WEANING PRACTICES AND NUTRITIONAL VALUE OF COMMONLY USED WEANING DIETS IN PERI-URBAN COMMUNITIES IN KUMASI, GHANA

BY

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Thesis submitted in partial fulfilment of the requirement for the award of Master of Science Degree in Applied Human Nutrition, in the Department of Food Technology and Nutrition, Faculty of Agriculture, University of Nairobi.

SEPTEMBER, 1993.

DECLARATION.

I, EDUSEI ANTHONY KWAKU 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 work is dedicated to my dear wife Benedicta, for the loneliness she endured during my absence, and my late uncle James Kwaku Asiedu-Donkor, who was not only responsible for my education but also loved me till the point of his death.

ACKNOWLEDGEMENT.

I am most grateful to the gracious and merciful God, whose steadfast love and protection has seen me successfully through this work.

I would like to acknowledge with sincere thanks the generosity of the Swiss Development Co-operation (SDC), especially Mrs. I. Islamshah, without whose understanding and support my stay in Kenya would not have been possible. My special thanks also go to the International Development Research Centre (IDRC) of Canada, which sponsored the entire work.

Special appreciation goes to the entire department of Food Technology and Nutrition of the University of Nairobi, and its staff, especially the chairman Professor J. K. Imungi. Throughout my stay in Kenya he appreciated my problems as a foreigner, and responded promptly to them. I am also indebted to the Unit of Applied Nutrition of the same University, and the entire staff. Not only has the Unit served as a home for me throughout my stay in Kenya, but it has also enriched me academically. A special note of appreciation is extended to Drs. A. M. Omwega and N. M. Muroki of the Unit, for their special interest and the keen supervision they showed throughout the work. Their criticisms, suggestions, and contributions were worthwhile. I wish to extend my deepest appreciation to the Regional and District Medical Officers of Health in Kumasi, Ghana, for granting me the permit to carry

out the research. My special thanks also go to Professor Hutton A. Addy and Mrs. Ernestine Gyebi-Ofosu of the Department of Community Health, School of Medical Sciences, University of Science and Technology, Kumasi, Ghana, for placing their facilities at my disposal, and showing a keen interest in supervising the work while I was with them. Special recognition is also extended to Mr. Asenso and Ms. Georgina of the Biochemistry department of the same University for their services rendered during the laboratory analysis. The efforts of the research assistants, and willingness showed by the mothers in the Kumasi municipality in providing the required information to make this work successful cannot go unrecognized. To them I give many thanks.

Finally, my deepest gratitude also goes to Mr. E. K. Bani, my wife, and my brothers Osei, Adu-Abankro and Owusu-Yeboah, for their moral support and assistance in diverse ways.

DEFINITIONS.

Weaning: the introduction of foods apart from breast-milk to the child until the usual family diet becomes the main source of nourishment. Thus, weaning diets are the foods other than breast-milk being given to the children.

Peri-urban communities: the indigenous and transitional communities in the periphery of the metropolis, beyond six kilometres from the city centre.

House: as used in the context of this study is a building or a compound occupied by one, or as is usually the case, more than one family.

Household: a group of people usually comprising a couple, their children and other relations, living under the same roof and eating from the same pot.

Koko: the local name of maize gruel prepared from fermented corn dough. Few spoonfuls of sugar and either evaporated skimmed milk or a commercially prepared infant formula may be added before feeding it to the infant.

Tom Brown: a gruel prepared from a composite flour of wheat and beans.

Weanimix: a gruel prepared from a composite flour consisting of roasted maize, beans and groundnuts. May also be used as a supplement in other weaning foods such koko.

Gari: roasted cassava crisp prepared from fermented, grated cassava.

Banku: a thick porridge prepared from fermented corn dough. In certain places the corn dough is mixed with cassava dough in the ratio of three to one.

Kenkey: a semi-solid ball of cooked fermented corn dough. It is prepared by boiling the precooked dough wrapped in corn husk or banana leaves.

Vitalmix: a cereal-based infant diet prepared commercially.

Fufu: a semi-solid preparation from pound cooked plantain or yam and cassava, usually in the ratio of one to one.

Tuozaafi: a thick porridge prepared from a mixture of cassava and maize flour mixed in the proportion of three to one.

Emotuo: cooked rice made into semi-solid balls.

ABSTRACT.

The period of weaning is very important in determining the nutritional status of infants, since malnutrition in children under the age of five years starts mainly during the weaning period. International guidelines recommend exclusive breast-feeding until the infant is 4 to 6 months old, followed by introduction of suitable supplementary foods, appropriately given till the child is about 2 years, to reduce malnutrition and infection. However, in many societies the weaning practices are inappropriate. This work describes weaning practices, factors associated with it, and the nutritional value of commonly used weaning diets.

Women with children 2 years or below, in peri-urban communities of Kumasi metropolis of Ghana, were interviewed in a cross-sectional survey. One hundred and seventy-two mothers were randomly sampled and questioned on weaning practices, socio-economic characteristics and the dietary intakes of their children. Composition of the commonly used weaning foods, energy and protein intakes of the children were determined. The relationship between the weaning practices and the socio-economic characteristics of the mothers, as well as the results of two focus group discussions on weaning and other practices held, are also reported.

Despite the prolonged duration of breast-feeding, with mean shortest and longest periods of breast-feeding being 13.7 and 16.9 months, respectively, the frequency was low,

and abrupt stoppage was a common practice. Liquid weaning diets were introduced earlier (at 1-3 months) than recommended, but semi-solids were given at the appropriate time (between 5 and 7 months). The energy and protein intakes of the children were low, meeting only 49% and 90% of their recommended daily intakes, respectively. This was attributed to the low energy and protein densities of *koko,* the most commonly used liquid diet, and low energy and nutrient contents of other commonly used weaning diets. The duration of breast-feeding was significantly, negatively correlated with the mothers' educational level and occupation, possibly due to the fact that the more educated mothers introduce weaning foods earlier, and are mostly employed outside the home. The breast-feeding duration was, however, positively correlated with the daily income of mothers who earned less than 2000 cedis, since a higher income could lead to a better nutrition for the mother, therefore a prolonged breast-feeding. Among the illiterate mothers and housewives, the daily energy and protein intakes of their children were significantly, positively correlated with their age, possibly because the older mothers feed the children more food as they spend more time with them.

The design and implementation of a nutrition education programme, and a complete evaluation of the usefulness of home-made and recommended weaning diets is recommended to improve the weaning practices.

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ABBREVIATIONS

A.O.A.C	Association of Official Analytical Chemists.
BDH	British Drug House.
C	Cedi.
GDHS	Ghana Demographic Health Survey.
GDP	Gross Domestic Product.
GLSS	Ghana Living Standard Survey.
GOG	Government of Ghana.
GSS	Ghana Statistical Service.
HDLCA	High Density Low Class Area.
IDRC	International Development Research Centre.
IRD	Institute of Resource Development.
NNS	National Nutrition Survey.
UNDP	United Nations Development Programme.
UNICEF	United Nations Children's Fund.
NPU	Net Protein Utilization.
PEM	Protein-Energy Malnutrition.
SDC	Swiss Development Co-operation.
SMA	An infant formula brand (full name not available).
US-NCHS	United States- National Centre for Health Statistics.
WHO	World Health Organization.

INTRODUCTION.

1.1 Statement of Problem:

Malnutrition is a serious health problem in developing countries. Acting concurrently with infectious diseases, improper health care, and contaminated water supply, it is a major cause of mortality in post-neonatal infants and pre-school children in countries such as Ghana.

In Ghana, the eight major causes of mortality in under-fives, in descending order of importance are: measles, pneumonia, low birth-weight, malaria, anaemia, diarrhoea, severe malnutrition and tuberculosis (GOG, 1992). Though malnutrition seems less important in this regard, it is nevertheless a serious health problem in the country. The National Nutrition Survey (1986), showed that protein-energy malnutrition (PEM) was high among children 0-60 months of age. The survey revealed that 51.5% of the age group were stunted (height-for-age below 90% of the US-NCHS standard), 40.3% were wasted (weight-for-height below 80% of the standard) and 8% were clinically classified as suffering from marasmus and kwashiorkor.

The level of malnutrition in the urban areas has risen to almost the same rate as in the more vulnerable rural areas in the past few years. For example, in the urban areas, chronic malnutrition, i.e., stunting (less than 90% of the reference height-for-age) is 12.3% as compared to 22.8% in the rural areas; while acute malnutrition i.e., wasting (less than 80% of the reference weight-for-height) is 3.5% and 5.8% in urban and rural areas, respectively

(Kumar, 1985). Under-weight (less than 80% of reference weight-for-age) was found to be 23.5% in the urban areas as against 38.4% in the rural areas.

There are other nutritional deficiencies in infants and children. These include nutritional anaemia, which is aggravated by malaria and intestinal worm infestations. Vitamin A deficiency (prevalent in the northern part of the country), and iodine deficiency disorders which was found in 10.7% of the population surveyed in the Upper region are also reported (NNS, 1986; GOG, 1992). Estimates reported by the World Bank (1989) identify Northern and Ashanti regions as areas where part of the population are at risk of developing goitre.

The high prevalence of malnutrition in peri-urban communities is attributable to a combination of factors. These include water supply, unsanitary living conditions, high incidence of infectious diseases, poverty, widespread illiteracy and inappropriate breast-feeding and weaning practices.

International guidelines regarding infant feeding discourages supplementary feeding before the age of four months. This guards against microbial contamination, as well as feeding infants on foods of composition inferior to breast-milk, and early termination of breast-feeding (Jackson et al., 1992), which can lead to inadequate food intake, and malnutrition.

Though exclusive breast-feeding for the first 4 months of a child's life can avert the above-mentioned nutritional

problems, the practice is unusual in many developing countries. In these countries, children are given supplementary foods at an early age, followed by a prolonged period of mixed breast-feeding and supplementary feeding until the child is completely weaned off the breast (WHO, 1981; Latham et al., 1986).

The deteriorating nutritional situation in the peri-urban communities in Ghana can also be attributed to the high rate of urbanization in the major cities. According to the 1970 census, about 30% of all Ghanaians live in towns and cities. This level of urbanization is higher than that of most African countries, and is sustained by the migration of young male adults from the rural areas (Winikoff, 1979). Apart from causing a decrease in efficiency in food production, this migration can also have a serious implication on nutrition of the people. The urban youth, who stay mostly in the peri-urban areas, are unemployed, or are employed as casual labourers with no job security. Their lack of education and skills, and their inability to understand town life and expenditure patterns may adversely affect their nutrition and that of their families.

Of major concern is the adverse effects the modernization or urbanization has on the feeding practices of nursing mothers. In peri-urban Kumasi, like other cities, working mothers have had to introduce supplementary foods earlier than recommended, whilst teenage mothers mostly buy street-foods for their infants, and give little

care and attention to them, (Researcher's observation). Furthermore, most of the mothers from the low income groups cannot afford commercial infant foods, neither can they prepare foods specially for their weanling. The child is instead gradually introduced to adult foods, starting with softer, carbohydrate-rich varieties. Such foods do not contain all the nutrients a child needs. Furthermore, the foods are so dilute that the infant whose stomach is small cannot consume enough to meet the nutrient needs (Nurture, 1993). With regard to Kumasi, food availability per se is not a major problem as in most other places. The locally available foods could be used to meet the nutritional requirements of the weanling. However, due to ignorance, cultural factors, and financial constraints, this does not happen.

In an attempt to solve this problem, the Ministry of Health has recommended a specially formulated mixture consisting of a composite flour prepared from roasted maize, beans and groundnuts in the ratio of 4:0.5:0.5, by volumes of a standard household measure, for the weaning age child. However, perhaps due to economic and time constraints with respect to its preparation, the low income groups in the peri-urban areas are not using it. The children are, rather, given the locally available foods which are mostly given at the wrong time and in wrong combinations. There is, therefore, the need to assess the nutritional value of the commonly used weaning diets prepared from the locally available foods, and also study

the weaning practices of the area. This will help to provide proper guidelines by which the mothers can be educated to improve the nutritional status of their infants.

1.2 Justification of the Study:

Breast-feeding and weaning practices in a society are very important to both the breast-feeding infant and the health-worker. A decline in the lactation period, and the early supplementation or replacement of breast-milk with wrongly and unhygienically constituted foods could have serious implications on the nutritional status of infants. While contaminated foods may cause infections to the infant, early supplementation may result in inadequated nutrient intake, since the digestive system of the infant is not matured enough to ensure effective digestion. What is more, the intensity of breast-feeding may reduce with early supplementation (Akinrele and Edwards, 1971; Laditan and Reeds, 1976).

Breast-feeding, like other cultural practices has been adversely affected by urbanization. In most of the urban and peri-urban communities in Ghana, the mean number of months of breast-feeding has declined as compared to the rural areas. Urban women breast-feed for an average of 17.5 months, while rural women breast-feed almost 4 months longer (GDHS, 1988). The breast-feeding has been adversely affected in the urban areas by increased level of education and the economic activities of the mothers. Uneducated

mothers breast-feed 7 months longer than the most educated mothers. Most of the mothers in these areas have replaced breast-milk with food preparations which are usually unhygienically prepared, bulky and low in energy and nutrient content. These foods are mostly given only three times per day, and therefore, do not meet the nutritional requirements of the children. Their nutritional status is further aggravated by high incidence of infections.

The nutritional problems of the infants include deficiencies in protein, calories and certain minerals and vitamins (UNDP, 1969). Studies conducted in Accra and Danfa for instance, reported low protein and calories in the diets fed to vulnerable groups (Winikoff, 1979).

In the attempt to solve this problem, many conferences have been held aiming at bringing down mass malnutrition and associated health problems. The declarations adapted at the Bamako Initiative (1987), World Summit for Children (1990), and the International Conference on Nutrition (1992), all call for a plan of action on the survival, protection and development of the child.

Rising to these challenges, Ghana has already taken a number of strategies aimed at meeting the health needs of her children. In this respect, attention is being paid to nutritional problems of children through research, nutrition education, increased availability and use of appropriate weaning foods and supplementation in the case of micronutrient deficiencies (GOG, 1992).

The results of this study will, therefore, provide the

needed information that could be used by policy makers, nutritionists, researchers and field workers in an effort to improve the nutritional and health status of infants and children.

1.3 Purpose of the Study:

Research in the field of nutrition in Ghana is not extensive. One of the most recent comprehensive studies is the National Food and Nutrition survey undertaken by Davey and the staff of the National Food and Nutrition Council in 1960-62, about three decades ago (Winikoff, 1979). Prior to and after that, there has only been qualitative surveys undertaken by individuals and isolated studies on smaller populations. What is more, there is lack of food consumption data from most of the major towns, where urban "modern" life is likely to have influence on existing infant feeding practices. The study was, therefore, carried out to provide up-to-date information on weaning practices and food consumption data of the peri-urban population that has hitherto been lacking, for use by the appropriate personnel concerned with the improvement of health and nutritional status of infants and children in Ghana.

1.4 Statement of Objectives and Hypotheses:

The study tried to ascertain whether the daily caloric and protein intakes of the weanling meet the recommended daily intakes, and also if there is any association between the weaning practices and the socio-economic

characteristics of mothers in the peri-urban communities of Kumasi municipality in Ghana. As such, the objectives of the study were:

i) to describe the weaning practices of the peri-urban communities in Kumasi municipality in Ghana.

ii) to determine the socio-economic and cultural factors that influence weaning in the area.

iii) to determine the nutritional value of commonly used weaning diets in the municipality.

The underlying hypotheses for the study were:

i) the mean daily caloric and protein intakes of the infants being weaned were below the WHO recommended intakes,

ii) there is an association between the weaning practices and the socio-economic characteristics of the mothers.

CHAPTER TWO.

LITERATURE REVIEW.

2.1 Infant Malnutrition:

In most developing countries, children under five years of age suffer the highest mortality rate. In fact, under-five mortality constitutes more than half of all deaths in the developing world. The major causes of this trend of events is malnutrition and infection (Mitzner et al., 1984; Nurture, 1993).

Nutritional deficiency is a significant contributory factor in deaths caused by infectious diseases in these children. This has been confirmed by studies carried out in Central and South America, where nutritional deficiency was found to contribute over 60.0% of deaths caused by infectious diseases (Mitzner et al., 1984). According to the same authors, the synergistic effect between malnutrition and infectious diseases, most notably diarrhoea, and communicable diseases such as measles and whooping cough, has also been established.

From the fore-going, the serious health problems confronting malnourished children become quite obvious. These children have less resistance to infections than well nourished ones. Consequently, they fall ill more often and when they do, their illnesses tend to be more severe and prolonged.

Nutritional deficiencies endured in early childhood can also bring about growth retardation or faltering both

mentally and physically, a problem which may be carried into adulthood (Ebrahim, 1983; Nurture, 1993).

Growth faltering could be attributed to several factors including poor breast-feeding and weaning practices. Generally, most infants thrive well on their mother's milk alone in the first 3-4 months of life. This is a period of rapid growth, characterized by increases in body weight by 50.0% and length by 10.0% (Ebrahim, 1983). However, in most developing countries, the growth of a large proportion of the children begins to slow down after the first 3-4 months of life as a result of malnutrition. Growth in both weight and height is most severely affected between 3 and 12 months of age. The slowing of growth in the first year of life accounts for 91.0% of the deficit in body weight and 98.0% of deficit in length at the age of 3 years (Ebrahim, 1983). According to the same author, it was found that in Uganda, there was a sharp fall in the rate of weight gain between the ages of 3 and 6 months, and a further fall between 6 and 9 months to a rate half that of English children. Growth in height also suffers in the same way.

Such a faltering of growth in the latter half of the first year of life is characteristic of the majority of children in the third world. Although the rate of child-growth normally slows down with age, the lost ground occurring early in life is never recovered, and the deficit remains.

2.1.1 Factors contributing to Infant Malnutrition: According to UNICEF (1985), the primary threats to a child's nutritional status and health are usually posed during the weaning process, which is defined as the transition from breast-milk as the sole source of nourishment to the usual family diet (Mitzner et al., 1984). These threats are posed by certain high risk factors which are related to medical, social, economic and educational conditions. These, according to Mitzner et al. (1984), Cameron and Hofvander (1983), Oniang'o (1988), Ganjoo and Rowlands (1988), Jellife (1985), include:

a) Infections, which act synergistically with malnutrition;

b) Dietary inadequacies, a direct cause of nutritional deficiencies and the associated health problems;

c) Poverty in the family;

d) Low level of maternal education, resulting in ignorance and bad feeding practices;

e) Poor environmental sanitation and personal hygiene, leading to high rate of infections;

f) Early separation of the children from breast which may result in loss of appetite and vomiting;

g) Short duration of breast-feeding, and undesirable weaning practices, leading finally to malnutrition.

a) Infections: The relationship between infection and malnutrition has been established. Infection can

precipitate malnutrition, because the sick individual usually does not eat well due to loss of appetite and vomiting. What is more, illnesses such as diarrhoea, pain or discomfort, difficulties in breathing, restlessness and convulsions may interfere with feeding (Oniang'o, 1988). On the other hand, when energy and nutrients are not provided in sufficient amounts for the body to grow and function normally, deficiency diseases may occur. One of such diseases which is most common in the world is protein-energy malnutrition (PEM), which is caused by deficient intake of energy and protein (Cameron and Hofvander, 1983). Cameron and Hofvander (1983) reported that in some countries four out of five young children have some form of PEM. According to them, poverty and poor living conditions are the underlying causes, making it difficult for the infants to meet the daily energy and protein requirements which according to WHO are 1150 kcal. and 13.5 g respectively, for children under two years (Clive West, 1987).

b) Level of Education: The level of maternal education is known to influence the nutritional status of children in different ways. In a study carried out in India (Ganjoo and Rowlands, 1988), illiterate mothers were found to be ignorant about quantity and frequency of feeding semi-solid diets to their children. Educated mothers were however, breast-feeding for a shorter time. Most mothers usually are unaware of the value of high protein and energy-dense foods and of the measures necessary to prevent contamination of

food and water. Moreover, certain cultural beliefs may restrict the use of vegetable sources of calories and proteins, and other protein sources in weaning diets.

c) Breast-feeding and Weaning: Exclusive breast-feeding for 4 to 6 months of the child's life is recommended (Oniang'o, 1988). However, in some communities the children are weaned earlier. Such children stand a risk of higher rate of infection, particularly diarrhoea. This is because the diet changes from clean breast-milk which contains anti-infective factors, to ordinary family foods which are often prepared, stored and fed in unhygienic ways (Cameron and Hofvander, 1983). On the other hand, if the introduction of complementary foods is delayed, unnecessarily, the child can only manage for a short time by drawing upon its own energy stores, which may soon be exhausted, and the child may become malnourished (Ganjoo and Rowlands, 1988).

Ideally, weaning should be a gradual process, during which breast-milk is increasingly complemented with other foods that fully meet the needs of the growing child (Mitzner et al., 1984). If the child is abruptly taken off the breast, or sent away from the mother to be cared for by grandparents and other relatives, a more serious break in the contact between the mother and child occurs. This practice may have a harmful psychological and nutritional effect on the young child (Cameron and Hofvander, 1983).

d) Poverty: Poverty with associated low levels of hygiene and education, leads to most of the diseases seen in much of the developing world. It is also an important factor in

determining the nutritional status of young children. If a family has little land for cultivation, and is poor, parents will not be able to produce enough food to meet the energy and nutrient needs of its members. Furthermore, families cannot afford the more expensive nutritious food items for their young children.

e) Environmental Sanitation: Poor sanitation such as overcrowding, unclean water sources, and poor disposal of excreta or rubbish, can lead to the easy spread of diseases. For example, overcrowded housing leads to the spread of tuberculosis and respiratory infections, and poor waste disposal leads to spread of diarrhoea and intestinal worms.

2.2 The Weaning Process:

The weaning process is defined as the transitional change of infant diet from breast-milk to a diet that includes breast-milk and other foods, and finally to a family diet.

The patterns assumed by this process vary from one part of the world to another, and even from one part of a country to another, since they are affected by many factors which also vary. These factors include cultural and individual beliefs, taboos, traditions, recommendations of family and friends, lifestyle, local resources, and new cultural adaptations through urbanization. These variations in the weaning patterns occur in the breast-feeding practices, first foods which are given, time and frequency

at which they are given, and the main persons responsible for feeding the infants.

2.2.1 Breast- and Bottle-feeding: Breast-milk as the first food, meets all of a child's nutritional needs from birth to about six months of age (Passmore and Eastwood, 1986; Oniang'o, 1988). Insufficient breast-feeding, could therefore, have serious implications on the nutritional status of infants. In many parts of the developing world, the high incidence of infant malnutrition, diarrhoea, and other infections can be directly linked to decline in or lack of exclusive breast-feeding, and its replacement by wrongly or unhygienically constituted infant formulae (Neequaye, 1985). The practice of bottle feeding has aggravated the situation. In support of this point, Neequaye (1985) asserts that WHO statistics indicate that in countries where breast-feeding has been replaced by bottle-feeding, bottle-fed infants or those who are breast-fed for less than 6 months have a mortality rate 5-10 times higher in the second six months of life than infants breast-fed for 6 months or more. Other studies in some developing countries also suggested that mortality rates are higher for artificially fed infants than for breast-fed infants (GDHS, 1988). These studies seem to suggest that there is need for promoting prolonged breast-feeding among lactating mothers.

The duration of breast-feeding is reasonably long among mothers in the developing countries, especially those

living in the rural areas, and among the urban poor. Most of them breast-feed up to two years (Olivia, 1983). For example, in Ghana, women breast-feed on the average for 20 months (GDHS, 1988). Evidence from the same survey indicates that, on the average, mothers exclusively breast-feed their children for a period of 5 months. They, however, give supplementary food to their children during the remaining period of breast-feeding. In Ethiopia too, Almedom (1991) found that prolonged breast-feeding remained universal among all ethnic and religious groups studied, and weaning was initiated at the mean age of 9.2 months and completed at a median age of 20.0 months.

2.2.2 The Age of Weaning: It is generally accepted that there are no physiological, psychological, economic and nutritional advantages of early introduction of weaning foods. On the contrary, this may result in poor food habits, obesity, allergy, malnutrition, and growth retardation if the foods are solids (Uwaegbute, 1991). In some populations, the child is weaned so early that it is deprived of breast-milk, and given substitutes which are nutritionally inadequate. The consequence is marasmus at a relatively early age (Olivia, 1983). Furthermore, these foods may be unhygienically prepared due to insufficient cooking or inadequate storage, and therefore likely to give repeated episodes of diarrhoea to the infant. On the other hand, late introduction of solid food is not a good solution, since breast-milk ceases to be adequate to meet

the infant's needs between the ages of 4-6 months. The child may fail to thrive because of inadequate food intake. Marasmus can again result from such practices (Uwaegbute, 1991).

Commencement of weaning may not only be determined by the age of the child. It may also be determined by the quantity of the mother's breast-milk, availability of weaning foods, and the environmental conditions in the home (Mitzner et al., 1984). Weaning earlier than 4 months is not advisable since the diets may be contaminated, and cause diarrhoeal and other diseases to the child. What is more, the digestive system of the infant less than 4 months old is not matured enough to digest most of the weaning diets. Generally, however, it should not be after six months, since by this age, most infants need other foods in addition to breast-milk (Nurture, 1993). A period of 4 to 6 months of exclusive breast-feeding, followed by appropriate weaning diet and improved feeding practices up to 24 months, is thus recommended (Oniang'o, 1988; Nurture, 1993).

2.2.3 Length of the Weaning Period: The period when the infant is completely put off the milk is recommended to be not less than 24 months (Nurture, 1993; Oniang'o, 1988). Weaning may occur abruptly or gradually. In some cultures women put their children off their breasts by sending them away to relatives or smearing repellent substances on the breast. In most cases, before the mothers do this, they

would have introduced their children to other foods. This they do by shifting gradually from a predominantly milk and liquid diet to the normal family diet (Mitzner et al., 1984).

2.2.4 Weaning Diets: In many cultures the weaning diet consists of locally available starchy staples (Oracca-Tetteh, 1985; Mbugua and Njenga, 1992). In Ghana for example, weaning diets are prepared mainly from cereals, and to a lesser extent, starchy roots and tubers such as yams, cocoyams and cassava (Neequaye, 1985; Personal Observation). In Kenya, and probably other parts of Africa, the major cereals used are maize, sorghum, millet and rice (Oniang'o, 1988). Though the methods of preparation may differ from place to place, the ultimate product is a porridge or gruel.

2.2.4.1 Dietary Bulk, Viscosity and Energy and Nutrient Densities of the Weaning Diets: The weaning foods contain large amounts of water which reduces the energy and nutrient densities of the food. The reason behind this practice is that generally mothers prefer to feed their infants on liquid foods, because the dentition of their children is not well developed. What is more, most of the staple foods which are used in preparing the weaning diets are high in carbohydrate (mostly starch), resulting in gelatinous and bulky products. When cooked the starch granules in these foods burst with increased water uptake,

hence, a viscous product. To make these diets thinner and less viscous, water has to be added. In doing so, its volume is considerably increased and the nutrient and energy density greatly reduced.

Given that their stomach is small, these infants cannot consume large quantities of such thin porridge in order to meet their daily energy and nutrient requirements. A study in Tanzania for example, found that a child would have to consume 4-5 litres of the traditional gruel to meet its daily energy needs (Nurture, 1993).

Several technologies have been suggested for the improvement of the quality of weaning diets, in order to increase energy and nutrient density. Fermentation, sprouting and germination are some of the technologies which reduce dietary bulk and viscosity, and increase energy density (Oracca-Tetteh, 1985; Mbugua and Njenga, 1992). Fermentation can also confer anti-diarrhoeal properties on the diets, by inhibiting or killing some of the common diarrhoea-causing bacteria (Mbugua and Njenga, 1992; Muroki, 1992).

2.2.4.2 Protein and Micronutrient value of Weaning Foods: In Ghana, weaning foods made from cereals are generally low in protein, since the cereals are low in protein content, ranging from 9% to 12% (Oracca-Tetteh, 1985). The biological value of the little protein in the weaning diets is also low because of the poor amino acid profile of the

cereals. Most cereals are limiting in the amino acid lysine, thus limiting the utilization of cereal protein (Oracca-Tetteh, 1985). The net protein utilization (NPU) of maize is given as 36% (Passmore and Eastwood, 1986). Oracca-Tetteh (1972) reported NPU in maize gruel (*'koko' or 'akasa'*) and sorghum gruel, both used in infant feeding in Ghana as 44.5% and 50%, respectively.

Thus, the use of these as weaning foods alone would not provide enough protein of good quality for the proper growth of the weaning-age children. They need to be further enriched with energy-dense, and good quality protein foods. In Ghana for instance, mothers are advised to add protein-rich foods such as cow's milk, powdered fish or meat, groundnuts, and beans. However, most mothers do not practise this, perhaps due to financial and time constraints.

The weaning diets are also often deficient in micronutrients such as Vitamin A, iron and zinc. These deficiencies can diminish a child's appetite and immunity to infection, resulting in stunted growth, mental and physical handicaps, and even death. Such problems can be solved by supplementation (Nurture, 1993).

2.2.4.3 Feeding Practices During Weaning: Malnutrition is more than a food issue. Various habits, traditional beliefs about food, and feeding practices also affect infant nutrition.

Home prepared weaning diets are said to be the best

foods for the infants (Passmore and Eastwood, 1986; Cameron and Hofvander, 1983). However, it has been observed that some mothers, especially the teenage ones, often buy cooked food from the street for their children (Passmore and Eastwood, 1986; Personal Observation). Either lack of sufficient funds or time to prepare them at home could be the reason behind this practice. This is because mothers require almost the average amount of money needed to prepare a main meal for a household in order to purchase fuel and minimum quantities of the raw ingredients used in preparing semi-solid weaning diets. Therefore, mothers who cannot prepare these weaning diets from portions of the food purchase for the family diet, may find it "more economical" to buy from the street, the small quantity of food the weanling will eat before the family food is ready.

In most cultures, certain locally available foods are used by the indigenous people there. Due to urbanization, and for cultural reasons, many people have had to live among other ethnic groups, but have refused to use their foods though they could be useful nutritionally to their infants. In other cultures too, the protein-rich foods are given to the household heads, instead of the infants who have special needs for rapid growth (Cameron and Hofvander, 1983).

Considering the low energy and nutrient contents of the weaning foods, in addition to the small stomach sizes of the infants, mothers should be made aware of more frequently feeding during the day to ensure adequate food

consumption and nutrient intake. The frequency, however, depends on the age of the infant, and should be increased as the infant grows older, and breast-feeding becomes less and less (Cameron and Hofvander, 1983; Oniang'o, 1988). Feeding between 4 and 6 times in addition to the breast-feeding, is recommended (Cameron and Hofvander, 1983; Neequaye, 1985; Passmore and Eastwood, 1986). Again, mothers are advised to freshly prepare and give foods under hygienic conditions.

The early introduction of bulky, low-nutrient-dense starchy diets has been found to limit the infant's intake of breast-milk. At the same time, the child gets little or no vitamin and/or mineral-rich food supplements (Akinrele and Edwards, 1971; Laditan and Reeds, 1976). This explains the high prevalence of protein-energy malnutrition during the weaning period (Uwaegbute, 1991). In Ghana for example, Davey (1962) showed deficiencies in both calorie and protein intakes of children between 1 and 4 years (Winikoff, 1979).

Poor feeding practices, especially during weaning is no doubt a major contributory factor to malnutrition in infants in most developing countries. There is, therefore, a growing need for researchers to investigate the feeding patterns of the weaning-age children. This is particularly important in a country like Ghana where data on the amounts and types of food consumed by the weaning-age children in the peri-urban communities is lacking.

CHAPTER THREE.

STUDY SITE AND METHODOLOGY.

3.1 Background Information of the Study Area:

The study was carried out in the peri-urban communities of the Kumasi metropolis of Ghana. These are indigenous and transitional communities on the periphery of the metropolis, beyond six kilometres from the city centre. On the basis of density, income and house types, these areas are classified as the High Density Low Class Area (HDLCA), as shown in Fig. 1, (Kwame Arhin and Afari-Gyan, 1992). The transitional nature of these communities stems from the fact that as new people from the rural areas join, most of the older settlers move to better settlements when their economic status improves. The study subjects were children of 24 months old or below, with their mothers as respondents.

Kumasi, a town of about 400m above sea level, is second to Accra, the national capital, in size, population and economic activities. It is situated almost centrally (Fig. 2), in the forest belt of the country. It is the administrative, as well as the traditional capital of Ashanti region.

The population of the metropolis is about 200,000, with an estimated growth rate of 7 - 12% per annum. This high population growth rate is sustained by young, mostly male adults who migrate from the rural areas into the city. According to Winikoff (1979), it was estimated that 20.0%

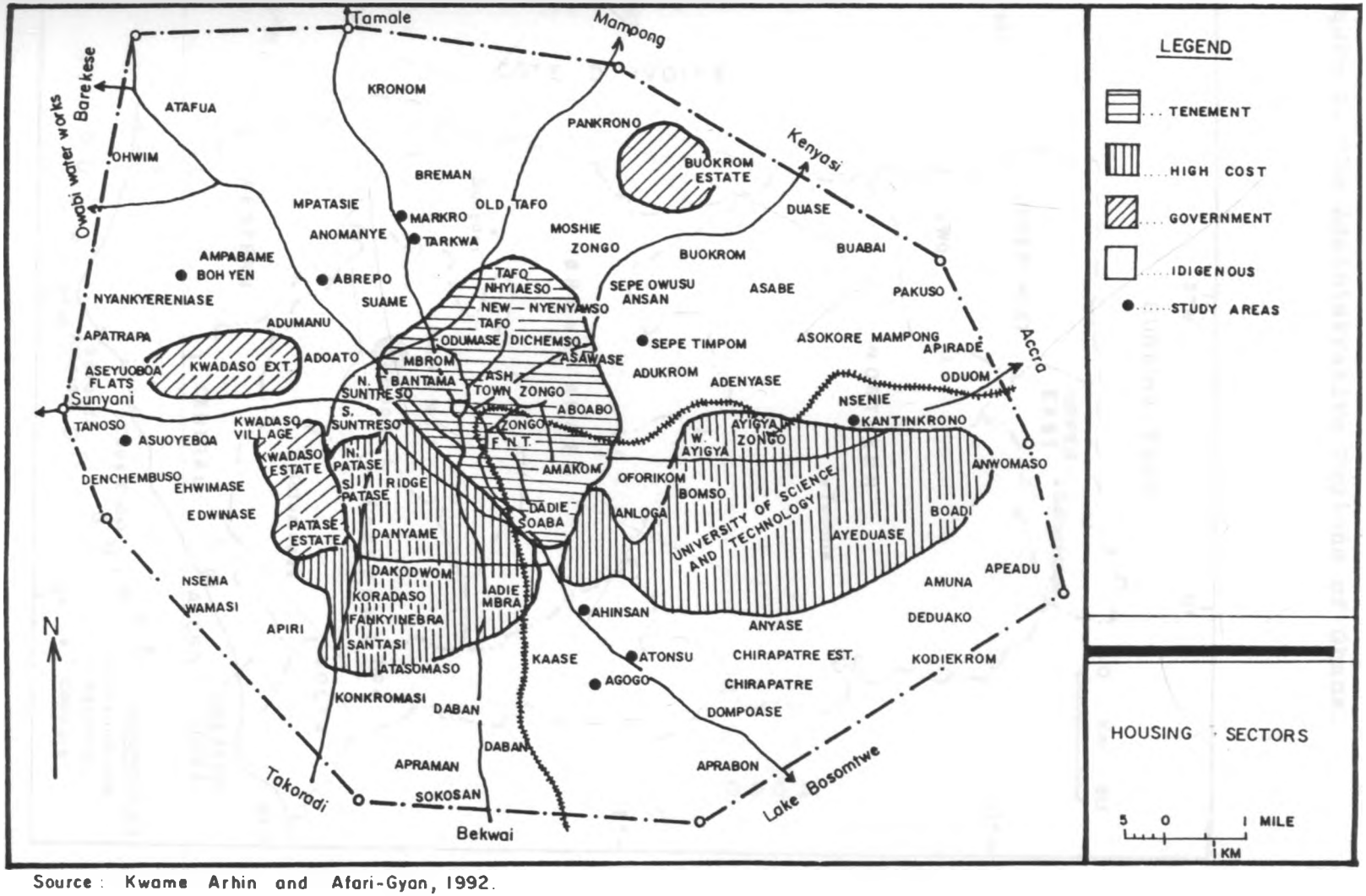
of the population were under 5 years of age, and 48.0% under 15 years. The proportion of the population over the age of 64 was about 4.0%. This signifies a high dependency ratio. Winikoff further gave the proportion of women in reproductive age (15-44 years) as being about 20.0%, and the crude birth rate as between 44 and 48 per 1000. The crude death rate was estimated to be about 17 or 18 per 1000 .

Health coverage is about 50% of the population. Maternal and child health services are adequate, especially in antenatal services (Winikoff, 1979). The metropolitan area has one public teaching hospital, five public clinics, and fifty-seven private hospitals/clinics (including the University hospital), (Kwame Arhin and Afari-Gyan, 1992).

Specific nutrient deficiency diseases have not been identified in Kumasi metropolis. However, World Bank (1989) identifies the area as among those at risk of goitre.

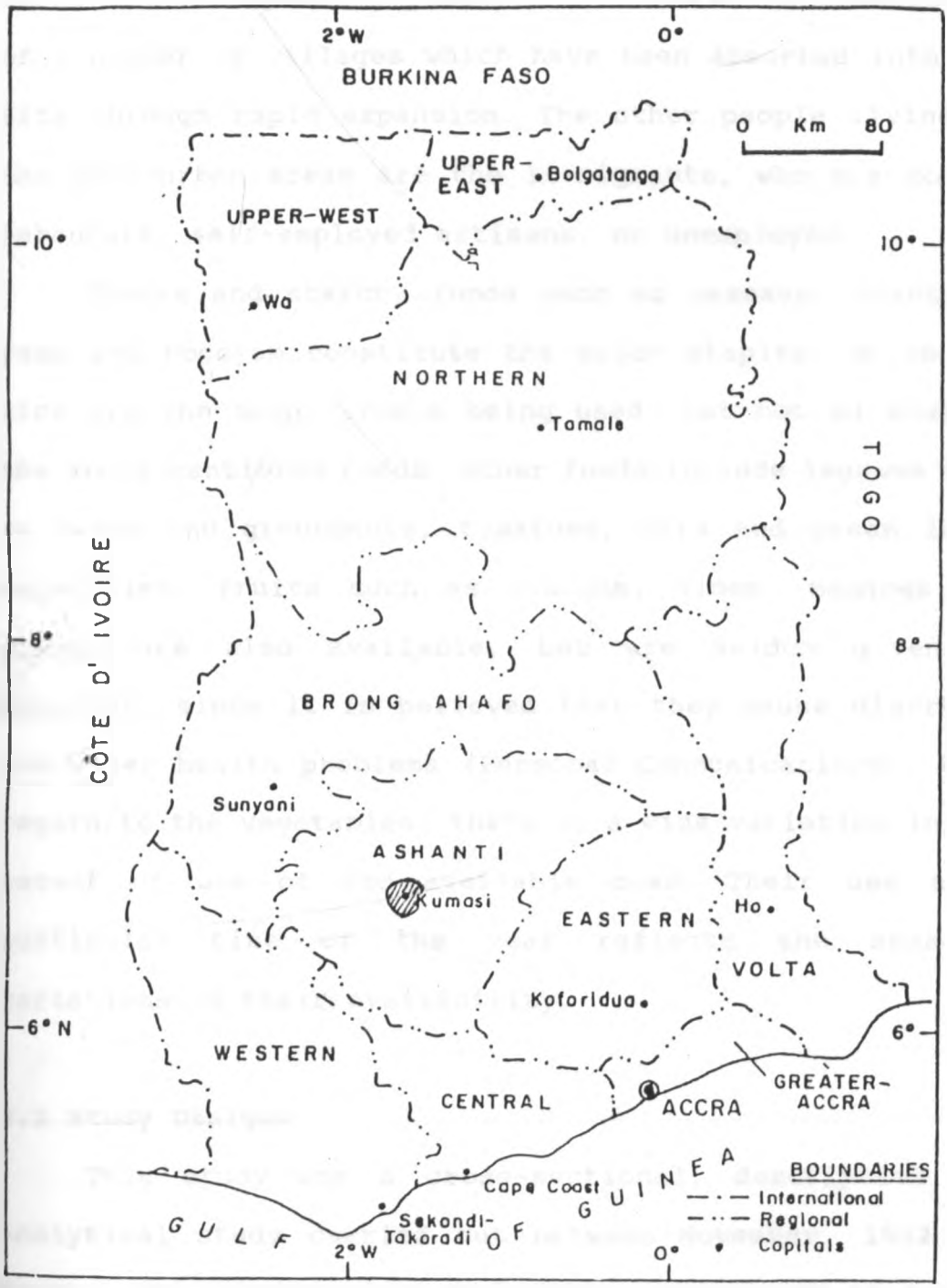
Unemployment level is high in the area, especially among the peri-urban dwellers. For this reason, though food availability is not a problem, thanks to the good road-network link between the city and other parts of the country, most of these urban poor may not or have little ability to purchase them.

Fig. 1. Kumasi metropolis by housing sectors (Dec. 1992)



Source : Kwame Arhin and Afari-Gyan, 1992.

Figure 2. The Administrative Regions of Ghana.



3.1.1 The People and their Foods: Majority of the people in the study area are Ashantis (one of the main tribes among the *Twi*-speaking people). These are the inhabitants of a number of villages which have been absorbed into the city through rapid expansion. The other people living in the peri-urban areas are the in-migrants, who are mostly labourers, self-employed artisans, or unemployed.

Tubers and starchy foods such as cassava, plantain, yams and cocoyam constitute the major staples. Maize and rice are the main cereals being used, but not as much as the above-mentioned foods. Other foods include legumes such as beans and groundnuts, tomatoes, okra and green leafy vegetables. Fruits such as oranges, limes, mangoes and pawpaw are also available, but are seldom given to children, since it is believed that they cause diarrhoea and other health problems (Personal Communications). With regard to the vegetables, there is a wide variation in the extent of use of the available ones. Their use at a particular time of the year reflects the seasonal variations in their availability.

3.2 Study Design:

This study was a cross-sectional, descriptive and analytical study carried out between November, 1992 and March, 1993, amongst the peri-urban communities of Kumasi metropolis, Ghana.

The study consisted of a survey and analysis of foods. The approach and methods employed are divided into sections

as follows:

3.2.1 Survey: The survey was carried out in three stages; the pilot study, the definitive study and focus group discussions.

3.2.1.1 Survey Tools: Interviews using structured questionnaire (Appendix 4), administered to mothers during a single visit to the selected households, was the major tool employed for the survey. For the purpose of validating some of the information obtained through the questionnaire, and extracting more, two focus group discussions, each with about eight participants were held. The survey was preceeded by a pilot study.

3.2.1.1.1 Pilot Study: The pilot study began with the preparatory phase which included such activities as getting research permit, ordering of equipment, making preliminary visits to the project sites and appropriate laboratories to arrange for the laboratory analytical component of the study, and getting pilot questionnaire ready. After this, two field assistants were recruited and trained for one week. The training consisted of four days of explanation of the purpose and objectives of the study, training in interviewing techniques using a questionnaire, and in field measuring techniques. The next three days were used for testing the assistants' ability in the field. Afterwards, the pilot study was carried out in order to test the survey

tools and planned methodology. The actual study followed almost immediately after reviewing and modification of the survey tools.

3.2.1.1.2 Definitive Survey: By means of structured a questionnaire, information was sought on weaning practices, weaning diets and socio-economic characteristics of the respondents (mostly the children's mothers). Information on the weaning practices included age at which weaning starts and breast-feeding ceases, the types of foods that are given to the children and at what age, the methods of preparation and service of the infants' diets, frequency of breast-feeding and feeding of the infants, and the main persons responsible for their feeding. Socio-economic characteristics included educational level, marital status, occupation, tribe, religion, daily income and their regular sources, and the taboos which affect food utilization and distribution.

3.2.1.1.3 Focus Group Discussions: In order to extract further information, or validate what had already been obtained, two focus group discussions, each lasting about one hour were held. The discussions were mainly centred on cultural factors that affect food utilization in the household, and weaning and breast-feeding in general (Appendix 4).

3.2.2 Sampling Methods:

3.2.2.1 Sample size Determination: A sample size of 172 mothers with their children 24 months or below was used for the study. This number was determined statistically, based on the energy requirement of children of the age group mentioned above as recommended by WHO (Clive West, 1987). Assuming the coefficient of variability of the energy intake of the children to be 10%, a mean intake of 958.3 kcal, with a standard deviation 95.83 kcal was determined. With the desire to estimate the mean energy intake of the children with 95% confidence, the sample size was calculated (Appendix 1), using the formula:

$$n = \frac{Z^2 \times V}{d^2}$$

where, Z = standard deviation at 95% confidence,
V = variance,
d = affordable difference between the estimate and the expected.

In order to allow for attrition, the figure thus calculated was increased by about 10%.

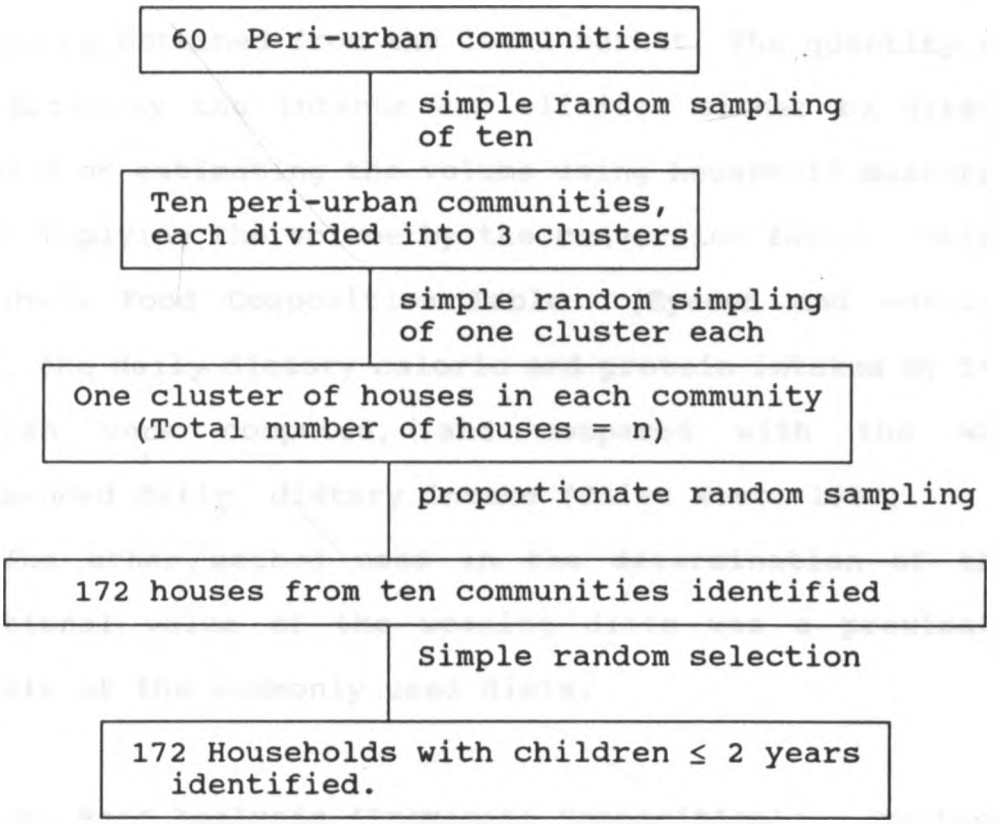
3.2.2.2 Sampling Procedure: A multi-stage sampling method was employed to randomly select 172 mothers with children who are two years of age or below for the study (Fig. 3).

Ten of the peri-urban communities in the municipality

were first selected randomly by simple random method. Using the Ghana Electricity Corporation consumer cards obtained from the regional electricity offices, each of the ten selected communities was divided into three clusters of houses, one of which was also selected randomly. With the same proportion, (172/N, where N is the total number of houses in the selected clusters) a number of houses proportionate to the size of the selected cluster, were randomly selected. From each house a household with a child and the mother who qualified was selected. If any of such houses contained more than one household with children who qualified, one was randomly selected. Furthermore, in the case where no child qualified in any selected house, it was replaced by the next house on the right with such a child.

For each of the focus group discussions, six of the ten selected communities were randomly selected, and a participant drawn from each. These participants who were mothers of similar characteristics in terms of age, marital status, and educational level were opinion leaders nominated by the chiefs in the selected communities. In the second discussion, however, four of the participants who failed to turn up were replaced by mothers with similar characteristics from the Centre for National Culture, Kumasi, where the discussions were held.

Figure 3. Sampling Scheme for survey on weaning practices in peri-urban Kumasi, Ghana (Dec., 1992).



3.2.3 Determination of the Nutritional Value of the Weaning Diets: The nutritional value of the weaning diets was determined by estimating the daily caloric and protein intakes of the children, using food composition tables, and carrying out laboratory analysis of food samples.

3.2.3.1 Daily Caloric and Protein Intakes by Food Composition Tables: The daily energy and protein intakes of the children were determined so as to assess the nutritional value of the weaning diets. The method employed was the 24-hour dietary recall method. By means of household measures, a conversion table was prepared by the

researcher, using a spring balance and measuring cylinder to determine the weights and volumes of cooked and raw foodstuffs obtained from the local market. The quantity of food eaten by the infants was elicited either by direct weighing or estimating the volume using household measures and multiplying the volume by the conversion factor. Using the Ghana Food Composition Table (Eyeson and Ankrah, 1975), the daily dietary caloric and protein intakes by the children were computed, and compared with the WHO recommended daily dietary intake (Clive West, 1987).

The other method used in the determination of the nutritional value of the weaning diets was a proximate analysis of the commonly used diets.

3.2.3.2 Food Analysis (Proximate Composition): Proximate composition analysis on commonly used weaning diets was carried out. Apart from *koko*, prepared and served with sugar only, the commonly used weaning diets which were analyzed were *Koko* prepared with corn dough and roasted groundnut (approx.4 : 1 w/w), *Koko* prepared with dry fish powder in the same proportion, and *Banku* with groundnut soup (40 g + 30 ml). *Weanimix*, a gruel prepared from a composite flour of roasted maize, cowpea and groundnuts (4 : 0.5 : 0.5, by volume of a standard household measure), and recommended by the Ministry of Health in Ghana, was also analyzed and compared with the mentioned ones.

3.2.3.2.1 Food Sampling: In all, four samples of each diet

were collected from different mothers who had been selected and interviewed, without prior notice.

3.2.3.3 Methods of Food Analysis: Moisture, protein, fat, crude fibre, and ash contents of the collected food samples were determined on wet basis in duplicate, according to the methods of A.O.A.C. (1980), in the laboratory of Biochemistry department of University of Science and Technology, Kumasi, Ghana. The carbohydrate content (including crude fibre) was determined by difference taking into account moisture, protein, fat and ash (Appendix 3). The energy content was determined using the ATWATER SYSTEM (FAO, 1982), by multiplying the carbohydrate, fat, and protein contents by the factors 4.03, 8.37, and 2.73, respectively.

3.3 Statistical Analysis:

The data obtained in the study was cleaned and analyzed using a computer at the Unit of Applied Human Nutrition, University of Nairobi. The entry and analysis of the data were done using D-Base III+ and SPSS/PC+ software, respectively. Student t-tests and correlations were carried out with significance level set at $p < 0.05$. One way analysis of variance (ANOVA) was also used to test the difference where there were more than two groups.

3.4 Reliability of Data:

The principal investigator maintained a close

supervision of the activities of the field assistants as well as hired personnel, to ensure accuracy and quality of data collected. In the course of the interviews, most questions were repeated to ensure a correct answer was given. Where relevant, supporting documents such as birth certificates were asked for in order to validate the information being sought. Furthermore, some of the questions on the questionnaire were preceded by others which would clarify the response required. At the end of each day's work, the researcher cross-checked every questionnaire for its completeness, and where any information was missing, another visit was made to the household to obtain it. Two focus group discussions, which considered some of the information that was being sought through the questionnaire were also held.

CHAPTER FOUR

RESULTS

4.1 Characteristics of the Study Population:

Results on the demographic aspect of the study showed that the mean age of the 172 children (96 males and 76 females) was 11.4 (± 6.4) months. Majority of the children (40.1%) were 6-12 months old, followed by those above 12 months (37.2%). The children in the age group 3-6 months constituted 15.1%, while 7.6% were less than 3 months old.

The demographic and socio-economic characteristics of the mothers are shown in Table 1. The mean age of the mothers was 26.1 (± 5.6) years, with a range of 17-42 years. Majority of these mothers were Akans (89.5%) (*Twi*-speaking people), with a few from the other tribes. Most of the mothers were Christians (82.0%), and in monogamous marriages (89.0%). Petty trading was the main occupation of slightly more than a half of the mothers (56.4%), while about 17.0% were housewives. Farming was not completely abandoned as a result of the urbanization, since 4.1% of the mothers were still dependent on it for their livelihood as peasants. Others were seamstresses or employees of restaurants and chop-bars.

The illiterate, categorized as those who had no formal education at all, and those who attempted primary school but could not complete were 42.4%. The literate were therefore 57.6%. However, among the latter, only

Table 1. Demographic and Socio-economic Characteristics of Mothers in peri-urban Kumasi, Ghana (Dec., 1992).

Variable		Number	%
Age (years):			
	< 18	11	6.4
	18.1 - 23	63	36.6
	23.1 - 33	81	47.1
	33.1 - 43	17	9.9
	Total	172	
Tribe:			
Akan		154	89.5
Eve		2	1.2
Others		16	9.3
	Total	172	
Marrital Status:			
Married (monog.)		153	89.0
Married (polyg.)		12	7.0
Single		7	4.1
	Total	172	
Religion:			
Christians		141	82.0
Muslims		17	9.9
Others		14	8.1
	Total	172	
Occupation:			
Petty trading		97	56.4
Housewife		29	16.9
Farming		7	4.1
Civil servants		6	3.5
Teaching		4	2.3
Others		29	16.9
	Total	172	
Educational level:			
None		27	15.7
Primary uncompleted		46	26.7
Primary completed		90	52.3
Secondary		5	2.9
Post-secondary		4	2.3
	Total	172	
Daily Income *			
< C 600		101	58.7
C 600 - C 1600		56	32.6
C 1600 - C 2600		10	5.8
> C 2600		5	2.9
	Total	172	

* Exchange rate at the time of the study was C 600 : 1 $ (US).

5.2% had their education above secondary school level. The daily income of the mothers ranged between 100 and 5000 cedis (C) (Ghanaian currency), an equivalent of 17 cents and 8.5 $ U.S.. The mean daily income was C1254.65 (±

C836.87) (2.03 $ U.S.). This distribution was however, not normal, since more than 60.0% received less than the mean daily income. The majority of the mothers (76.0%) spent more than half of their daily income on feeding the household. The mean proportion spent on household feeding was 0.7 (70.0%).

4.2 Dietary Practices of the Population:

4.2.1 Breast-feeding Patterns: The survey and focus group discussions revealed that breast-feeding was widely practised. At the time of the study, 81.4% of the infants were still being breast-fed. The results also show that mothers breast-fed for a reasonably long time, with 92.0% of them having breast-fed the previous child for periods ranging from 1 and 2 years (Table 2). The mean shortest and longest time of breast-feeding reported were 13.7 (± 8.4) and 16.9 (± 8.7) months, with medians of 15.5 and 18.0 months, respectively. This was in agreement with focus group discussions, which gave a period of one to one and a-half years for the breast-feeding.

The frequency of breast-feeding per day varied widely among the mothers, but most breast-fed between 5-10 times per day (Table 3). Table 3 further shows that while 61.6% of the infants under-3 months were breast-fed 5-10 times, 50.0% of the infants between 3 and 6 months old were breast-fed 5-8 times per day. About a third of children 6-12 months of age, and those above one year were breast-fed 5-8 times per day.

Table 2. Breast-feeding Practices by Mothers in peri-urban Kumasi, Ghana (Dec., 1992).

Variable	Number	%
Shortest time of breast-feeding:		
< 1 year	6	5.8
1 - 2 years	95	92.0
> 2 years	2	2.0
Total	103	
Longest time of breast-feeding:		
< 1 year	1	0.01
1 - 2 years	103	92.8
> 2 years	7	6.3
Total	111	

Table 3. Distribution of frequency of breast-feeding per day by age of infants in peri-urban Kumasi, Ghana (Dec., 1992).

	Frequency of breast-feeding per day							
	<5		5-8		8-10		>10	
	*#	%	#	%	#	%	#	%
Age of children (months):								
< 3	3	23.1	4	30.8	4	30.8	2	15.4
3 - 6	1	3.8	13	50.0	11	42.3	1	3.8
6 - 12	17	25.0	23	33.8	20	29.4	8	11.8
> 12	7	21.2	11	33.3	8	24.2	7	21.2

*# Number of children.

With regard to the method of stopping breast-feeding, majority of the mothers (94.9%) did this abruptly, either by physically separating the children from them, or applying a repelling substance on the nipples of their breasts (Table 4). As shown in the Table, some of the repellants used were plaster (45.9%) and chloroquine capsules (29.7%).

Table 4. Breast-feeding Stoppage and types of repellents used by Mothers in peri-urban Kumasi, Ghana (Dec., 1992).

Methods of stopping breast-feeding:	Number	%
gradually	6	5.1
abruptly	64	54.2
physical separation from mother	11	9.3
applying a repellant	37	31.4
Total	118	
Repellants used:		
plaster	17	45.9
chloroquine	11	29.7
red-clay	3	8.1
talcum powder	2	5.4
corn dough	1	2.7
feathers or cotton wool	2	5.4
gentian violet	1	2.7
Total	37	

4.2.2 **Infant Feeding and Weaning Practices:** The weaning period in the peri-urban communities varied from child to child, mother to mother and also on the type of food. Generally, weaning began as early as two days after birth (for only few mothers) to as late as seven months. According to the focus group discussions, it is usually between 2 weeks and 4 months after birth. However, the participants said that it depends on the eating habits of the child, amount of breast- milk produced by the mother and mother's activities.

4.2.2.1 Introduction of First Weaning Foods:

4.2.2.1.1 Types of Food: The first locally available liquid weaning diet given by most of the mothers (36.9%) was *koko,* with sugar added to taste (Table 5). Some of the mothers (29.9%) were adding about 3 or more spoon-fuls of

evaporated skimmed milk or *lactogen* or *SMA* (Infant formulae milk with cow-milk base) before giving the *koko* to their children. *Lactogen*, was the most commonly used infant formula. Surprisingly, however, *weanimix* which is recommended for use by the Ministry of Health in Ghana, and fruits were rarely used.

Table 5. First liquid weaning foods received by infants in peri-urban Kumasi, Ghana (Dec., 1992).

Liquid Foods;	No. of mothers (N = 153)	%
koko + sugar (exclu.)	58	36.9
koko + lactogen + sugar	35	22.3
koko + sugar + milk	12	7.6
lactogen	15	9.6
other infant formulae	14	8.9
koko + sugar + g'nut	4	2.5
weanimix	4	2.5
koko + sugar + dry fish	3	1.9
koko + soy bean	3	1.9
koko + sugar + egg	2	1.3
orange	3	1.9
other fruits	0	0.0

The results further show that the weaning diets which were mostly given as the first semi-solid diet were rice with stew, *cerelac* (ready-to-eat infant cereal-based food), and *banku* by 33.3%, 25.6%, and 13.7% of the mothers, respectively (Table 6).

Table 6. First Semi-solid weaning foods received by infants in peri-urban Kumasi, Ghana (Dec., 1992)

Semi-solid Foods;	No. of mothers (N = 117)	%
rice with stew	39	33.3
cerelac	30	25.6
banku	16	13.7
fufu	9	7.7
mashed yam	7	6.0
kontomire stew	6	5.1
tuozaafi	4	3.4
emotuo with soup	3	2.6
others (kenkey, mashed plantain, custard)	3	2.6

4.2.2.1.2 Weaning Age: The age of introduction of the first liquid food apart from breast-milk to the child varied widely, with a mean of 2.2 (± 2.4) months and a median age of 2.0 months. As shown in Table 7, a majority of the mothers (85.5%), introduced it before the infant was 3 months old. As regards the semi-solid foods, apart from *cerelac* which 17.3% of the mothers gave about a month after birth, about half of them (51.1%) started giving the rest between 5 and 7 months.

Table 7. Distribution of Mothers by age of introduction of First Weaning food received by infants in peri-urban Kumasi, Ghana (Dec., 1992).

Age (months) of introduction of:		Number	%
First Liquid foods:	0 - 1	79	49.7
	1 - 3	57	35.8
	3 - 5	16	10.1
	5 - 7	4	2.5
	> 7	3	1.9
	Total	159	
First Solid foods:	0 - 1	24	17.3
	1 - 3	13	9.4
	3 - 5	27	19.4
	5 - 7	44	31.7
	7 - 9	11	7.9
	9 - 11	6	4.3
	> 11	14	10.0
	Total	139	

The age of introduction of most commonly used weaning foods identified as *koko* with sugar, *lactogen,* rice with stew, *banku* with soup, and *fufu,* are shown in Figs. 4 and 5. Over a third of the mothers (36.9%) introduced their children to *koko* with sugar, followed by 33.3%, 13.7%, 9.6%, and 7.7% who introduced rice with stew, *banku*, *lactogen*, and *fufu*, respectively. Whereas most mothers who were giving *lactogen* started giving it a week after birth, majority of those who were giving *koko* gave it when their infants were 2-3 months old. As the infants grew, the proportion of mothers giving *lactogen* decreased. With regard to semi-solid weaning foods, majority of the mothers started giving them 6 months after birth. Generally, by the time the children are about 10 months old, most mothers had already introduced some semi-solid foods.

Figure 4. Distribution of mothers by age of introduction of commonly used liquid weaning diets given to infants in peri-urban Kumasi, Ghana (Dec., 1992).

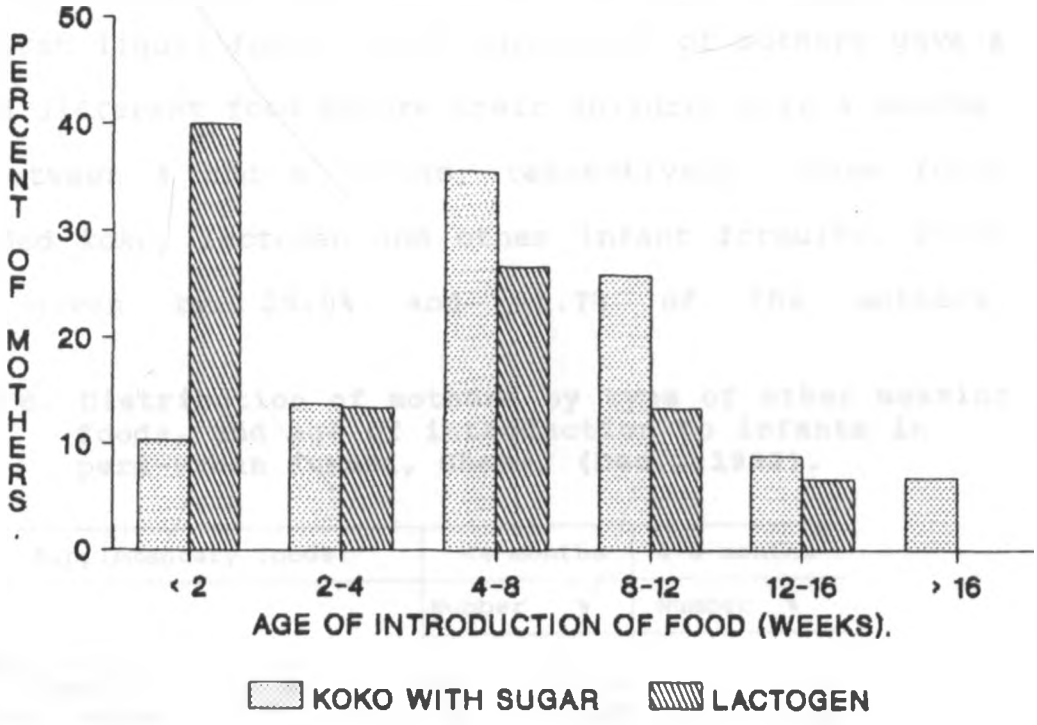
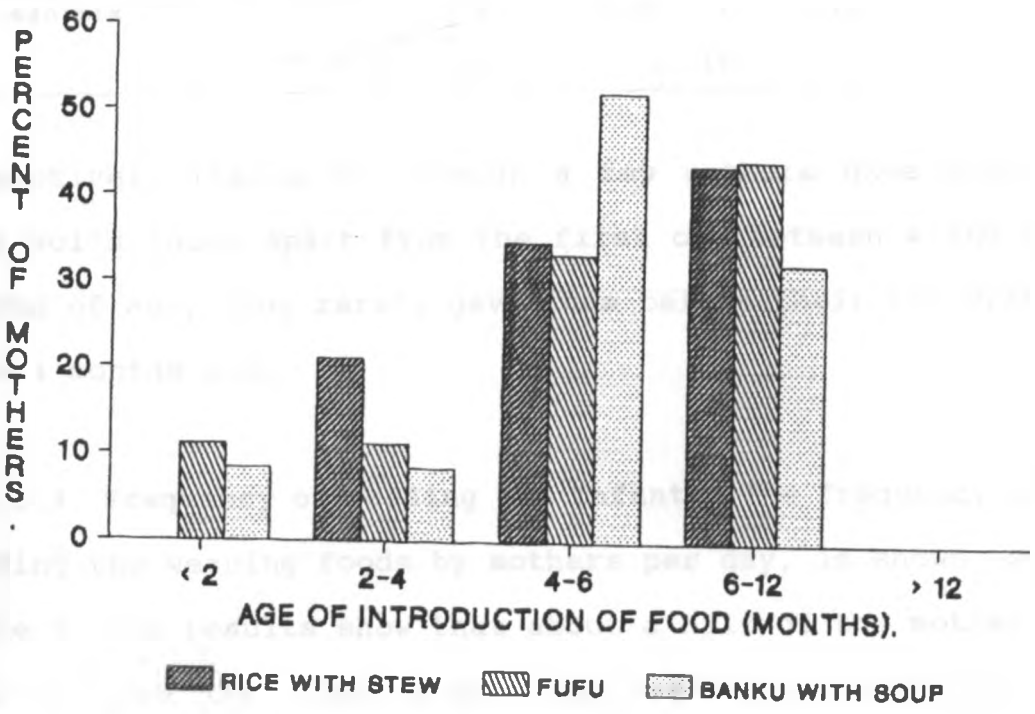


Figure 5. Distribution of mothers by age of introduction of commonly used semi-solid weaning diets given to infants in peri-urban Kumasi, Ghana (Dec., 1992).



4.2.2.2 Other Foods given during Infancy: The study showed that some of the mothers did not give the same type of liquid food throughout the weaning period. Apart from the first liquid foods, 20.9% and 11.0% of mothers gave a second different food before their children were 4 months, and between 4 and 6 months, respectively. These foods included *koko, lactogen* and other infant formulae, which were given by 25.0% and 41.7% of the mothers,

Table 8. Distribution of mothers by type of other weaning foods, and age of introduction to infants in peri-urban Kumasi, Ghana, (Dec., 1992).

Supplementary foods:	<4 months		4-6 months	
	Number	%	Number	%
other infant formulae	10	27.8	5	31.2
koko + sugar	9	25.0	3	18.5
lactogen	5	13.9	3	18.5
koko + sugar + lactogen	3	8.3	-	-
koko + sugar + groundnut	2	5.6	-	-
orange	2	5.6	1	6.2
light soup	2	5.6	2	12.5
koko + sugar + milk	1	2.8	1	6.2
koko + sugar + dry fish	1	2.8	-	-
weanimix	1	2.8	1	6.2
Total	36		16	

respectively (Table 8). Though a few mothers gave other semi-solid foods apart from the first one between 4 and 6 months of age, they rarely gave them before their children were 4 months old.

4.2.2.3 Frequency of Feeding the Infants: The frequency of feeding the weaning foods by mothers per day, is shown on Table 9. The results show that about a half of the mothers (51.0%) gave the first liquid supplementary diets three

times per day. The additional liquids given before 4 months were also given by almost an equal proportion of mothers (52.8%) three times per day. Between 4 and 6 months, most mothers (42.1%) gave liquid foods once per day. Unlike the liquid foods, the majority of the mothers (64.2%) gave the semi-solids once or three times per day.

Table 9. Distribution of mothers by frequency of feeding weaning foods to infants in peri-urban Kumasi, Ghana (Dec., 1992).

Freq. per day	First liq.		Other liq. (< 4 mon.)		Other liq. (4-6 mon.)		First solid	
	#	%	#	%	#	%	#	%
1	12	7.6	5	13.9	8	42.1	43	36.8
2	32	20.4	5	13.9	2	10.5	22	18.8
3	80	51.0	19	52.8	5	26.3	32	27.4
4	17	10.8	2	5.6	2	10.5	5	4.3
5	11	7.0	3	8.3	-	-	2	1.7
6	4	2.5	-	-	-	-	-	-
irregular	1	0.6	2	5.6	2	10.5	13	11.1
Total	157		36		19		117	

4.2.2.4 Use of Commercially prepared weaning diets: The use of commercially prepared weaning diets is shown in Table 10. Over half (64.0%) of the mothers used various commercial preparations, with the main ones being *lactogen*, *cerelac*, evaporated skimmed milk, and *Nido*. These were used by 44.0%, 43.1%, 20.2%, and 16.5% of the mothers, respectively. Most of the mothers, however, used more than one type.

Table 10. Distribution of mothers by type of commercially prepared weaning diets used in peri-urban Kumasi, Ghana (Dec., 1992).

Type of commercial food.	Number,	%
lactogen	48	44.0
evaporated skimmed milk	22	20.2
cerelac	47	43.1
nido	18	16.5
others	24	21.8

For the mothers who did not give commercially prepared weaning diets, money was the major limiting factor. The other reasons given by 14.3% and 11.1% of the mothers, respectively, were; the child did not like the foods, and the mother herself did not want to use them.

4.2.2.5 Reasons for introducing Semi-solid food: The mothers gave various reasons for introducing semi-solid foods to their children. About a third of the mothers (32.4%) gave the foods because the infants were willing to eat them, whilst about 21.0% of the mothers felt the breast-milk was not sufficient. Other reasons given by 19.8%, 12.6%, 5.4%, of the mothers were, mother's previous experience, child's refusal to eat liquid foods, and advice from health workers, respectively. A few mothers (8.1%) also introduced the semi-solid foods to enable the children learn how to eat them.

4.2.2.6 Methods of Preparation of Infant Diets and Feeding: Most mothers (65.9%) prepared their infants' diets

separately, while 14.1% fed them from the family pot, and 20.0% fed them either way. The reasons advanced by the mothers who prepared the diets separately were: (i) the infants' need for special diets or richer foods, (ii) the infants being the only persons who will eat that food, and (iii) the infants' inability to eat adult foods. Those who fed the infants from the family pot felt that they were old enough. Lack of money was another reason.

The results of the study show that majority of the infants were fed by their mothers (84.9%). Other infants either fed themselves or were fed by their older siblings or grandmothers. The feeding of the infants was mainly by hand done by mothers (86.5%), using cup and spoon (48.8%), and bottle (31.8%). Some of the mothers, however, combined more than one method of feeding.

4.2.2.7 Other Weaning Practices from Focus Group Discussions: There are other weaning practices that came to light through the focus group discussions. For instance, participants said that alternating the available weaning diets, and sometimes addition of spices improved the flavour and therefore intake by infants. Mothers also pointed out the importance of home preparation of the weaning diets rather than buying from the streets.

As for foods that are not suitable for the weanling, participants were of the view that it was difficult to declare some foods unsuitable for all children, because

though some infants may have problems in eating a particular food others might not. However, they mentioned foods like cassava (in all forms), *fufu* (by a few of them), and groundnut paste sold on the market, as unsuitable. Some also mentioned *cocoyam,* especially when it is hard, while one participant mentioned rice cooked with oil and eaten without stew, since the oil "could cause fever". Too much pepper was also considered not good.

Asked which locally available foods are good for use as weaning diets, but are not being given, some mothers mentioned *kontomire* (cocoyam leaves), fruits and other dishes like *tuozaafi*, a dish prepared from maize, cassava and a lot of green vegetables. Some mothers did not attach much value to fruits as they neither ate them nor gave them to the children. Others also believe that fruits like mangoes, pawpaw and oranges could cause diarrhoea in both the lactating mother and her infant. They also believe that orange reduces milk volume. *Tuozaafi*, is also not being given by most of the Akans for cultural reasons. They believe it is a food for the Northerners. Some mothers also mentioned fish and meat as good for the infants, but are being withheld from them for fear that they may grow to love them, and end up stealing the little the family can afford to buy.

The focus group discussions further revealed that feeding patterns of the infants change during such illnesses as measles, fever and diarrhoea. In such a situation, participants said that semi-solid foods are

withheld and only liquid foods are given to the sick infants. The reasons the participants gave for this practice were: in the case of measles "the children develop soars in the mouth", and during fever "they loose appetite and feel lazy to chew". Rice for instance, was said not to be good for a child with measles, since during coughing, which was said to be a common occurrence in this illness, some rice might enter the wind-pipe. During measles and fever some mothers give their children hot pepper-soup. Frequency of breast-feeding was also increased. During diarrhoea, some participants said they give ORS, whereas others give the liquid portion of rice-porridge or mashed plantain (without oil). Some participants said giving orange juice would aggravate diarrhoea. This was, however, disagreed with by one participant who supported her stand by quoting a radio programme which had advised them to use tomato juice. This implied that participants were not certain on the use of fruit juices to control diarrhoea.

4.3 Nutritive Value of the Weaning Foods:

4.3.1 Energy and Protein Densities of *Koko*: The results showed that the energy and protein densities of the maize gruel *(koko)*, the most commonly used locally available

diet, is very low for most or the mothers (Figs. 6 and 7). The energy density ranged from 0.18 to 1.99 kcal/ml, with a mean of 0.77 (± 0.36) kcal/ml, whilst the protein density ranged from 0.005 to 0.04g with a mean of 0.014g (± 0.008) g/ml.

The average serving volume for koko was 194 mls, though there were few mothers who served more. Using the mean energy and protein densities of the *koko*,

Figure 6. Frequency distribution of mothers by energy density of koko, a liquid weaning diet prepared by mothers for their infants in peri-urban Kumasi, Ghana (Dec., 1992).

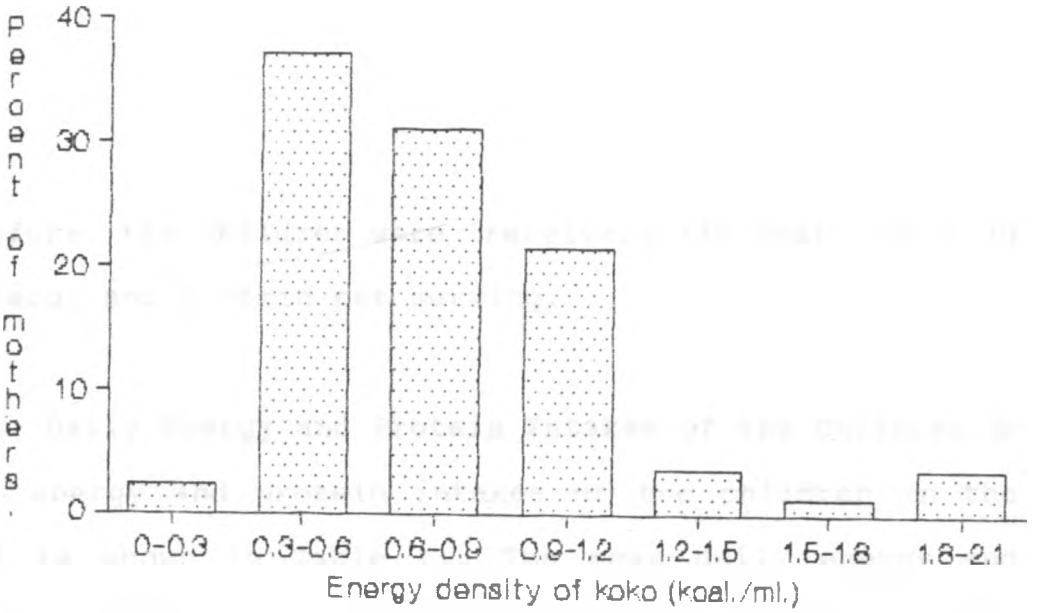
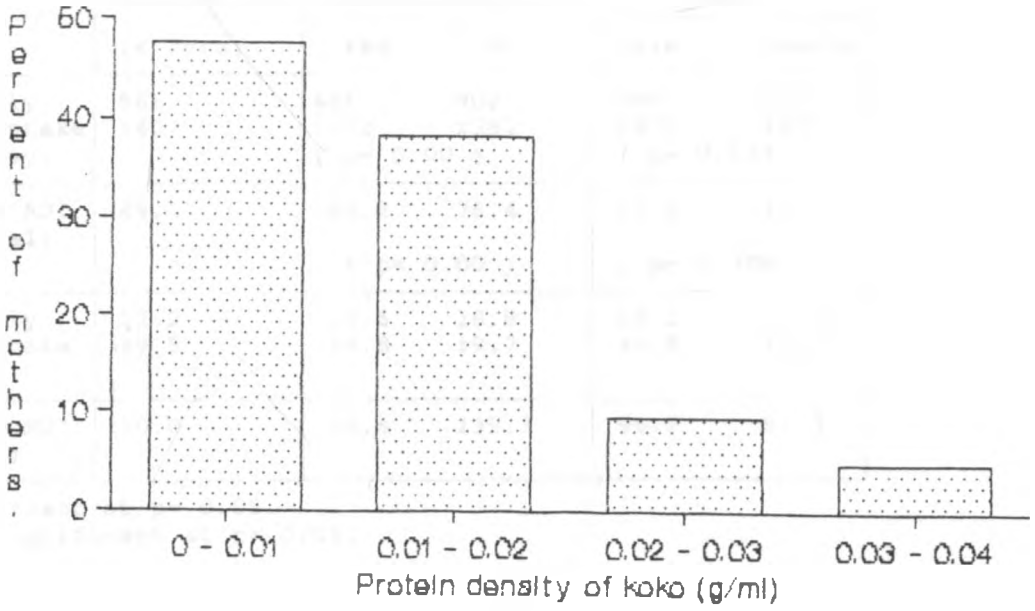


Figure 7. Frequency distribution of mothers by protein density of koko, a liquid weaning diet prepared by mothers for their infants in peri-urban Kumasi, Ghana (Dec., 1992).



therefore, the children were receiving 149 kcal. and 2.7g of energy and protein per serving.

4.3.2 Daily Energy and Protein Intakes of the Children: The daily energy and protein intakes of the children in the study is shown in Table 11. The mean daily energy and protein intakes of the study population were 565 (± 407) kcal. and 12.2 (± 9.5) g, respectively. Though the mean daily intakes of non-breast-feeding children was significantly higher than breast-feeding ones, that of the different sexes did not differ significantly.

Table 11. Mean Daily Energy and Protein intakes by Breast- feeding status and Sex of Weaning-age children in peri-urban Kumasi, Ghana (Dec., 1992).

	Entire pop. (< 2yrs)	Breast-feeding*		Sex**	
		Yes	No	male	female
Mean Daily Energy Intake (kcal/day)	565 ±407	485 ±372	902 ±381	596 ±433	525 ±371
		(p= 0.00)		(p= 0.534)	
% of WHO RDI (1150 kcal)	49.1	42.2	78.4	51.8	45.7
		(p= 0.00)		(p= 0.308)	
Mean Daily Prot. Intake (g/day)	12.2 ±9.5	10.6 ±8.8	18.8 ±9.7	13.1 ±9.8	11.0 ±9.0
% of WHO RDI (13.5g)	90.0	78.4	139.3	96.9	81.3

* significant at p= 0.05.
** not significant at p= 0.05.

4.3.3 Proximate Composition of Commonly used Weaning diets: As shown in Table 12, the energy, crude fat, protein and total carbohydrate contents of *koko* with groundnut is higher than that of *koko* with dry fish ($p< 0.05$). Moisture, however, is significantly higher in the former. Apart from the protein contents which is significantly higher in *weanimix, koko* compares favourably with it. Compared to *weanimix, koko* with dry fish is significantly lower in almost all the components. The results further show that *koko* prepared without any additional food material is essentially water. *Banku* with groundnut soup, a solid food is higher in protein, fat and carbohydrate, than all the liquid foods.

Table 12. Proximate Composition of common weaning diets fed to infants in peri-urban Kumasi, Ghana (Dec., 1992). (Figures indicate amounts per 100g of wet food).

Food item	Energy (kcal)	Moisture (g)	Ash (g)	Crude fibre (g)	Crude fat (g)	Protein (g)	*Total Carbo (g)
Koko with groundnut	69.3	82.6	0.2	0.4	0.5	1.7	15.0
Koko with dry fish	54.5	85.7	0.2	0.3	0.1	2.1	11.9
Weanimix	78.6	79.9	0.3	0.5	0.5	2.6	16.7
** koko	24.0	94.1	0.2	0.2	0.2	0.6	5.0
Banku with g'nut soup	105.3	63.7	0.5	0.9	3.4	6.4	25.9

* Total Carbohydrate.
** Figures taken from Eyeson and Ankrah, (1975).

4.4 Correlations:

'Weaning practices' which was looked at in terms of age of introduction of the first liquid and semi-solid weaning foods, the last, longest and shortest period of previous breast-feeding, daily energy and protein intakes of the children under the study, and the energy and protein densities of the maize gruel being used, was found to be correlated with some of the socio-economic characteristics of the mother.

The correlations between the weaning practices and the socio-economic characteristics of the mothers are shown in Table 13. The mother's educational level, daily income and proportion of it spent on feeding the household had no significant correlation with the age of

Table 13. Pearson correlation coefficient and p-values ($p<0.05$) of the correlation between weaning practices and socio-economic characteristics of mothers in peri-urban Kumasi, Ghana (Dec.,1992).

		Age	Tribe	Educ.	Occu.	Daily income	Propor. of inc.
Age of intro. first solid (among Akans)	r	.150	-	-	-	-	-
	n	(150)					
	p	.034					
Longest b-feeding period		.658	-	-.193	-.268	*.192	-
		(84)		(138)	(84)	(138)	
		.000		.039	.007	.012	
Shortest b-feeding period		.618	-	-.221	-.285	*.181	-
		(84)		(84)	(84)	(138)	
		.000		.022	.004	.017	
Last breast-feeding period		.622	-	*-.218	-.271	*.169	-
		(84)		(138)	(84)	(138)	
		.000		.005	.005	.024	
Protein density		-	-	-	-	.387	-.279
						(84)	(84)
						.000	.005
Daily Energy intake (housewives)		.396	-	-	-	-	-
		(28)					
		.018					
Daily Energy intake (illiterates)		.218	-	-	-	-	-
		(70)					
		.035					
Daily Protein intake (housewives)		.343	-	-	-	-	-
		(28)					
		.037					
Daily Protein intake (illiterates)		.188	-	-	-	-	-
		(70)					
		.059					

* If mother's daily income is less than 2000 cedis.

introduction of the first liquid or semi-solid foods. Though the age of introduction of the first liquid food was not affected by mother's age, occupation and tribe,

among the Akans, the age of introduction of the first semi-solid food and volume of *koko* given to the child were significantly, positively correlated with mother's age. Both the longest and shortest period of breast-feeding showed significant correlation with mother's age, educational level, occupation and daily income (for mothers whose income was less than 2000 cedis), but not significantly correlated with tribe and proportion of daily income spent on feeding the household. The last breast-feeding period was significantly negatively correlated with mother's educational level. However, it was positively correlated with the mother's daily income if the income was less than 2000 cedis, and the proportion spent on household feeding was greater than 0.5 (50%).

The energy density of the *koko* was not significantly correlated with any of the characteristics of the mother mentioned above. However, the protein density was positively correlated with the daily income, but negatively correlated to the proportion spent on household feeding ($p < 0.05$). The daily energy and protein intakes of the children are not significantly affected by the mother's educational level. Nevertheless, among the illiterate housewives, the age of the mothers is positively correlated with the daily protein and energy intakes of their children ($p < 0.05$).

CHAPTER FIVE

DISCUSSION

5.1 Characteristics of the Study Population:

The high proportion of monogamous marriage (Section 4.1) is not unexpected in peri-urban, predominantly christian communities with a high literacy rate. The legal pluralism with regard to marriage in Ghana, enabling women to marry under the Marriage Ordinance, the Mohammedans Ordinance or under different systems of Customary Law (GOG and Unicef, 1990) can also explain the marital status of women noted here. Since the educational level of most of the mothers in the study area does not exceed secondary level, easy access to the job market is not possible, thus most of them are in petty trading, and their daily income are lower than the mean daily income (1255 ± 837 cedis) in the study area. This is in agreement with a report by the Government of Ghana (1992), that although the real GDP per capita increased by more than 15% between 1984-1990, as stated by Alderman (1991), the real household income is low. It also reflects the fact that average wages in Ghana are low by international standards (Alderman, 1992). The marked inequalities in the distribution of income is consistent with what was observed in the Ghana Living Standard Survey (1989). This low income, coupled with the fact that 76.0% of the mothers spend almost all of it on household feeding, might make it almost impossible for

most families to have enough money for health care and other necessities in the household. This is likely to account for the overcrowding and poor environmental conditions which is characteristic of the peri-urban communities.

5.2 Breast-feeding and Weaning Practices:

Long breast-feeding periods (1-2 years) as observed in this study (Section 4.2.1) have been observed by Olivia (1983), and Cameron and Hofvander (1983). These authors observed that the urban poor breast-feed for up to 2 years. This was also observed in the 1988 Ghana Demographic Health Survey, which reported average breast-feeding periods of 20 months.

The frequency and the method of stopping breast-feeding leaves much to be desired, considering that in all age groups only 11.4% of the mothers breast-fed for more than 10 times in 24 hours. This frequency of breast-feeding is rather low, especially in the infants less than 3 months old, since most of them are being breast-fed exclusively. This low frequency of breast-feeding could be explained as one of the adverse effects of 'modernization'. Most of the mothers in the urban areas believe that too much sucking of their breast can cause them to sag early (Personal Observation). These mothers should be encouraged to breast-feed 'on demand' 12-15 times during the 24 hours, including several times during the night (Oniang'o, 1988; Cameron and Hofvander, 1983).

The practice of abrupt stoppage of breast-feeding should also be discouraged. Ideally, this should be a gradual process, since an abrupt breakage of the close relationship established between the child and the mother in the womb and after birth can result in serious emotional and psychological problems, which in the long run, will affect his or her nutrition. This problem may even become more serious if the child is physically separated from the mother to another relative. In such a situation, the child who feels rejected may lose appetite and may refuse to eat, thus becoming malnourished.

5.2.1 Commonly Used Weaning Diets: The widespread use of *koko*, (the pap made from maize) is consistent with the practices in other parts of Africa (Uwaegbute, 1991; Oniang'o, 1988; Mbugua and Njenga, 1992). Uwaegbute (1991) reported that in Nigeria, cereal pap may be regarded as 'cultural superweaning foods'. This is likely to be the same in Ghana, given the results from the discussions by the focus groups and the mothers in the course of the survey.

The low use of commercial infant formulae as the first supplementary weaning food can be attributed to the low income, as was rightly said by the 61.9% who were not using them. This may also explain the fact that *weanimix*, though recommended by the Ministry of Health in Ghana, was fed to infants by only 2.5% of the mothers. The method of *weanimix* preparation, and time involved could

be also responsible for its low use, since mothers need an easy-to-prepare weaning food if they are to keep up with other work schedule. Furthermore, as reported by Uwaegbute (1991), some mothers in Nigeria believe that beans, a major constituent of *weanimix,* are indigestible and cause flatulence and other abdominal problems when given to the infant. Though bean contains anti-nutritive factors such as oligo-saccharides, which are responsible for the undesirable effects, the contribution from *weanimix* is rather small to cause problems to the child. Nevertheless, if a child experiences discomfort when fed with this food another one should be given.

With respect to fruits, both the survey and focus group discussions give enough evidence that they have no food value as far as the communities are concerned. This is an unfortunate situation considering the fact that these are them major sources of minerals and vitamins which offer protection to the infants against diseases. Since for most times of the year there are some fruits on the market at affordable prices, mothers should be encouraged to give them to their children. The semi-solid foods which were being given to the children were those commonly found in the family pot. This is a good practice (Mitzner et al., 1984).

5.2.2 Weaning Age: The age of introduction of the first liquid supplementary foods in this study which ranged between 1-3 months (Section 4.2.2.1.2) is much lower than

the recommended period of 4-6 months of exclusive breast-feeding (Jackson et al., 1992). This is in contrast with the practice in Ethiopia, where Almedon (1991) reported a mean age of 9.2 months after birth for initiation of weaning in all ethnic and religious groups. In Kumasi it is apparent that the period of exclusive breast-feeding is low or has declined, given that the 1988 Ghana Demographic Health Survey, observed an average period of 5 months for exclusive breast-feeding in the country. Once again, this could be one of the adverse effects of 'modernization', and influence by other people. The age of introduction of the first semi-solid foods was however, 5 - 7 months, and thus appropriate.

Evidence from the study indicates that there was not much variety in the weaning diets being given to the children, as only 20.9% and 11.0% of the mothers, respectively, changed the liquid diet before 4 months and between 4 and 6 months. In either case, they were interchanging *koko* with infant formulae. This is probably where fruits can be given to them so that the children can grow to like them.

5.2.3 Frequency of Feeding Weaning Foods: The low frequency of feeding these weaning foods, evident from the fact that only 51.0% of the mothers gave the liquid foods three times, whilst semi-solid foods were mostly given once per day (Section 4.2.2.3), possibly explains the low energy intake of the infants. According to

Mitzner et al., (1984), the energy deficits suffered by most weaning-age children in developing countries can be explained by the practice of feeding two to three meals a day, which they describe as insufficient. 'More, frequent feedings, such as five meals a day, are preferable', they recommend.

With regard to the study area, where the breast-feeding frequency is low, and both the protein and energy densities of the most commonly used gruel are also low, feeding about five times a day would be very useful to the nutritional status of the weaning age children.

5.2.4 Methods of Preparing Weaning Diets: The practice of preparing the infants' diets separately by majority of the mothers is commendable, since as they rightly said, the children need special diets or richer foods. This practice could be attributed to the high literacy rate in the area, since other studies in Nigeria observed that majority of educated urban Ibo mothers prepared weaning foods separately for their babies (Uwaegbute, 1991). On the contrary, a high proportion of Hausa mothers fed their infants from the family pot (Uwaegbute, 1991). Uwawgbute lauds this practice of feeding from the family pot with the reason that most rural and some poor urban mothers have to fetch firewood and water from long distances, and clean the wood ashes from previous cooking before making the fire for cooking. They are thus faced with an extra burden if they have to prepare the infant's food separately. In the view

of the same author, the overburdened mother may therefore not prepare the infant's diet properly, hence contamination of the infant's food, leading to infections. He, therefore, recommends feeding the baby from the family pot to ensure that fresh and properly heated foods are fed each time. But so far as most of the urban or peri-urban areas are concerned, the activities mentioned above may not pose any problem to the preparation of the infant's diet separately. In the presence of adequate cooking and storage facilities, it should be encouraged. For instance, mothers can put the day's meals in a thermos flask to ensure that she always serves it hot. They should, however, avoid giving foods that have stayed overnight.

5.2.5 Other Weaning Practices: No food taboos in the peri-urban communities was reported. With their relatively higher level of education compared to their counterparts in the rural areas, mothers might have realized the adverse effects of the taboos, and have therefore, done away with them. The absence of food taboos could also be a positive effect of 'urbanization'. However, some cultural factors prevented mothers from giving some of the locally available foods to their children, though they admitted that such foods were good for them.

It is gratifying to note that during the common

sicknesses which affect weaning-age children, mothers employ the necessary steps such as increased breast-feeding, giving of liquid diets and ORS (for diarrhoea), in an effort to manage the situation.

5.3 Nutritive Value of the Weaning Diets:

5.3.1 Energy and Protein Intakes of the Weanling: The low energy and protein densities of *koko*, as observed in this study (Figs. 6 and 7), are in agreement with data from studies by Oracca-Tetteh (1985) and Uwaegbute (1991). The wide range in both the energy and protein densities of *koko* can be attributed to variations in types and quantities of other foods added before feeding it to the child. Apparently, this the result of the wide range in the reported income, given that the added foods are usually expensive. These low energy and protein densities, coupled with the low frequency of breast and supplementary feeding, reflect the low energy and protein intakes of the children. This can explain the fact that the children could meet only 49% and 90% of their daily energy and protein intake requirements, respectively. These low intakes are consistent with those found in Bangladesh, where Rafiqul (1988) reported that a sizeable proportion of pre-school children fall short of the energy requirements. Considering the observed mean energy and protein densities of the *koko*, the reported mean intake of 194 mls. per serving will provide an under-2 years of age with 149 kcal. and 2.7 g of energy and

protein, respectively. Therefore, mothers would have to give it about 8 times, and 5 times to a child who depends solely on the *koko*, in order to meet the required daily energy and protein intakes, respectively. This implies that the child needs to eat almost one litre of *koko,* in order to meet the daily energy and protein requirements. The protein intake may not be too low, but as observed by Rafiqul (1988), it is usually of low quality in the local diets, and therefore not all will be biologically available to the infants. The intake needs to be increased to meet the body's requirements.

The significantly lower energy and protein intakes of the breast-feeding children as compared to non-breast-feeding ones, could be explained by the fact that the contribution of breast-milk was not determined. Nevertheless, it can be computed from the assumption that healthy infants consume about 700-800 mls. of breast-milk per 24 hours (Cameron and Hofvander, 1983), and since 100 mls. of human milk contain 70 kcal. of energy and 1.07 g of protein, the caloric and protein contributions would be 560 kcal. and 8.6g, respectively. The mean daily energy and protein intakes of the breast-feeding infants would then become 1045 (485 + 560) kcal. and 19.2 (10.6 + 8.6)g, respectively. These figures are not too low compared to the WHO recommended intakes (Table 11). This would then explain why the breast-feeding infants appeared nutritionally sound through physical observation. The figures may however, be overestimated

due to the 24-hour recall method employed.

5.3.2 Proximate Composition of the Weaning Foods: The proximate composition of the commonly used liquid weaning diets showed that they were high in moisture and low in energy, ash, fibre, protein and carbohydrate (Table 12). This observation has also been made in other studies (Uwaegbute, 1991; Nurture, 1993). It is not surprising therefore, that these diets seem to have low energy and protein densities. *Koko*, without the addition of another food or food item such as sugar, milk or an infant formula, makes little contribution to the energy and nutrient intakes of the infant, given the low energy and nutrient contents. These findings underscore the need to add energy dense foods such as margarine or vegetable fat to the gruel prepared for the infants. *Banku* on the other hand, is higher in all the constituents than the other foods, because it is a solid, and therefore has a higher dry matter.

5.4 Relationship Among Variables:

The data from the study showed that there was no significant correlation between the age at which mothers introduced weaning foods, and their level of education or daily income (Section 4.4). This suggests that the introduction of the weaning foods was determined by other factors including the infant's willingness to eat these foods and availability of sufficient breast-milk, as

reported earlier (Section 4.2.2.5). Among the Akans, however, their hard and starchy staple foods and knowledge from previous experience, reported in Section 4.2.2.5, could explain why older mothers introduced semi-solid foods to the children later than the younger ones. Similar reasons could be advanced to explain why older mothers in the study area breast-fed longer. The decrease in period of breast-feeding with increase in educational level (Section 4.4), is also reported by other studies (Ganjoo and Rowlands, 1988; GDHS, 1988). The earlier introduction of the weaning diets by mothers of higher educational level, coupled with their involvement in work outside home could be the reason. The breast-feeding duration was also found to be longer among the housewives, farmers and other occupations like seamstress and restaurant or chop-bar keeping, apparently due to longer time mothers in these occupations spend with the children. The significant positive correlation between the duration of breast-feeding and the daily income of mothers in the peri-urban areas whose income was less than 2000 cedis is in line with report by Olivia (1983), that among the urban poor, breast-feeding is longer. This is probably, due to lack of money to buy the commercial infant formulae, as already reported in this study.

The significant positive correlation between the protein density of *koko* and daily income is perhaps due to the fact that with increase in daily income, the mothers can purchase the more expensive protein foods

such as evaporated skimmed milk, which are added to the *koko*. Where the daily income is low, the proportion spent on household feeding is expected to rise, and since most families cannot afford the more expensive protein-rich foods added to the gruel, the protein density is likely to fall. However, if the income increases, it can also increase. The daily energy and protein intakes of the children of the illiterate mothers and housewives were higher among the older mothers, suggesting that these mothers eventually feed more food to their children as they spend more time with them. This observation appears consistent with the report that among the Akans, which constituted 89.5% of the mothers in the study, the older mothers gave more *koko* to their infants (Section 5.4).

CHAPTER SIX

CONCLUSION AND RECOMMENDATION

6.1 Conclusion:

This study sought to describe the weaning practices, and determine the socio-economic and cultural factors that influence weaning, as well as the nutritional value of commonly used weaning diets, in the peri-urban communities of Kumasi municipality in Ghana.

The results of the study show that breast-feeding practice in the peri-urban communities of Kumasi municipality, Ghana, is good. Mothers breast-feed for a reasonable length of time (between 1 and 2 years), though the duration was found to be shorter for the more educated mothers, and longer among housewives, farmers and seamstresses. The frequency of breast-feeding, was however low, since on the whole only 11.4% breast-fed more than 10 times per day. Majority of the mothers stopped breast-feeding abruptly.

There is little variety of weaning diets. Liquid weaning diets are introduced to the infants earlier than recommended i.e. between 1 and 3 months after birth. The first semi-solid foods are, however, given between 5 and 7 months. These results imply that the period of exclusive breast-feeding is short.

The children in the study area meet 49% and 90% of their recommended daily energy and protein intakes, respectively, mainly because of the low protein and

energy density, and frequency of feeding the infant foods.

The protein density of *koko* is low for mothers whose daily income was low, and those who spend a higher proportion of it on household feeding, probably due to economic constraints. Among the illiterate and housewives, both the energy and protein intakes of their children are higher for the older mothers, probably because the older mothers feed more food to their children and spend longer time with them.

Apart from the cultural factors which prevent mothers from giving certain food items to the children, there are no food taboos.

6.2 Recommendations:

It is recommended that:

1. Future studies on weaning practices should employ methods which involve actual measurement of foods consumed on several visits, instead of 24-hour recall method for just one visit. Furthermore, child-related variables such as nutritional status, birth weight and morbidity experience, and characteristics of the father and the entire family should also be considered in the data collection.
2. A proper evaluation of the usefulness of the existing home-made and recommended weaning diets, especially *weanimix*, be carried out, so that necessary suggestions can be made for improvement.
3. A nutritional education programme that emphasizes the

use of fruits, usefulness of exclusive breast-feeding for the first 6 months of the child's life, and the timely introduction of weaning diets together with breast-milk, to ensure the caloric adequacy of infant diets, be designed and implemented.

4. Further education, stressing the importance of protein foods to the growing infant, in order to discourage the practice of giving the protein-rich foods to the household head or older members of the family, be promoted.
5. Mothers breast-feed their infants more than 10 times, and feed *koko* about six times per day, if no energy or protein-rich foods are added.

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APPENDIX 1.

CALCULATION OF SAMPLE SIZE.

According to the East African Food Composition Table, the basic energy requirement of children of age group 0-24 months is 1150 kcal. Supposing the mean intake is denoted by M, and its standard deviation by S. This implies that:

$$M + 2S = 1150 \text{ kcal}$$

Assuming coefficient of variability of the energy intake of the children to be 10%,

Coefficient of variability (c.v.) = $0.1 = S/M$

$$S = 0.1M$$

From the equation above, mean intake, $M = 1150 \text{ kcal}/1.2$

$$= 958.3 \text{ kcal}$$

and $S = 95.83$ kcal

With the desire to report the mean energy intake which is expected to be 958.3 kcal, with a standard deviation of 95.83 kcal, with 95% level of confidence , n (sample size), is given as:

$$n = \frac{Z^2 \times V}{d^2}$$

where, Z = standard deviation at 95% confidence

V = variance

d = affordable difference between the estimate and the expected.

$$n = \frac{(1.96)^2 \times (95.83)^2}{(15)^2}$$

$$n = 3.84 \times 9183.39 / 225$$

$$= 156.7$$

plus 10% attrition, $n = 156.7 + 15$

$$= 170$$

APPENDIX 2.

CONVERSION FACTORS (LOCALLY AVAILABLE DIETS/FOODS IN PERI-URBAN KUMASI, GHANA).

Food / Diet	Mass (g)	Volume (mls)	Conversion factor (g/ml)
Cereal-based Foods:			
Rice (uncooked) ;			
1 margarine cup (2)	520.0	-	-
½ " (2)	260.0	-	-
Rice (cooked plain)(2)	97.0	83.0	1.17
Emotuo (rice balls)(2)	78.0	72.0	1.08
Banku (3)	243.0	211.0	1.15
Accra kenkey (2)	360.0	265.0	1.36
Fante kenkey (2)	325.0	230.0	1.02
Raw corn dough (3)	188.0	158.0	1.19
Tuozaafi (2)	38.0	36.5	1.04
Koko (2)	85.0	78.0	1.09
Starchy Foods:			
Plantain (apantun);			
big size (2)	430.0	380.0	1.13
medium size (2)	365.0	314.0	1.16
small size (2)	280.0	240.0	1.16
Plantain (apem);			
big size (2)	240.0	05.0	1.17
small size (2)	155.0	130.0	1.19
Fried ripe plantain (1)	18.0	15.5	1.16
Yam (cooked) (3)	82.0	75.0	1.09
Yam (fried) (2)	30.0	29.0	1.04
Fufu (2)	98.0	93.0	1.05
Gari & Beans;			
Gari (½ margarine cup)	220.0	-	-
Cowpea (cooked) (2)	35.5	50.0	0.71
Soups and Stews:			
Groundnut soup (2)	83.0	78.0	1.06
Palm-nut soup (2)	82.0	78.0	1.05
Light soup (2)	83.0	78.0	1.06
Kontomire stew (2)	30.0	80.0	0.40
Garden eggs stew (1)	25.0	70.0	0.36
Tomato stew (2)	14.5	16.0	0.91
Okro soup (1)	83.0	78.0	1.06
Fruits:			
Orange (edible portion);			
large (2)	120.0	-	-
medium (2)	87.0	-	-
small (2)	60.0	-	-
Banana (edible portion);			
large (2)	93.0	-	-
medium (2)	49.0	-	-
small (2)	30.0	-	-

	Mass (g)	Vol. (g)	Conv. factor (g/ml)
Others:			
Sugar;			
1 table spoonful (2)	18.0	-	-
1 tea spoonful (2)	8.6	-	-
Milo;			
1 table spoonful (2)	8.5	-	-
Milk (evaporated skimmed);			
1 tin (1)	170.0	-	-
1 table spoonful (2)	8.5	-	-
Babelac/Lactogen;			
1 table spoonful (1)	14.0	-	-
1 tea spoonful (1)	8.0	-	-
Ceralac;			
1 table spoonful (1)	10.0	-	-
1 tea spoonful (1)	6.0	-	-
Tom Brown;			
1 table spoonful (1)	15.0	19.0	0.78
Egg (3)	32.0	-	-
Bread;			
tea (50 cedis) (1)	90.0	-	-
sugar (50 cedis) (1)	86.5	-	-
Palm-oil;			
1 table spoonful	80.0	10.0	0.8

Figures in brackets indicate the number of samples weighed.

Household Measures Equivalent:
1 cup of margarine = 570.0 mls.
Alluminium laddle = 78.0 mls.
1 table spoonful (level) = 15 mls.
1 tea spoonful (level) = 5 mls.

APPENDIX 3.

REAGENTS, EQUIPMENT AND PROXIMATE ANALYSIS.

A 4.1 Reagents and Equipment:

The following reagents were obtained from British Drug House (BDH) Ltd. 1574272, Poole, England; Petroleum Ether (B.P 60-80°C), concentrated Sulphuric acid, concentrated Hydrochloric acid, Sodium hydroxide (pellets), Mercuric oxide, Potassium sulphide, Methyl red indicator, Zinc granules, and Ethanol.

The following equipment were used: Hot air oven, from Mermet, 854 Schwabach, West Germany; Spring balance, from Rebüre, West Germany; Mufful furnace, Steam bath, Digestion burner, Mettler weighing balance from Gallenkamp.

The other materials used were 22 x 80 mm paper thimble, Gooch crucible, Erlenmeyer flask, asbestos, Kjeldal digestion flask, soxhlet extractor, glass wool, linen cloth and other relevant laboratory glassware.

A 4.2 Proximate Composition Analysis:

A 4.2.1 Moisture Determination:

Principle: The method involves measurement of the weight lost due to the evaporation of water from the food sample. The method which is also referred to as dry-weigh method thus involves drying, and accurately weighing the food samples in a specially constructed laboratory oven.

Materials and Reagents: Weighing balance, air oven, desiccator, crucible.

Procedure: About 5.0g portions of the sample was placed in previously dried and weighed crucible in hot air oven, thermostatically controlled at 105 ± 1 °C for about 5 hours, removed, placed in a desiccator to cool and weighed. This procedure was repeated until the weight became constant, hence resulting in a dry sample. The difference between the weight of the wet and dry samples expressed as a percentage, gave the moisture content.

A 4.2.2 Crude Protein Determination:

Principle: The improved Kjeldahl method is used. This method involves determination of the total reduced nitrogen in the food, then multiplying this by an empirical factor based on the average percent of nitrogen in the protein.

Materials and Reagents: Kjeldahl digestion flask, weighing balance, digestion burner, HgO, K_2SO_4, conc. H_2SO_4, potassium sulphide, NaOH, HCl, methyl red indicator.

Procedure: 2.0g of the dry sample was transferred to Kjeldahl digestion flask, and 0.7g mercuric oxide (HgO) and 15g of K_2SO_4 were added. 25ml concentrated H_2SO_4 was added,

and the flask shaken so that the entire sample was thoroughly wet. The flask was placed on a digestion burner in an inclined position and heated gently until frothing ceased. Boiling continued for about 30 minutes after a clear solution was obtained. The flask was cooled, 200ml of wated added, cooled again below 25 °C and 25 ml of K_2S (potassium sulphide) solution added and mixed to precipitate mercury. Few zinc granules were added while the flask remained tilted to prevent bumping. Without agitation, a layer of NaOH (38g - 15g for each 10ml H_2SO_4 used) was added. Immediately, the flask was connected to a distillating bulb on condenser, with the tip of the condenser immersed in a standard solution of acid (1ml 0.5M HCl for each 2% protein expected in the sample), 3 drops of methyl red indicator was added, and the flask rotated to mix the contents thoroughly. The flask with the contents was first heated gently until there was no danger of foaming, then strongly until all NH_3 has distilled (about 150ml distillate). The receiver was removed, the tip of the condenser washed and the excess standard acid in the distillate was titrated with standard NaOH solution, 0.1M.

Blank determination on reagents was run by carrying through 2.0g of sugar in place of the sample.

Percentage of nitrogen was determined as:

% N = [(ml standard acid x molarity of acid) - (ml standard NaOH x molarity of NaOH)] x 14.007/g of sample

A 4.2.3 Crude Fat Determination:

Principle: This determination is made by Soxhlet extraction method which is based on extraction of fat from the sample with a fat solvent, by shaking it with the solvent.

Materials and Methods: Soxhlet extractor, air oven, steam bath, desiccator, paper thimble, glass wool, petroleum ether (B. P. 60°-80°C).

Procedure: In this method, 5.0g of the dry sample was transferred to a 22 x 88mm paper thimble, using a funnel. Glass wool plug was placed on top of the thimble, then placed in soxhlet extractor. 150ml of petroleum ether (B. P. 60°-80°C) was put in previously dried (air oven, 100°C) beaker which was in turn attached to the extractor and extraction carried out for about 4 hours. The beaker was removed and placed on steam bath to evaporate ether. It was further dried at 100°C for one hour in an oven with door closed. It was then cooled in a desiccator and weighed. The difference between the weight of the beaker with the fat, and the dry beaker gave the crude fat content.

A 4.2.4 Crude Fibre Determination:

Principle: The method used involves heating the food sample with dilute solution of a strong alkali, followed by

heating with dilute solution of a strong acid with or without prior fat extraction in order to digest the soluble carbohydrates. The residue left after the digestion is ignited to determine the crude fibre content.

Materials and Reagents: Air oven, hot plate, linen cloth, Erlenmeyer flask, condensor, Gooch crucible, H_2SO_4, NaOH.

Procedure: The sample from crude fat determination was transferred to a 750ml Erlenmeyer flask and approximately 0.5g of asbestos added. 200ml of boiling 1.25% H_2SO_4 was immediately added, and the flask set on hot plate and connected to a condenser, so that the contents boiled within one minute and frequently, until the sample was thoroughly wetted. After about 30 minutes boiling, the flask was immediately removed and the contents filtered through linen cloth in funnel. The residue was washed with boiling water until washings was no longer acidic. The residue and the asbestos was washed back into a flask and 200ml of boiling 1.25% NaOH solution added and boiled as before. It was filtered and washed as previously after 30 minutes boiling, until the washings was no longer alkali.

The residue was then transferred to a Gooch crucible using funnel, with water from a wash bottle. It was washed with approximately 15ml ethanol. The crucible and contents was dried for one hour at 100°C in a hot air oven, cooled in a desiccator and weighed. This was followed by ignition in electric furnace for 30 minutes after which it was cooled and reweighed. The difference in weight between the dried solids and the ash gave a measure of the crude fibre content.

A 4.2.5 Ash Determination:

Principle: The ash content of a food sample is the inorganic residue remaining after the organic matter has been burnt away.

Materials and Reagents: Weighing machine/balance, porcelain crucible, muffle furnace, desiccator.

Procedure: 5.0g of the dry food sample was transferred into a previously ignited, cooled and weighed porcelain crucible, and placed in muffle furnace (preheated to about 600°C) for about 2 hours. After igniting again, the crucible was removed, cooled in air for some few minutes before transferring into a desiccator for further cooling, then reweighed. The difference in weight between the crucible and the ash, and the crucible alone gave a measure of the ash content (inorganic residue).

A 4.2.6 Determination of Soluble Carbohydrates:

Principle: The food sample consists of moisture, crude protein, crude fibre, crude fat, ash and soluble carbohydrates, implying that the sum of the percentage

composition of these components is 100. Therefore, the soluble carbohydrate content is the difference between 100 and the sum of the moisture, protein, fat, fibre, and ash contents.

APPENDIX 4

SURVEY QUESTIONNAIRE.

WEANING SURVEY, IN PERI-URBAN KUMASI. 1992/93.

FORM 1

Socio-Economic Characteristic Survey.

[Please, provide the socio-economic characteristic information in the spaces provided].

1. Cluster #:.....House #:.....Date of survey:../.../...
2. Name of interviewer:.....
3. Name of Index child:.....Sex:M/F Age:.....(mon)
4. Name of Mother/Respondent:.....Age:.....(yrs)

5. Socio-economic characteristics of the index child's mother/respondent. [Enter the information in the table below using the codes below it. Where more than one option holds, indicate as such].

Marital status	Religion	Educational level	Occupation	Tribe

Code:

Marital Status:
Single- 1
Married (mong.)- 2
Married (polyg.)- 3
Separated- 4
Widowed- 5
Do not know- 6

Educational level
None- 1
Primary uncompleted- 2
Primary completed- 3
Secondary- 4
Post-secondary- 5
University- 6.

Religion
Christian- 1
Muslim- 2
Others (specify)- 3

Occupation.
Civil servant- 1
Business (trading)- 2
Teaching- 3
Housewife- 4
Farming- 5
Others (specify)- 6

Tribe.
Akan- 1
Eve- 2
Ga- 3
Krobo- 4
Northerner- 5
Others (specify)- 6

6. How much money do you receive per day? |.....|

7. What is/ are the usual source(s) of this money? [Please tick.]

Employment:¦.....¦

Trading:¦.....¦

Husband:¦.....¦

Gift:¦.....¦

Others (specify):¦.....¦

8. What proportion of the daily income goes into feeding in the household?

FORM 2.

WEANING PRACTICES SURVEY.

[Please interviewer, provide the information on weaning practices in the spaces provided.]

1. Cluster #:.....House #:.....Date of survey:.../.../...
2. Name of Interviewer:.....
3. Name of Index child:.....Sex: M/F Age:.....(mon)
4. Name of Mother/Respondent:.....Age:.....(yrs)
5. Are you breast-feeding your child?

   Yes - 1

   No - 2 ¦.....¦

6. How many times per day, from dawn to dusk, do you breast-feed your child? ¦.....¦

7.i) Are you giving any food apart from breast-milk to your child?

   Yes - 1

   No - 2 ¦.....¦

ii) [If yes], what, and what age of the child do you start giving each type of food, and how many times per day do you give?

TYPE OF FOOD.

1) Liquid foods;

Age in months.	Liquid (specify)	Times/day
.....	.....	.....
.....	.....	.....
.....	.....	.....
.....	.....	.....

2) Solid foods;

Age in months	Solid (specify)	Times/day
.....	.....	.....
.....	.....	.....
.....	.....	.....
.....	.....	.....

....

8. What types of other foods do you give apart from the ones you have told me?

Type of food	Consistency	Ingredients	Times/day
.....	.....	.....	.....
.....	.....	.....	.....
.....	.....	.....	.....
.....	.....	.....	.....
.....	.....	.....	.....

9. Why did you introduce solid foods to the infant?

.....

.....

.....

.....

10.i) Do you give different food to children of different sexes?

Yes - 1

No - 2 |.....|

ii) [If yes], what do you normally give to which sex, and at what age? [If no], skip to question 12.

TYPE OF FOOD.

Liquid foods.

Sex	Age (mon)	liquid food (specify)
.....	.....	.....
.....	.....	.....
.....	.....	.....
.....	.....	.....
.....	.....	.....

Solid foods

Sex	Age (mon)	solid food (specify)
.....	.....	.....
.....	.....	.....

....

....

11. Why do you give different foods to different sexes?

Food	Sex	Reasons
.....	.....	.....
.....	.....	.....
.....	.....	.....
.....	.....	.....
.....	.....	.....

12. i) How do you prepare the infant's diet?

Feeding from family pot - 1

Food prepared specially for infant - 2

Both ways - 3 ¦.....¦

Others (specify):.....

ii) Why is the preparation done by the mentioned method(s)?

.....

.....

.....

13. How do you feed the child?

By hand - 1

Bottle - 2

Cup - 3

Spoon - 4

Others (specify) -5 ¦.....¦

14. i) Who normally feeds the child? ¦.....¦

ii) Who fed the child yesterday? [Main persons]

.....

.....

.....

.....

15. Which foods available in the area do you consider good for weaning your child?

....

....

....

16. Why do you consider these foods good for weaning?

.....

.....

.....

17. Do you use commercial weaning foods?

Yes - 1

No - 2 |.....|

[If yes], which one(s)?

....

....

[If no], why? .....

.....

18. At what age did you stop breast-feeding your last child?

|.....|(months)

19. How do you stop breast-feeding?

Abruptly -1

Gradually -2

Physically separated from mother -3

By applying something on nipples -4

No answer -5

20. [If something is applied to the nipples], what is it?

|.....|

21. i). What is the longest time you have breast-fed?

|.....|(months)

ii) What is the shortest time you have breast-fed?

|.....|(months)

FORM 3

FOOD INTAKE SURVEY.

1. Cluster #:.....House:.....Date of survey:.../.../...
2. Name of interviewer:.....
3. Name of Index child;.....Sex: M/F Age:....(mon)
4. Name of mother/respondent:.....Age:....(yrs)

24-hour Dietary Recall Survey (child).

[To be asked mother of the weaning child below 24 months. Plea
interviewer, ask the following questions and fill the table below].

1. a). Starting from morning (yesterday), apart from breast-milk what did you feed your child on?
   b). Did you prepare for the child alone or including other family members?
   c). What did the dish consist of?
   d). How much of each of these ingredients did you include?
   e). How much was the whole dish after preparation?
   f). How much food did you give to the child?
   g). How much was left over?

FOOD INTAKE SURVEY CONT'D.

Cluster #:.....House #:.....Date:..../..../.....

Time	Dish	* Code	Ingredient	Amount (mls)	Amount given	Amount left	Amount eaten

* Indicate by C if food was prepare for child alone, and F if other family members were included.

FOOD CONSUMPTION -SHEET A

ENERGY AND NUTRIENT CONTENT OF DISHES.

House #:.....Data analyst:.....Date:.../.../....

Child's name:.....Sex: M/F Age:.....(mon)

Time	Dish	Amount of Dish *	Ingred.	Amt. in Dish	Con-ver-sion Fac-tor.	Gram-equ't	Energy + ptn. density/mls	
							Energy (kcal)	Protein (g)

* Density (if applicable) = Total content + Amount of Dish;
To be multiplied by amount eaten by child on sheet B.

FOOD CONSUMPTION-SHEET B.

NUTRIENT INTAKE OF CHILD BY DISH.

House #:.....Data analyst:.....Date:.../.../.... Child's name:.....Sex: M/F Age:.....(mon)

Time	Dish	Amount of Dish	Amount eaten by child *	Prop. cons'd by child **	Code	Ener Den. kcal /g	Ptn. Den. g/g	Intake by child	
								Ener kcal	Ptn (g)

* To be multiplied by density, if applicable (see sheet A)-**OR**

**Proportion consumed = amount eaten by child + amount of dish; to be multiplied by total content.

WEANING PRACTICES SURVEY, KUMASI, 1992/93.
FOCUS GROUP DISCUSSION GUIDELINE.

Group #:..... Date:.....Moderator:.....

1. Generally, at what age do mothers in this community start introducing other foods apart from breast-milk to their infants, and when do they stop breast-feeding?

2. Which locally available foods are used for weaning?

3. In what forms or combinations are they given to the child?

4. State the types of food that are unsuitable for weaning, and give reasons for their unsuitability.

5. What other foods are locally availabble, which in the opinion of the group can be used as weaning diets, but are not being used? Reasons?

6. How best does the group think mothers in this community can make use of the locally available foods to improve the nutrient intake of their infants during weaning?

7. Do women in the community use breast as a soothing instrument?

8. Do women in the community express colostrum?

9. Do women in the community usually wash or clean their breasts before offering them to the child?

10. Is there a change in feeding practices during sickness like diarrhoea, fever and measles? What do mothers do if the child cannot eat?

11. What foods are not given the child during each of the sicknesses mentioned above?

12. Do lactating mothers eat fruits? [If yes], which ones? [If no], why?

13. What are the main factors which will prevent any mother from using commercial weaning diets?