATION.*

5.1.1 *Age of Respondents and marital status.*

A total number of 324 women were interviewed. The majority of the women (82.9%) were aged between 20 - 39 years, while 15.6% were aged between 15 -19 years (Figure 2.1). Only four women were aged between 40 - 49 years and two were between 50 -59 years. The majority of the women (86.7%) were married, 12.1% were single while only three (0.7%) were widowed and two (0.5%) were divorced (Figure 3).

FIGURE 2: DISTRIBUTION OF RESPONDENTS BY AGE
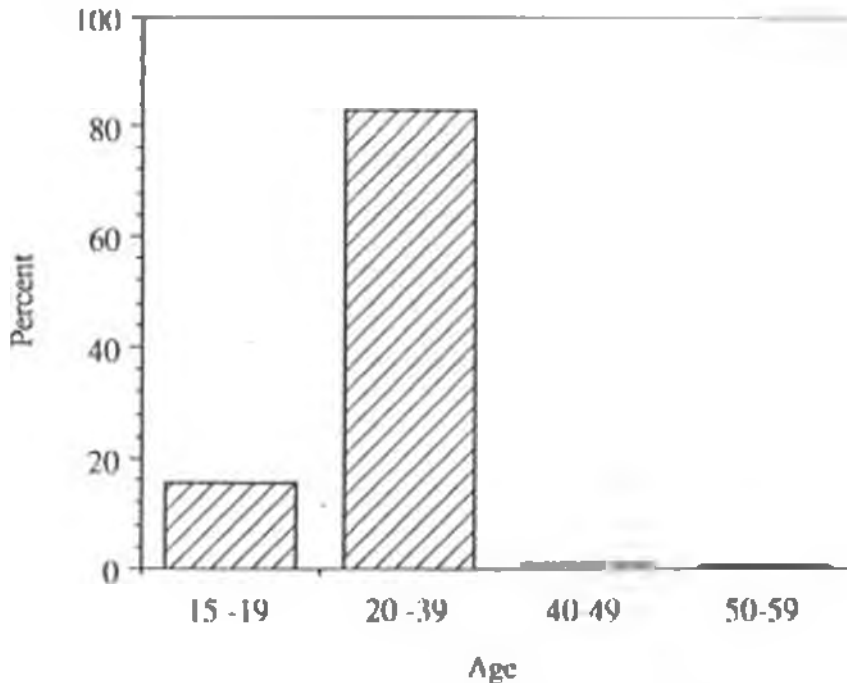
FIGURE 3:   DISTRIBUTION OF RESPONDENTS BY MARITAL STATUS

Marital Status
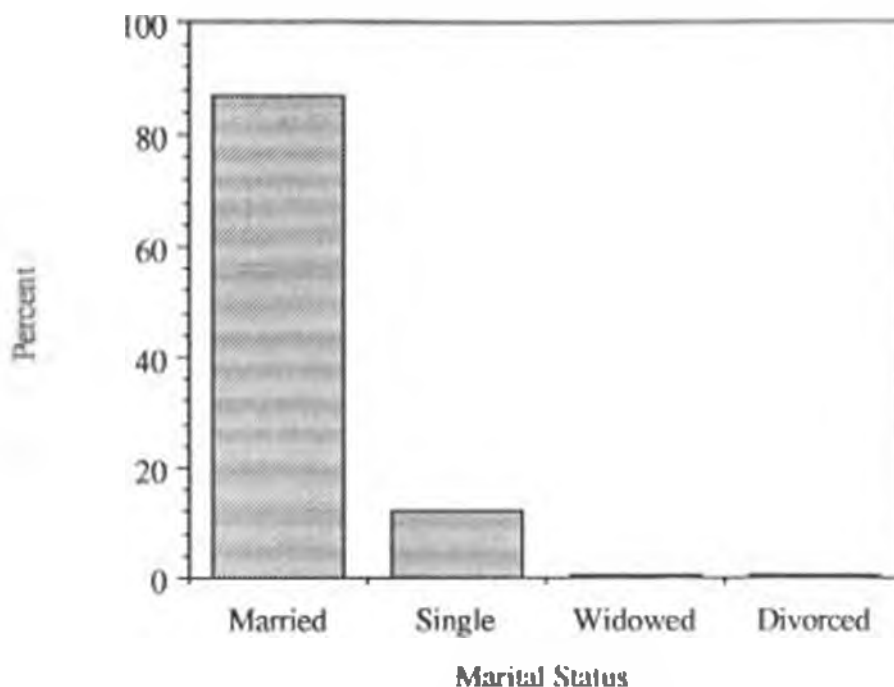
5.1.2   *Educational level of husbands and wives.*

More women (56.4%) had attended primary school than the men (33.7%), while more men

(66.3%) had higher school education than the women (45%).(Table 2)

TABLE 2:   DISTRIBUTION OF WIVES AND HUSBANDS BY EDUCATIONAL LEVEL

Level	Wife % N-422	Husband % N=371
Primary (Std. 1 - 8)	56.4	33.7
Secondary (Form 1 - 4)	34.1	49.3
High school (Form 5 - 6)	2.6	6.5
University	1.4	4.8
No formal education	5.5	5.7

5.1.3 *Occupation of the women and that of their husbands.*

The classification on occupation was based on the one suggested by Abramson (1984) (Appendix 1). All the women had some form of occupation except six who became pregnant when they were still students (Table 3). Despite their educational level, housewifes were included in the unskilled and semi-skilled category. The majority of the women (78.7%) were in the unskilled and semi skilled categories. Only 12.1% were in the skilled workers and clerical staff category and 7.3% belonged to the lower professional category. Only two of the women (0.5%) belonged to the higher professionals (Appendix 1). About the same number of the men (79.5%) were in the lower socio economic status while, a higher number of men than women were in the higher socio-economic status group.

TABLE 3: DISTRIBUTION OF WIVES AND HUSBANDS BY OCCUPATION

Occupation categories	Wives	Husband
	N=422 %	N=371 %
Higher professionals	0.5	4.3
Lower professionals	7.3	16.2
Skilled workers and clerical staff	12.1	57.1
Unskilled and semi-skilled workers	78.7	22.4
Students	1.4	

5.1.4 *Household income (of wife and husband).*

The women were asked to give an estimate of their total household monthly income. The majority of the couples (76.8%) were in the income bracket KSh (0-1999) per month, while 23.2% were in the KSh (2000+) per month bracket (Figure 4.0). For the women, income ranged between KSh 0-4497 per month. The mean was KSh 1235 while the mode was KSh 500. For their husbands income ranged between 50-9000 Ksh per month. The mean income was 1804 Ksh and the mode 1000 Ksh.

FIGURE 4 DISTRIBUTION OF RESPONDENTS BY THEIR HOUSEHOLD INCOME (N = 422). (Ksh 0-1999 = 76.8%, Ksh 2000 - 7999 = 20.9%, Ksh 8000+ = 2.3%)

KSh 0-1999
KSh 2000 7999
KSh 8000
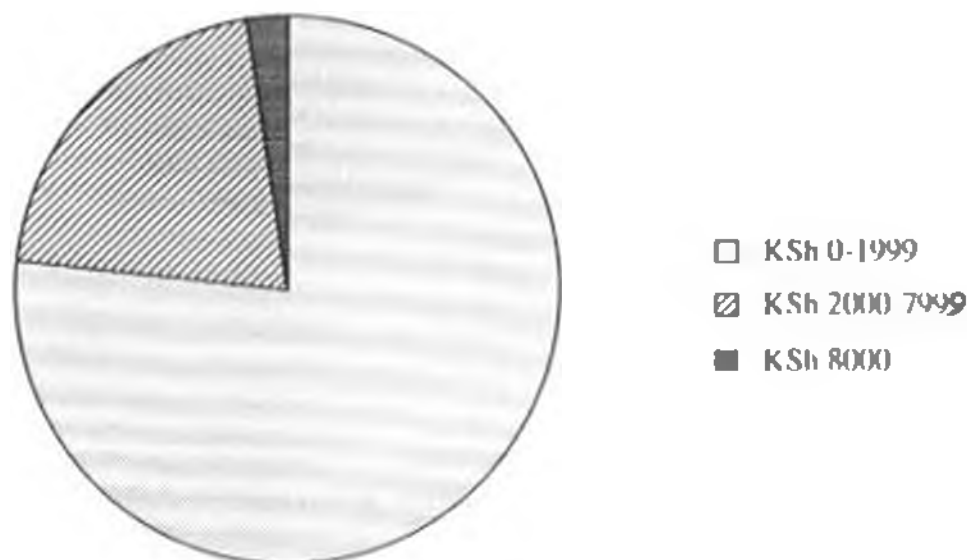
5.1.5 *Current stage of pregnancy*

Over half of the women (60%0)interviewed were in their third trimester of pregnancy.

36.9% in the second trimester and 3.1% in their in their first trimester (Figure 5.0)

FIGURE 5: DISTRIBUTION OF WOMEN BY TRIMESTER OF PREGNANCY (N = 422). (First trimester = 3.1%, second trimester = 36.9%, third trimester = 60%).
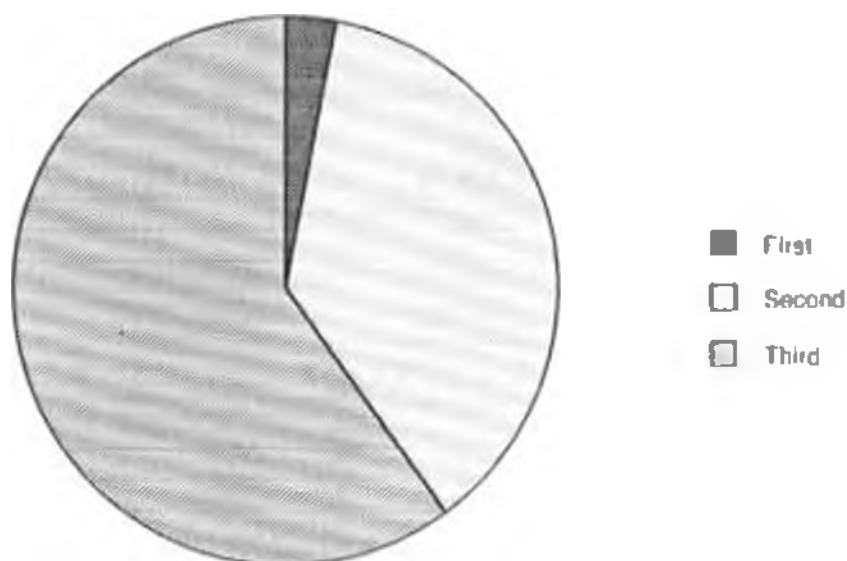
5.2.0 *Pica consumption and factors associated with the practice*

5.2.1 *Prevalence of pica consumption*

Table 4 gives the prevalence of pica practice among the pregnant women. the overall prevalence of pica consumption was 45%. Out of the 422 women interviewed, 79.1% had not practiced pica in previous pregnancies. Of these women, 71.1% do not currently

practice pica. Out of the 122 women who currently practice pica, only 17.2% had practiced pica in previous pregnancy. Results also indicated that there was no difference between pica consumption and previous exposure to the practice (P > 0.05). An estimated relative risk of 0.6 indicated that previous exposure was not necessarily a factor in pica consumption.

TABLE 4: DISTRIBUTION OF RESPONDENTS BY PICA PRACTICE.

	Pica group	Non pica group	Total
	(n)	(n)	(n)
Previous exposure to pica practice	21 (5)*	67 (15.9)	88 (20.9)
No previous exposure to pica practice	101 (23.9)	233 (55.2)	334 (79.1)
Total	122 (28.9)	300 (71.1)	422

OR = 0.6   df = 1 $X^2 = 1.2$ P > 0.05

*The figures in parentheses are percentages.

5.2.2 *Pica practice and SES*

The distribution of pica consumption by SES is shown in table 5. The overall prevalence of the women currently consuming pica substances was 28.9%, with the LSES representing 20.6% while the HSES represented 8.3%. An estimated relative risk of pica practice associated with SES was 0.7, meaning that LSES is not necessarily a factor in pica consumption. A chi-square test indicated that there was no difference in the prevalence of pica practice between the women of LSES and those of HSES.

TABLE 5: DISTRIBUTION OF RESPONDENT BY PICA PRACTICE AND SOCIO-ECONOMIC STATUS

		LSE'S		HSE'S		Total	
Pica Practice	Yes	87	(20.6)*	35	(8.3)	122	(28.9)
	No	237	(56.2)	63	(14.9)	300	(71.1)
	Total	324	(76.8)	98	(23.2)	422	

OR =0.7   df =1 X^2 = P > 0.05

*The figures in parenthesis are percentages.

5.2.3   Pica practice by age and trimester

Most of the women (77.9%) in the pica group were in the age category of 20-39 years, (Table 6.0). Twenty one percent were in the age category of 15-19 years while only 0.8% were in the age category of 40-49 years, and none in the last category. There was a significant difference in pica consumption between the ages ($P < 0.05$), with most of the women who consuming pica substances falling in the age category of 20-39 years.

Over half of the women (55.7%) in the pica group reported that they started the practice in their second trimester (Table 7). Thirty one percent started the practice in their first trimester, while 18.9% started in their third trimester. Results of a chi-square test indicated that there was a significant difference in the time of onset of pica consumption. Most women begin to consume pica substances in their second trimester.

TABLE 6: DISTRIBUTION OF THE PICA GROUP BY AGE. N=122

Age category (years)		
15 - 19[1]	26	(21.3)*
20 - 39[1]	95	(77.9)
40 - 49	1	(0.8)

df = 1 $X^2 = 39.4$ P < 0.05.
† Chi-square test is only possible for the first two age categories.
* Figures in parenthesis are percentages.

TABLE 7: DISTRIBUTION OF THE PICA GROUP BY TIME OF ONSET OF PICA CONSUMPTION (N=122).

Trimester		
First	31	(25.4)*
Second	68	(55.7)
Third	23	(18.9)

df = 2 $X^2 = 28.3$ P < 0.05
* The figure in parenthesis are percentage.

5.2.4 *Pica practice during pregnancy and in the absence of pregnancy.*

Out of the 422 women, 28.9% were currently consuming pica substances (Table 8) . Of the pica group, 17.2% admitted that they also consumed pica substances even when they are not pregnant, while 82.8% do not. Out of the 300 women, who do not currently consume pica, only 2 of them admitted that they eat pica substances even when they are not pregnant. Of the total number of women, only 5.5% practice pica in the absence of pregnancy. An estimated relative risk of 31 indicated that pica practice in the absence of

pregnancy is a factor in pica consumption during pregnancy. The results also suggest that pica consumption is mainly practiced during pregnancy than in the absence of pregnancy.

TABLE 8: DISTRIBUTION OF RESPONDENTS BY PICA PRACTICE DURING AND IN ABSENCE OF PREGNANCY.

		Pica practice in absence of pregnancy					
		Yes		No		Total	
Pica practice during		n		n		N	
	Yes	21	(5.0)*	101	(23.9)	122	(28.9)
pregnancy	No	2	(0.5)	298	(70.6)	300	(71.1)
Total		23	(5.5)	399	(94.5)	422	

OR= 31

X^2 and P values could not be calculated for this table.

5.2.5 Types of substances consumed.

Most of the women (37.7%) consumed loose soil (Table 9.0). The next most frequently consumed pica substances were roasted clay, termite clay and construction stone which were consumed by 22.1%, 14.7% and 13.1% of the women respectively. There was a significant difference in the frequency of consumption of loose soil, roasted clay, termite clay and construction stone among the LSES women ($P < 0.05$). On the other hand, there was no significant difference in the frequency of consumption of the same substances among the HSES women ($P > 0.05$).

TABLE 9:   DISTRIBUTION OF RESPONDENTS BY SES AND TYPES OF SUBSTANCES EATEN

Substance	LSES**	HSES***	Total	
Loose soil†	39	7	46	(37.7)*
Roasted clay†	17	10	27	(22.1)
Termite clay†	11	7	18	(14.7)
Construction stone†	11	5	16	(13.1)
Wall mud	6	2	8	(6.6)
Charcoal	3	0	3	(2.5)
Charcoal stones	0	2	3	(2.5)
River clay	0	1	1	(0.8)
Total	87	35	122	100

† - Chi-square test was only carried out for the first four substances to test whether there was any differences in the frequency of consumption of these substances.
* The figures in parenthesis are percentages.
** df = 3 $X^2 = 27.2$ $P < 0.05$
*** df = 3 $X^2 = 0.8$ $P > 0.05$

Results showed that there was a significant difference in the proportion of the women consuming the first four substances in the LSES (P< 0.05). There was no significant difference in the preference of the first four substances in the HSES group.

5.2.6   Quantities ingested

The amounts of pica substances ingested ranged from 5 g to 500 g per day, (Table 10.0) with the majority of women (75.4%) ingesting between 5-50 g per day.

TABLE 10: DISTRIBUTION OF THE PICA GROUP BY SOCIO-ECONOMIC STATUS AND AMOUNTS OF PICA SUBSTANCES INGESTED. N = 122

Weight (g)	SES (%)		
	LSES	HSE	Total
1 - 50	54.1	21.3	75.4
51 - 100	8.2	4.2	12.4
101 - 150	3.4	1.6	5.0
151 - 200	0.0	0.8	0.8
201 - 250	1.6	1.6	3.2
400	1.6	0.0	1.6
500	1.6	0.0	1.6
Total	70.5	29.5	100

5.2.7 *Reasons given for pica practice and perceived benefits of pica consumption.*

The majority of the women (76.7%) gave strong urge as the reason for pica consumption. The rest gave good taste, smell, flavour, general good feeling, relief of heartburn, nausea vomiting, increase of appetite, and stopping of saliva flow as the reasons for pica

consumption. Fourteen percent of the women reported that they simply did not know why they ate pica substances.

Most of the women (62.3%) reported that consumption of pica helped satisfy an urge that would keep them restless and fidgety until they consumed some. Twenty five percent reported that they derived no special benefit from pica consumption . About 6 % of them did not know of any benefit derived from pica consumption.

5.2.8   *Problems experienced and solutions sought.*

Only 25 women (21%) reported they experienced some problem while 78% reported no problem (Table 11). The most commonly reported problem was constipation and abdominal discomfort which was reported by 60% of the women. Other problems included diarrhoea and heartburn, and vomiting and faster heartbeat which were reported by 12% and 8% respectively.

TABLE 11.   DISTRIBUTION OF THE PICA GROUP BY PROBLEM RELATED TO PICA CONSUMPTION (N=25)

Problems	n	%
Constipation/Abdominal discomfort	15	60
Diarrhoea	3	12
Heartburn	3	12
Vomiting	2	8
Faster heartbeat	2	8
Total	25	100

Over half of the women, (52%) with problems did nothing about them (Table 12). Twelve percent stopped pica consumption altogether while 16% took milk and antacid tablets. Eight percent reduced the amounts ingested. Four percent in each case took plenty of water, oralite, and saw a doctor.

TABLE 12.   WOMEN'S OWN SOLUTION TO THE PROBLEMS($n = 25$).

Solution	n	%
Did nothing	13	52
Stopped consumption	3	12
Took milk/antacid tablets	4	16
Reduced amount consumed	2	8
Took plenty of water	1	4
Took oralite	1	4
Saw a doctor	1	4

5.2.9   *Mineral composition of pica substances   (Table 13).*

The elements that were found to be spread over all the samples were silica, aluminium, iron, calcium and potassium. Silica content was quite high, ranging from 19.75% to 28.71%. Aluminium content was relatively high with sample 6 and 7 (Table 13) having a content of 17 %. Iron content was moderately spread through all the samples with 4, 5 and 10 having above 6%. Calcium content was low but high in sample 2 and 11. There were significant amounts of titanium in samples 5 and 6. Potassium was fairly well spread throughout all the samples and was high in sample 11. The contents of the other elements were fairly low.

TABLE 13. MINERAL CONTENT OF SELECTED PICA SAMPLES (%) (n = 11).

Sample Nr	Si	Al	Fe	Ca	Ti	Mg	Mn	Zn	Pb	Cu	Cd	Co	Cr	K	Na	P
1	25.48	6.41	4.18	2.39	0.86	0.04	0.16	0.03	0.02	0.01	0.0	0.02	0.0	3.58	1.70	0.02
2	21.20	3.94	2.29	16.42	0.66	0.26	0.87	0.03	0.02	0.00	0.0	0.03	0.01	2.39	0.73	1.16
3	24.00	5.35	5.19	9.08	0.61	0.13	0.32	0.05	0.03	0.02	0.0	0.03	0.01	2.92	1.78	0.02
4	28.71	7.46	6.22	1.14	1.00	0.01	0.21	0.02	0.02	0.02	0.0	0.02	0.0	4.47	0.45	0.10
5	23.40	9.52	6.02	0.70	1.25	0.01	0.23	0.02	0.02	0.01	0.0	0.02	0.01	3.32	0.60	0.01
6	19.75	17.01	0.94	0.11	8.41	0.04	0.02	0.01	0.02	0.09	0.0	0.02	0.03	0.06	0.55	0.38
7	20.12	17.10	1.10	0.12	6.47	0.02	0.03	0.01	0.02	0.01	0.0	0.02	0.05	0.07	0.70	0.70
8	24.36	4.28	3.99	7.53	0.60	0.10	0.16	0.02	0.03	0.01	0.0	0.02	0.01	2.22	2.00	1.99
9	2.42	0.89	0.63	0.82	0.10	0.06	0.03	0.00	0.06	0.12	0.0	0.02	0.01	0.68	0.53	2.48
10	26.31	8.08	6.47	0.24	1.25	0.02	0.12	0.02	0.01	0.01	0.0	0.02	0.01	3.38	0.83	3.38
11	3.13	0.64	0.08	18.64	0.11	4.35	0.01	0.01	0.02	0.01	0.0	0.02	0.01	11.30	0.41	2.37

Key to the samples

1. Soil dug from a polpular cave near NCCK, Nakuru.
2. Soil dug from a polpular cave at Race course, Nakuru.
3. Termite clay dug out of an anthill, Race course, Nakuru.
4. Quarry stone (greyish) obtained from quarry site Race course, Nakuru.
5. Quarry stone (brownish) obtained from quarry site Race course, Nakuru.
6. Roasted clay bought from Gillani supermarket, Nakuru.
7. Roasted clay bought from a shop in Nakuru.
8. Treated termite clay obtained from an anthill, Ronda, Nakuru.
9. Jiko ash.
10. Charcoal stones.
11. Charcoal.

CHAPTER 6

DISCUSSION

6.1   *Pica prevalence and related factors.*

The observations in this study indicate that the prevalence of pica practice by pregnant women is 45%. This fits well with other studies where prevalences of between 40 - 75% have been reported (Worthington and Vermeersch, 1985; Jansen et al., 1987). It points therefore to the fact that a high proportion of the pregnant population consume pica substances, and therefore suggests further investigation.

That the practice is more likely to be common during pregnancy has been confirmed by other studies. Reed, (1980) observed that though pica consumption has been documented amongst children and non-pregnant women, it was more likely to occur among the pregnant than non pregnant women. Past exposure (previous pregnancies) does not necessarily predispose one to eating pica substances in the next pregnancy, as shown in this study, (section 6:2:1) since one is 0.6 times more likely to practice pica consumption when previously exposed as one who is not. Even though this was the case, this study also established that consumption of pica ad hoc, ie in the absence of pregnancy will most likely lead to pica consumption during pregnancy. The observation that the proportion consuming pica substances during the second trimester is significantly higher than the first and third trimesters, ($P < 0.05$) may most probably be related to maternal nutritional needs which are on the increase. Consumption of pica may help to get rid of the bad feelings brought about by biochemical and hormonal changes in pregnancy. Robson, (1985) suggested that cravings may be caused by mediating factors such as maternal and metabolic changes and changes in olfactory and taste sensitivity during pregnancy. This suggestion seems to lend more weight to the reasons given by the women for the practice. During the first trimester of pregnancy, the woman is still struggling with hormonal imbalance leading

to nausea, and therefore, the compulsion for other foods, or non-food substances is not so marked.

6.2 Effect of SES

As mentioned in section 2:1, some researchers (Christian and Greger, 1988; Suitor and Crowley, 1984) had indicated that pica practice was more prevalent in LSES groups. One of the objectives of this study was to determine the prevalence of pica practice in the LSES and HSES groups. On the contrary, this study established that there was no significant difference ($P > 0.05$) in pica consumption between the two groups. This implies that SES may not be an influential factor in determining pica consumption. From these observation, it may be reasonable to conclude that pregnant women from both the LSES and HSES groups practice pica consumption. This may be probably because pica consumption could be related to physiological factors of pregnancy that affects many women inspite SES.

6.3 Reasons for pica consumption

It was expected that the women who practice pica would shed some light on the underlined cause of the craving for non food substances. Instead the majority of them explained that they felt a strong compulsion to do so without giving any specific factors that drove them towards this urge. A few of the women (14%) confessed that they simply did not know why they consumed pica substances. Some researchers (Feildhouse, 1986 and Gachago, 1990) had also indicated that when women are asked why they practice pica they say they crave for the substances but do not know why. These unexplained factors have led to a lot of theories about the practice as shown in section 2.3.2.

Some few women, however gave some concrete reasons which are consistent with the observations of Fieldhouse, (1986) namely, good taste and smell, relief of nausea vomiting and heartburn, increasing appetite and stopping saliva flow. These reasons could represent a deep physiological need which needs to be investigated further.

6.4   Types of substances consumed.

The substances eaten appear to vary from one community to the other and also depend on availability. The substances reported in this study, namely, soil, termite clay, construction stone, roasted clay, river clay, charcoal and ash are different from those reported by Worthington et al. (1985), in America. These are burnt matches, cigarette ash, coffee grounds, inner tubes of tires, newspapers, paint chips, moth balls, toilet air fresheners, baking soda, laundry starch, egg shells and ice cubes. Hunter, (1973), working among the Ghanians and the Tiv of Nigeria reported mainly clay eating. This gives it a cultural dimension that people eat what they are exposed to and familiar with, and also what they can afford.

The search for pica substances has created a whole commercial dimension. Inquiries revealed that clay or soil is dug out of ant-hills or popular sites, boiled with salt, baked and then sold for money ranging from Ksh 5-Ksh 20, depending on the weight. There is also an imported brand from India sold mainly in Asian grocery shops and supermarkets known as roasted clay or *mahri*. The shopkeepers claim that this is treated although they are not willing to disclose how this has been done.

Results showed that there was a significant difference in the proportions consuming the first four substances, namely loose soil, roasted clay termite clay and construction stone in the LSES. This that the choices of the substances eaten by those in the LSES was influenced by SES, with most of the women consuming loose soil. Even though most women in the HSES group consumed roasted clay, there was no significant difference in the proportion consuming the first four substances (Table 4). An explanation for this could be that the LSES women ate what was within their reach particularly the loose soil, and that some could afford the roasted clay and it was easy for some to get the termite clay and

construction stone. On the other hand, the choices of substances eaten by the HSES women could have been purely by chance and not based on their SES.

6.5   *Mineral elements present in the pica samples.*

Some samples had fairly high levels of certain mineral elements. Silica was quite high and well spread through all the samples. This is understandable since these were earth substances and silica is the most common mineral in the earths crust. Carried by air, water, plants and animals, silica finds its way into human tissues concentrating in skin, bones, tendons, lymph nodes, trachea, lungs and aorta (Reed, 1980). Although the extent of silicon involvement in human metabolism is unknown, it has been shown to be essential in several animal species for collagen formation and bone calcification. Silica may cause toxicity leading to silicosis, a respiratory disease of miners who inhale large amounts of silica particles. Silica particles trigger fibrosis of the lungs and other tissues by over stimulating collagen formation. Perhaps ingestion of soil with high levels of silica could have been the cause of the woman who had fibroids (Section 2:3:1) and ate alot of soil. When the uterus was removed, the craving for the soil ceased. An increase in the incidence of malignant tumour formation is also associated with silicosis. From these findings, it is not healthy to ingest huge doses of clay or soil. The women in the study were taking in doses ranging from 5 g - 500 g of soil per day.

Aluminium content was also relatively high and spread through most of the samples. This is not surprising because aluminium is the third most abundant element in the earths crust and its compounds are widespread in soils. Of great interest, were two types of roasted clay which had a very high content of aluminium. These two are the two types of clays known as roasted clays or *mahti* and imported from India, and sold mainly in Asian shops. Although aluminium is present in trace amounts in biological material, it does not appear to be an essential element. Aluminium hydroxide is used therapeutically as an antacid.

Iron was also available in fairly high amounts in almost all the samples except four. These four were the two types of roasted clay, *jiko* ash and charcoal. During pregnancy, there is need for increased iron intakes to cater for the increased in material blood volume.

The importance of calcium for the formation of bones of the foetus during pregnancy cannot be underscored. There is likelihood that the pregnant woman relies on extra stores if her diet is deficient of calcium. It has also been reported in other studies that women eat egg and oyster shells and chalk which are rich in calcium (Reed, 1980), most likely due to a deficiency of calcium. Calcium was present in most samples in fair amounts except four. These four included the two types of roasted clay and *jiko* ash and stones normally found in the charcoal. There was a notably high percentage of calcium in one type of soil and in charcoal.

Phosphorus was not as abundant as other minerals discussed above. It was found in small amounts in samples of the charcoal group. It is clear charcoal is from wood and phosphorous is a major requirement in plant nutrition. Phosphorus is required along with calcium for bone formation and particularly so during pregnancy. Its deficiency may lead to craving for substances containing it.

Titanium was relatively high in the two types of roasted clay, but low in the other samples. Interestingly, the two types of roasted clay are imported from India and perhaps gotten from an area that is rich in titanium. Not much has been written about titanium and therefore its biological functions are not yet known.

Potassium is found in almost all food, and perhaps, this is the same for the soils. It is the body's principle intracellular electrolyte, important in maintaining the fluid volume inside cells and the acid-base balance (Whitney and Hamilton, 1987). This element was fairly

well spread out through all the samples but in moderate amounts. The highest levels were found in charcoal. The deficiency of this element is unlikely because of its abundance in nature.

Elements like magnesium, manganese, zinc, copper, cobalt and chromium were found in very small amounts. These could be useful to the body but are required in very small amounts (Whitney and Hamilton, 1987). Lead and cadmium which are toxic elements if ingestion in large doses were found in minute amounts.

6.6 *Problems associated with pica consumption.*

Some of the problems reported by some of the women namely constipation, abdominal discomfort and diarrhoea have been reported by other authors. These authors have also reported intestinal obstruction and in some cases, appendicitis (Suitor and Crowley, 1984; Muller et al., 1977; Hadar and Sella, 1979). Other problems observed as shown by case studies reported by Worthington and Vermeersch (1985), include tiredness, dizziness, anorexia, obstruction of birth canal during labour and wear and tear of teeth and death.

6.6.1 *Treatment action taken*

The observation that most women do nothing when they experienced problems is not unique in Kenya. In the case studies given by Worthington and Vermeersch (1985), it was discovered when problems were inevitably reported too late. This in essence means that pica practice has come to be accepted as normal. In the present study, the author has noted, and with a lot of concern, that at most antenatal clinics in Kenya no proper diet history is

taken and no questions at all are asked about pica practice, or if it is done, no follow up is

carried out. Therefore, nothing is ever documented about pica practice. So, any problems or complications arising from its consumption may never be known or may arise when it is too late. During the study, it was noted that some health-workers and gynaecologists attending to the pregnant women did not know the meaning of the word pica, or had never heard of it.

Pregnancy is a critical stage for both mother and foetus. Anything that the mother ingests during this time should be observed carefully because it would ultimately affect the outcome carried out. Enquiry on pica practice should always be made in normal clinical practice.

6.7   *Nutritional implications of pica consumption.*

6.7.1   *General observations*

The continous consumption of pica may have a negative impact on nutrition. In some cases it has been observed that women ingest large amounts of pica substances (Theuri et al., 1982). Consumption of pica substances can easily satiate appetite, leading to reduced intake of nutritious foods and this may subsequently result in dietary deficiencies. The problems reported like constipation, diarrhoea, heart burn, and abdominal discomfort could lead to reduced food intake thereby leading to deficiencies.

6.7.2 *The iron theory*

One of the strongest theories about pica consumption has revolved around iron. This theory suggests that women consume pica due to iron deficiency. In this study the analyzed pica samples (Table 13) showed fairly high levels of iron content except four. Even though the haemoglobin (Hb) and haematocrit (Ht) values of the women in this study were not determined, another study in Kenya (Theuri et al., 1982) had shown that there were no statistically significant differences in the Hb and Ht values of the pica and non pica groups.

Naturally, if pica consumption was due to iron deficiency, one would have expected to see higher levels of Hb and Ht in the pica group. It could, however, be possible that the iron is not readily available due to binding by some substances. Clay is known to bind iron Reed. 1980; Christian and Greger, 1988). This theory is still inconclusive and needs further research.

6.8 *Health implications of pica consumption.*

Consumption of soil substances from the road side or garden as was observed in this study is a big hazard considering that some of these substances may be contaminated or have parasite sand may lead to infections and ill health. Worthington and Vermeersch (1985) reported even more serious problems arising out of pica consumption (section 2.4). There is need for further research related to these complaints to establish their seriousness. Some pica substances may contain toxic components, and if taken in excess, may cause diseases. As discussed in section 2.4, lead intoxication can have serious effects on the nervous system, kidney and bone marrow and sometimes may lead to death. Ciachago (1990) also reported that excess consumption of silica may cause a form of elephantiasis, excess chromium may cause lung and liver cancer and that excess iron may lead to liver cirrhosis and fibrosis of the lungs.

CHAPTER 7

CONCLUSIONS AND RECOMMENDATIONS

7.1   *Conclusions*

Pica consumption is a common practice among pregnant women, although it occurs to a small extent among non pregnant women and children. The practice commonly starts during the second trimester of pregnancy. It was established in this study that pica consumption is not influenced by SES and past exposure.

The underlying causes of pica consumption were not very clear. The reasons given by the women for pica consumption point to an unexplained physiological need during this state of pregnancy, that still needs to be investigated further.

Analysis of pica substances consumed yielded some useful mineral elements like iron, calcium, phosphorus and potassium among others. However, more studies need to be carried out to establish whether there is a relationship between pica consumption and a deficiency of the elements.

The effects of pica consumption on nutrition are both positive and negative.The positive implications of pica consumption   in the analysed pica samples relate to presence of elements that could be useful to the body, namely, iron, calcium, titanium, magnesium, zinc, phosphorous and potassium. The most evident negative nutritional implications of pica consumption are: it could cause satiety, abdominal discomfort, nausea, vomiting and diarrhoea, leading to reduced dietary intake, which may in turn lead to deficiencies.
The health problems arising from pica consumption are many and varied as shown in this study and the case studies. The most evident are obstructions during labour, toxicity and parasitic infections.

7.2   *Recommendations*

1. The ministry of health, through its nutrition and health workers should help the women who consume pica substances because the practise has gone on for generations resulting into a habit that cannot easily be changed. This is a habit that is difficult to get rid of and cannot be condemned wholesome. Instead, the health and nutrition workers can educate the women on the practice by giving cautious advice on the limits of amounts ingested, the treatment of these substances before eating and the harmful effects.

2. Nutrition and health workers need to be made aware and sensitized to the prevalence and magnitude of pica practice and its possible implications. They should advice the women to treat the soil before eating them. During dietary counselling, the women need to be asked whether they practice pica, how much they ingest and the sources of these substances. They should then be followed up right to the time of delivery to see if there are any problems and to asses the pregnancy outcome. All this information should be documented to help future researchers in this area. Since some pica substances are now on the market, perhaps manufactures can come up with products that are nutritious and more palatable. But the Kenya Bureau of Standards should step in to see that these are made in conformity with the laid down health and hygienic standards.

3. Additional and detailed studies are still needed in this area and some suggested areas for further research are:

   (a) Determining the real cause of pica consumption

   (b) Establishing the relationship between pica consumption and dietary intake by carrying out a quantitative analysis.

   (c) Establishing the role of mineral elements in pica consumption particularly iron.

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APPENDICES

APPENDIX 1

Determination of socio-economic status.

Socio-economic status was determined mainly by using two variables, income and occupation.

Income (Gross) was based on figures obtained from the Urban Household survey, CBS, 1982.

Income status	Income bracket	Percentage of population
Lower income	KShs. 0 - 1999	76.77
Middle income	KShs. 2000 - 7999	20.89
Upper income	KShs. 8000 +	2.34

Occupation was based on a scheme suggested by Abramson (1984) with adjustments to reflect the Kenyan society.

Occupation	Socio-economic status
Higher professionals e.g. executive businessmen Large scale farmers, doctors, lecturers, accountants etc.	Higher socio-economic status
Lower professionals e.g. nurses secondary school teachers, government officers.	Middle socio economic status
Skilled workers and clerical staff	Lower socio-economic status
Unskilled and semi skilled workers	Lower socio-economic status

APPENDIX 2

QUESTIONNAIRE

PREVALENCE OF PICA AMONG PREGNANT WOMEN OF THE LOWER AND HIGHER SOCIO-ECONOMIC STATUS IN NAKURU MUNICIPALITY AND SOME NUTRITIONAL IMPLICATIONS.

INSTRUCTIONS:

[Use pencil for filling in the questionnaire. The codes for each question are listed immediately after the question].

FORM NUMBER:_____DATE_____

ANTENATAL CLINIC:_____

NAME OF INTERVIEWER:_____

NAME OF RESPONDENT:_____

SECTION A

1. Respondent's age (years).

2. Marital status:

>   1 = Married
>
>   2 = Single
>
>   3 = Widowed
>
>   4 = Divorced

3. Educational level:

        1 = Primary (Std 8)

        2 = Secondary (Form 1-IV).   i) wife

        3 = High school (Form V-VI)   ii) husband

        4 = University

        7 - Response refused

        8 = Do not know.

4.   Occupation:

      i) Wife_____

      ii) Husband_____

5.   a) Monthly income:

      (i) Wife_____(Ksh.)

      (ii) Husband_____(Ksh)

        Total_____(Ksh)

    b) Do you have any source of income?

       1 = Yes

       2 - No

       7 = Response refused

(If yes) Ask which sources and how much money do you get from each source per month.

Other sources of income	Kshs. per month
i)	
ii)	
iii)	

(Interviewer, add up total income and enter the appropriate number of the income bracket in the box).

1 = Between 0 and 1,999 Ksh per month

2 = Between 2,000 and 7,999 Ksh per month

3 = Above 8000 per month.

....

SECTION B

10. Do you eat any substance that is not food?

1 = Yes

2 – No

7 = Response refused

(if yes, ask: which substances)

1 = Soil

2 – Termite clay

3 = construction stone

4 = roasted clay

5 = Ash

7 = Response refused

8 = Other (specify).................................

(if no skip to Qn 18)

11. How many months old was the pregnancy when you started eating (Mention the substances identified above).

    1 = 1 - 3 months (1st trimester)

    2 = 4 - 6 months (2nd trimester)

    3 = 7 - 9 months (3rd trimester)

    9 = Do not know (DNK)

12. Why do you start eating (Mention the substances mentioned).

Substances	Reason for eating
a)	
b)	
c)	
d)	

13. Where do you get (Mention the substances mentioned) from?.

Substances	Reason for eating
a)	
b)	
c)	
d)	

14. How much does the respondent eat per day? Show me using this sample, approximately how much you ate. Interviewer, (Enter after weighing the amount).................................(g).

15. What benefit do you think you get from eating (mention the substances).

Substance	Benefit

16 a) Do you experience any problem after eating (mention the substance)

       1 – Yes

       2 = No

       7 – Response refused

       9 – Do not know

    (If yes, ask) which problem?.................................

b)   What have you done about these problems............................

17. Do you normally eat these substances when you are not pregnant?

> 1 = Yes
>
> 2 = No
>
> 7 = No response.

18 a) How many previous pregnancies have you had?

....

b) Did you eat any of these substances during the pregnancies?

> 1 = Yes
>
> 2 = No
>
> 7 Response refused
>
> 9 = Do not know

(If yes, ask) which substances?..

(If no stop the interview).

19 I would like to know if you experienced any problem after eating (name the substances) what you did about the problems.

Substance	Reason (why)	Problem	Solution
a)			
b)			
c)			