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**Cross-sectional MAASAI PRIMIGRAVIDAE
DIETARY HABIT AND PREGNANCY
OUTCOME STUDY
LOITOKITOK KENYA.**

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Submitted to:
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LIST OF ACRONYMS

ADP	Area Development Programme
BW	Birth Weight
CHWs	Community Health Workers
CM	Community Motivators
CMR	Child Mortality Rate
CN	Chief Nutritionist
CSP	Child Survival Project
DF	Degree Of Freedom
EPI	Expanded Programme on Immunisation
FI	Field Investigator
FN	Field Nutritionist
IMR	Infant Mortality Rate
LBW	Low Birth Weight
LCHDP	Loitokitok Child Survival and Development Project
MOH	Ministry of Health
NGOS	Non Governmental Organisations
NM	Neonatal Mortality
OVS	Other Vounteers

PI	Principal Investigator
PN	Postnatal Mortality
SD	Standard Deviation
TBA	Traditional Birth Attendants
UFM	Under Five Mortality
USAID	United States Agency for International Development
WVC	World Vision Canada
WVI	World Vision International
WVK	World Vision Kenya
WVRD	World Vision Relief and Development Inc.,
WVUS	World Vision United States

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The Loitokitok Child Survival project was initially funded by the World Vision Relief and development Inc (WVRD), the United States Agency for International Development (USAID)and World Vision Canada International Programme Department in collaboration with World Vision Kenya as an implementing Agency.

The author had been involved, together with other colleagues, in the identification , initiation and designing of the child survival project from its inception, and managed the project for the four years. The project was initially to phase out in 1991, but through efforts of this author and other colleagues at World Vision Kenya it was extended for an additional three years, through the fiscal year 1994 (i.e. September 1994). Moreover, the author wishes to recognise the contributions of the Maasai community, the Ministry of Health (MOH), and other non governmental organisations (NGOs) which, along with the WV staff, laboured hard and contributed to the success of the project.

Special thanks go to World Vision Kenya staff in general and the Loitokitok Child Survival project staff in particular for their commitment, hard work and motivation which have positive impact on knowledge, attitude and practice (AKP) within the Maasai community. Without their hard work, creative planning, and community mobilisation efforts, it would have been impossible to raise raising immunisation coverage from under 20 per cent at the inception to over 87 per cent at the end. Special thanks go to the USAID and WVRD for providing financial and moral support that enabled us to carry out the project, and for having confidence in WV Kenya and its staff in funding not only the first phase of the project , but the second phase as well.

It was possible to raise the immunisation coverage to over 87 percent among the rural Maasai. Both others and ourselves had doubts about attaining this goal. Our reservations were based on our perception that service may not be utilised as effectively as we expected by the Maasai. But we admit that health we were wrong , along with others , in misjudging the Maasai 's level of understanding of the importance of health service and their willingness to cooperate. The project was successful because they actively participated, positively responded and sacrificially contributed. Special thanks go the following individuals :

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ABSTRACT

The overall aim of this prospective study was to describe the dietary habits of Maasai pregnant women in relation to pregnancy and birth weight. The dietary habits of N = 451 Maasai pregnant women, n = 301 multi para and n = 125 Primigravidae (first pregnancy) were investigated over a period of 30 months between January 1993 and June 1995 in Kajiado District in the Republic of Kenya. The pregnant women initially joined at least during the fourth month of pregnancy and were followed until within 24 hours of delivery. Their food intake and weight were monitored and recorded monthly and their socioeconomic profiles as well as with height and weight were noted at the time of joining the study.

The study concluded that both food avoidance and induced vomiting played a significant role in the reduction of mothers' weight and foetus birth weight among the Primigravidae at the ninth month pregnancy. Although at the time the subjects joined the study, the weight differences between Primigravidae and multi para were trivial, never the less, by the ninth month, multi para had a mean weight of 55.39 kg, as compared to the Primigravidae mean weight of 50.66 kg, showing in a significant weight gain among the multi para at childbirth: $p = 0.028$.

Babies born to the multi para weighed on average 2.9 (SD 0.6) kg compared to those of Primigravidae who weighed 2.6 (SD 0.6) kg ($p=0.001$). Significantly more Primigravidae (71.4 %) than multi para (48.5 %) had induced vomiting at the ninth of month pregnancy ($p=0.001$). There was some evidence suggesting that more Primigravidae than multi para had protein restricted diet during lunch ($p=0.051$) and supper ($p=0.068$) at the ninth month of pregnancy. Nearly half of Primigravidae (47.5 %) were influenced on food intakes by their mothers-in-laws. Multi para during their previous pregnancy had avoided fresh milk (45.3 %) because it would make the baby too big for a safe delivery, un slaughtered meat (46.0 %) because it would cause diseases to both the mother and unborn baby, and young animal meat (34.3%) for unspecified traditional or cultural reasons. After adjusting for husbands' education, induced vomiting among multi para at the ninth month of pregnancy was associated with birth weight (adjusted mean baby weight difference was 0.18 with a standard error of 0.09, $p < 0.05$). Among Primigravidae, restricted protein diet at supper at the ninth month of pregnancy was associated with baby weight (adjusted mean baby weight difference was 0.84 with a standard error of 0.21, $p < 0.001$).

The study concluded that both food avoidance and induced vomiting played a significant role in reduction of weight among the Primigravidae.

This study suggests the need for a further research to assess the impact of cultural practices on the dietary habits of Maasai pregnant women and birth weight, which may or may not require subsequent intervention. A case control study has to be carried out to investigate an association between diet, pregnancy and birth weight. In addition to this, there should be a follow up of the children born to these women to their fifth birth day along with the children born to the control groups, to determine dietary impact on mother's and birth weight and growth and development of children, which is beyond the scope of this study.

CHAPTER ONE

INTRODUCTION TO THE STUDY AREA, POPULATION AND HEALTH SERVICES IN KENYA

This section provides background information on the study area, the population and Kenya's Health Services delivery system.

Two hundred and fifty kilometres southwest to the Nairobi, Kenya's capital, along the Kenya-Tanzania border, lies a harsh, hot, boulder-strewn land which is home to approximately 84,000 Maasai. The LOITOKITOK Community-based Health and Development Project (LCHDP) was located in the Loitokitok Division, one of three Divisions of the Kajiado District at the southern end of the Rift Valley Province of Kenya. The area is semiarid with a bimodal rainfall pattern -- short rains falling from November to December, and long rains between March and June -- and has fertile black cotton soil interspersed with lava rock. The natural vegetation is tall savannah grass with scattered acacia trees. Also located in the District are the Amboseli National Park and West Chyulu Game Reserve, one of the largest games reserves in the country.

While their origins remain a mystery, it is clear that by the year 1800 the Maasai had spread into the Rift Valley to the south, past Mount Kilimanjaro, into what is today known as Tanzania. Although the southward migration of the Maasai from the north involved the assimilation of other livestock keeping and non-livestock keeping people due to removal by the colonial authorities from the area, today the area that the Maasai occupies is far smaller than in the past -- Kajiado and Narok districts being the two main administrative districts that comprise the Maasai land.

The Maasai continues to predominate as the largest ethnic group in the District, but immigration of non-Maasai to the District has increased rapidly. In fact, the newer residents, principally Kikuyu and Kamba who have come from more densely populated agricultural areas, make up roughly 38 percent of the population of Kajiado District, though this is not yet the case in Loitokitok Division where the Maasai stills constitute about 80 percent of the Division's population.

Formerly a society where settlements and families were organised around livestock, water and pastures -- livestock's ownerships being a status symbol the Maasai today have diversified their economic life. While most of the population have remained nomadic and pastoral, in rearing of cattle, sheep and goats for their survival and livelihood, the Maasai of Loitokitok, who were forced to move to the area in 1984 as a result of the loss of their animals in a severe drought, are currently engaged in subsistence cultivation and livestock breeding. Attracted to the area by the permanent availability of water and unoccupied land, they are currently engaged in growing vegetables, particularly onions, green and chilli peppers for sale in Mombasa and Nairobi. They utilise simple irrigation techniques which were introduced with World Vision assistance and facilitation based on appropriate technology.

According to the 1993 Census Data, the population of Loitokitok Division in 1988 was about 84,000. The area has an annual population growth rate of 2.4 % per annum, attributable partly to immigration.

There were 20,637 (24.7 percent) women of childbearing age and 19,000 (22.6 percent) children less than five years of age, based on the 1993 census and the author's own observation polygamy and the extended family system are common among the Maasai, the average man having two wives, and relatively wealthy men having as many as 10 wives. Between 12 and 15 households cluster together in a residential enclosure called a manyatta with gates for letting the animals in and out. These enclosures are grouped into an emurua (cluster) or several imurua representing 20-30 households whose members collectively utilise common pastures and water supplies. The WVK staff targeted the manyatta as the basic social unit for their health interventions.

The social and economic organisation at Loitokitok is structured around patriarchal kinship relations, age-sets and territorial boundaries. Young women are commonly married off to much older men who already have at least one other wife. The age-set system transcends clan boundaries, ordering all males into groups of familiarity and reciprocity. Political authority is decentralised and vested in members of certain age-sets.

Those individuals known for their inherited qualities of good strength, cool-headedness and articulateness dominate the social and political life until their rule terminates through a series of ritual ceremonies. These ceremonies begin just before male circumcision and terminate after an age-set has been allowed to partake in a grand meat-feasting gathering in the presence of initiated women. After the members of the community age-set have performed this rite-of-passage, they take over authority from an older retiring age-set. Often members of certain age-sets can be in control for more than 20 years. The ceremony generally occurs during the teenage years, 14 to 18 years of the coming age-set.

Although western medicine is traditionally based, to a large extent, on curative service delivery, the Ministry of Health (MOH) in Kenya has, in recent years, sought to decentralise health care services to the district hospitals from which services radiate laterally -- even to health centres, sub-health centres or dispensaries, and community-based health care. These peripheral dispensaries are constructed by the Government and from harambee funds (a tradition of self-help unique to Kenya where support is derived from the collective efforts of the local people) with the assistance of non-governmental organisations (NGOs), which account for more than 45 percent of the entire health and development work in Kenya. The dispensaries regularly offer preventive care in the form of immunisations, as well as basic curative and promotive health services.

These services, however, run thin at the edges and WVK Kenya, as one of the major NGOs operating in the Loitokitok Division of Kajiado District, had recognised the need for cooperation with the MOH in the health sector, particularly in the area of maternal and child health (MCH). In keeping with the Government's policy and the community's expressed need, WVK initiated the Loitokitok Child Survival Project (LCSP), with a pilot phase in Namelok, (total population of about 4,500 people or 750 households). This was a community-based health care project (CBHCP), which combined harambee, (Community Self Help Initiative) World Vision and United States Agency for International Development (USAID) funds to build a dispensary and introduce mobile immunisation and primary health care clinics (PHCC) to reach those members of the community who did not have to access to scattered static service centres.

CHAPTER TWO

BACKGROUND TO LOITOKITOK CHILD SURVIVAL PROJECT

Initially, this study had started as a child survival and development (CSD) project through collaboration between World Vision United States (USID), Relief and Development Inc., World Vision Kenya and the United States Agency for International Development. The project area had a high prevalence of preventable diseases and lower coverage rates of immunisation for under fives, as depicted in Table I. The project was designed to address the foregoing problem was intended to raise immunisation coverage rates among the under-five children from under 20% of pre-project level to at least 90% in a period of four years. The immunisation coverage among the under fives during the first phases of the project's implementation was raised to 87%.

Health reports from Kajiado District health centres revealed that disease patterns in Loitokitok are typical of Kenya as a whole. Malaria, measles, diarrhoeal diseases (gastroenteritis and subsequent dehydration) and respiratory infections account for 70 percent of childhood diseases in the community. Anecdotal discussions with members of the community in Namelok also identified malaria, measles, diarrhoea and vomiting among young children, as well as complications during childbirth, as major community health problems. Eye infections, lack of facilities for immunisation, risk of injury from wild animals and difficulties in gaining access to treatment for the injured, were also stressed by community members. Indeed, in the course of this study several incidents where members of the community had been attacked by wild animals and needed major surgical repairs, were witnessed.

The present study is a product of the eight years World Vision Kenya's experience in implementing emergency relief interventions, community development and the Child Survival Project (CSP) in the Maasai area. The study concept, hypotheses, and rationale is built upon this specific involvement and the child survival and development experience, working with children, mothers and the community in general. The questions addressed in the study have been part of the Child Survival Project initiation and implementation experience.

This project activities and services were supported and maintained collectively by World Vision, the community and the Ministry of Health (MOH). By the end of 1993, the programme had raised the immunisation coverage from under 20 percent at its inception in 1987 to 87 percent in 1993 among the target group i.e. children under five years of age and among women of childbearing age (WCBA) in Loitokitok Division.

Since the 1984/85 drought that affected the East Africa Region (EAR), World Vision carried out integrated community development activities in the Namelok area, the pilot site of the Child Survival Project. These activities included:

- assistance to the community in the areas of food and livestock production;
- introduction of an irrigation scheme for small-scale agriculture, thus enabling the community to raise the production of all-season cash crops and small scale food production and achieve eventual self-reliance in market gardening,
- restocking and improvement of domestic animals through building of cattle dips facility,
- provision of a grinding mill in the community,
- support for a school feeding programme,
- support to formal education by building a primary school and making provision for students' fees and uniforms.
- improvement of water supply through spring protection and sanitation education.

However, the most significant activity was the joint initiation and completion of a dispensary (a small health centre). The dispensary project was initiated in conjunction with community sensitisation and raising awareness about disease prevention and health promotion, with regard to the high incidence of measles, malaria, diarrhoea, respiratory diseases and injuries caused by wild animals in this particular area.

Transporting the injured and or ailing members of the community to the nearest hospital (Divisional Hospital, 35 km away at Loitokitok town) was often extremely arduous. The integration of this dispensary as part of a primary health care (PHC) delivery system was a major step towards the development of a self-sustaining, integrated primary health care service, combining the efforts of families, community, local MOH and WV. The integrated primary health care service among the Maasai has motivated the community to participate actively in PHC activities.

Initially, the dispensary functioned primarily as a curative facility. However it has served as the "backbone" to the community's preventive and promotive activity, and has greatly complemented the child survival activities that were subsequently introduced. The dispensary was the physical focus for immunisation activities, providing cold-chain facilities essential for storage of vaccines and serving as an important entry point into the community. The enrolled community nurses (ECN) have been instrumental in prenatal and post-natal referrals for women at risk, and have played an active role in both malaria surveillance and the provision of family planning services.

The Loitokitok Child Survival Project was piloted by an 18-month project restricted to the Namelok area in central Loitokitok Division. Namelok is an isolated swampy area, 15 km from the main feeder road, with no public transport. The area has a population of about 4,500 people or 750 households with an average household size of six. Child survival interventions -- immunisation, growth monitoring, oral re-hydration therapy, child spacing programmes and nutrition programmes -- were introduced and implemented. These were preceded by immunisation as a single community entry intervention followed by the other interventions.

The pilot phase of the project provided information on the characteristics of the area's population and the prevalence of endemic disease patterns, identified the high risk groups and, most important, provided experience with a community-based approach. This pilot phase essentially served as a prototype for the larger Divisional programme.

The Loitokitok Child Survival Project had a mobile team which went out to 21 centres in the Division. The services provided included: immunisation, training in basic

nutrition and in the preparation and utilisation of oral rehydration solution (ORS), growth monitoring and other health promotion activities. The project staff had at least three years experience before involvement in this study with the people of the Division and, since 90 percent of them are Maasai, they were familiar with the culture, habits and language in the area. Furthermore, the project had established a very "healthy" relationship with the people. This was due to implementation of a successful immunisation programme which had brought mothers, children, and the whole community and project staff together to celebrate the improved health condition and survival of children in the community.

The outreach centres eventually were replaced by static facilities. WV, the community, USAID and the MOH (i.e. Government of Kenya) jointly agreed to phase the child survival interventions into the local PHC system and overall development activities, step by step, each year for a period of three years. Both USAID and WVRD provided second-phase funding to consolidate the gains made during the first phase. The second-phase included repairing and renovating local Government dispensaries, using USAID and WV funds matched by the community and local Government (particularly the District office of MOH). The remaining mobile sites were replaced by local NGOs which had been providing static services. The plan to renovate the Government dispensaries included equipping the dispensaries with a cold chain system using a solar cold chain system to store essential drugs and immunization supplies. This was important to sustain the gains made in immunization coverage and other PHC interventions such as MCH and growth monitoring activities, and general PHC implementation.

CHAPTER THREE

STUDY RATIONALE, OBJECTIVES, AND HYPOTHESES

A significant aspect of Maasai culture is the sharing of food in the enclosures; the staple food largely consists of milk and milk products, while meat and soup are normally taken during ceremonial occasions and illness. Increasingly, maize (corn) meal and a limited range of vegetable foods are being incorporated into the diet. While food is usually served by women, slaughtering of animals is done by the warriors. Distribution of meat to household members is done according to traditionally set rules, whereby particular parts of the animal are served to specific household members in accordance with age and gender of the individuals.

Customarily, dietary laws require that during the first pregnancy a woman should eat only porridge and other foods without milk or fat. She is given plenty of water, but is sometimes forced to vomit after a meal "to ensure delivery of a healthy child." When a baby is born, those from nearby enclosures help the new mother with cooking, fetching firewood and carrying water.

Tradition dictates that a sheep is slaughtered for the new mother. The baby may grow up to 2 to 4 years of age before another child is desired, though survey findings revealed the average period is three years. During this period breast-feeding is practised. Supplementary foods such as soft meat, soup, animal fat (ghee) and milk are given to the baby after two months. Breast-feeding mothers are well provided with milk, maize meal, porridge, beans and potatoes. Chicken or eggs and fish are not part of the Maasai diet, as chicken is considered an "undomesticated fowl" while fish is simply taboo, incompatible with their culture.

The effect of maternal nutrition on the course and outcome of pregnancy and on the nutritional status of the infant is profound. It is essential that the special nutritional demands during pregnancy are adequately met. Failure in this area may contribute to impaired maternal and infant health (Rogo and Oniango, 1987; Lawrence et al., 1987; Murtaugh et al., 1995; Olson et al., 1997 and Rees 1992).

In economically marginal societies, the dietary intake of pregnant women unfortunately has been far from satisfactory. Several studies have indicated an endemic inadequacy in calorie intake and other essential nutrients in the diets of pregnant women in developing countries (Jansen et al, 1980; Shah, 1981. , Morae, 1985 ; Devadas et al 1986). Inadequate food intakes have been found to be associated with poverty, deep-rooted dietary habits/beliefs/customs and/or lack of knowledge regarding the nutritive value of locally available foods (Walker et al., 1982; Winikof et al., 1981; World Bank, 1994; WHO, 1980; Reyonbo et al., 1993; Righy, 1979 and Saitoiti , 1977).

A statement of the Research Problem

The Maasai community, like many other groups in Africa, has a number of beliefs and customs, some of which might adversely affect the health of both mothers and infants. These are related to young age initiation and marriage, resistance to formal education of female, customs surrounding childbirth, pregnancy, and other cultural beliefs.

Maasai girls generally undergo initiation rites at the age of 10-12 and are usually married at age 13-15. They usually give birth to their first child well before the age of 16. In addition, there are unique cultural and dietary values which are reflected in their social and dietary habits. For instance, a tradition exists that requires protein rich foods (meat and milk) to be restricted during a woman's first pregnancy (Primigravidae) in particular, and during the pregnancy in general. It is speculated that protein rich foods will cause disproportionately large babies, resulting in dystocia (difficulty in childbirth). Dystocia involves a mismatch of foetus and pelvis, termed foetopelvic disproportion . It is widely believed, however, that problems like dystocia are influenced by a multiplicity of factors, including: a poor pelvis development due to early age malnutrition of the mother; a normal, but large baby, making child delivery too difficult; or a combination of both (Williams et al., 1985 ; Worthington-Roberts , 1987, Brems et al., 1985 and Garner, 1992).

Such restrictive dietary habits impact on both the course of pregnancy and its outcome. Protein, the nutritional element that is basic for growth, is required in all facets of foetal growth

and development.

Yet, these dietary habits have been sustained for many generations (Samm-Vaughan et al., 1990 and Sarris et al., 1975). The introduction of modern agricultural practices, primary health care (PHC) and the immigration among the Maasai of other tribes in search of agricultural land, however, have a significant effect on the indigenous food habits/taboo and other similar cultural values and beliefs of the Maasai.

The possible consequences of these socio-nutritional habits, have not yet been fully investigated and documented in the Maasai community. Thus, more studies are needed on this subject to learn in depth the impact of dietary restriction both on mother and child. This research, therefore, was undertaken with the aim of describing the food habits and traditional practices influencing the pregnant Maasai woman, and assessing how these practices have been modified in the process of transitional change from a pure pastoral to a more sedentary lifestyle. Emphasis was placed on assessing the impact of dietary practices in relation to custom on pregnancy and its outcome (birth weight).

Aim

To describe the dietary habits of Maasai pregnant women during pregnancy and to determine the relationships between those dietary habits and a pregnancy outcome.

Specific Objectives

1. To investigate the relationship between the cultural beliefs and dietary habits of pregnant Maasai women.
2. To compare the dietary habits of Maasai Primigravidae and multi para.
3. To compare a pregnancy outcomes between protein-restricted and un-restricted Primigravidae and multi para.
4. To investigate the relationship between dietary habits and maternal weight gain during pregnancy among Primigravidae and multi para.

Hypotheses

- I Maternal weight gain is less prominent among Maasai women whose diet is restricted for cultural reasons during pregnancy compared with those who have a more normal diet.

- II Prevalence of low birth weight among the Maasai Primigravidae whose protein intake is restricted is higher than those who are not restricted.

CHAPTER FOUR

NUTRITION AND PREGNANCY

LITERATURE REVIEW ONE :

The subject of nutrition, pregnancy and its outcome has been widely discussed during the last five decades. However, due to varying views held globally by nutritionists, obstetricians and anthropologists, and the complexities of cultural diversities and methodological difficulties, the results concerning both nutrition supplementation and aversion during pregnancy remain inconclusive (Brems and Berg, 1989).

Studying and analysing food habits during pregnancy, then, would reveal the cultural patterns and determine the adequacy or inadequacy of dietary intakes during pregnancy. Inadequate diets result in poor maternal nutrition, already identified as a major determining factor of pregnancy performance and outcome. Information on food habits, beliefs and taboos, especially during the reproductive period, therefore, becomes invaluable in planning nutrition intervention programmes (Cobgs et al., 1996; Cassidy et al.,1997) .

Women in developing countries have faced impediments to their own nutritional status and that of their offsprings. These impediments include: customary beliefs about nutrition, pregnancy and childbirth. Furthermore, women in rural Africa have a heavy load of responsibilities. A typical day's activities include sometimes walking more than 5 km to fetch water, collecting fire wood, cooking for the family, carrying lunch to the farm site for the husband, and sometimes looking after livestock, if the children are not old enough to perform this task. In addition to the above-mentioned responsibilities, African women are responsible for 60-80 percent of agricultural production. This leads to a colossal depletion of energy; pregnancy and child bearing become an added stress to the majority of women, resulting in high infant and maternal mortality rates (Pitkin, 1981; Winikoff et al., 1981; Metcoff et al., 1981; Chi et al., 1987; Chambers, 19982 and Sasson, 1990; Llewellyn-Jones).

Women living in developing countries are 50 times greater risk of dying during pregnancy and childbirth than women in developed countries, and they suffer more than eight million episodes of illnesses per annum (Liskin, 1988; Starr, 1985). More than 500,000 mothers and more than 14,000,000 infants die worldwide, each year, of which, women and infants of developing countries constitute more than 90 percent of morbidity and mortality. In some sub-Saharan Africa countries, IMR ranges from 110 to 300 per 1000 live births. The maternal mortality rates in some countries in the region exceed 530 per 100,000 live births (Mosley et al., 1978).

WHO estimates that more than 146,000,000 children under five years of age and 10,000,0000 mothers are malnourished globally, of which, women and children of developing countries constitute the majority. Furthermore, 570,000,000 women are illiterate and nearly three quarters of them live in countries with income below \$500 per annum (WHO Technical Report Series 701, (1984); 728, (1985); 752(1987); 768(1990); Preston, 1980 and 1983; Chambers; 1982).

The UNESCO Third World food survey carried out between 1957 and 1959 estimated that 60 percent of the population of developing countries was undernourished. The scenario had not improved 24 years later when the WHO Progress report on Primary Health (1983) stated that malnutrition was still affecting more than 25 percent of the population of the poorest countries, at times more than 50 percent in selected countries in sub-Saharan Africa. The WHO study further suggested that the prevalence of malnutrition in the less-developed countries implies that the root cause of malnutrition is poverty and ignorance, which are predominant in these countries (Scholl et al., 1988 and Scholl et al, 1994).

In Africa south of the Sahara, food production is also affected by unpredictable weather patterns, such as severe droughts. A study of malnourished children in Lusaka, Zambia, by Khan et al., (1979) concluded that malnourishment in Zambia was a by-product of social and economic depression (poverty). A large number of children of low-income or unemployed parents were undernourished. A similar study carried out in Kenya by Kusin et al (1987) emphasised a synergistic relationship between malnutrition and low socioeconomic status among the study subjects (Brazelton et al., 1984; Brown et al., 1986; Sena 1986; Scott

et al., 1986).

Pregnancy is a state of physiological stress characterised by profound metabolic and hormonal changes (Lawrence et al., 1987). The elevations in a maternal metabolism and the requirements for foetal growth and development impose additional nutritional demands on the mother. Some of the changes that occur during pregnancy are:

- Increased basal metabolic plasma volume by 50 percent, while blood cell mass increases by about 20 percent. In total, the body fluid increases by 8.5 litres;
- Increased absorption of certain nutrients like calcium and iron.
- Increased body weight;
- Nausea, heartburn and constipation due to alimentary functional adjustments.

Furthermore the nutritional state of a pregnant woman has a great effect on the unborn child. Raman et al., (1983 ; Prentice et al., (1983) and Prentice et al., (1981) observed that low birth weights in Kenya were associated with maternal vitamin deficiencies. In a separate study, Gopalan et al., (1972) found that pregnant women in Guatemala increased birth weight progressively as dietary intake increased.

A review of the current literature suggests that a high proportion of childbearing women in the rural regions in developing countries have low food intakes. Their energy intake is, therefore, very often below the recommended daily allowance of 2200 kcal/day. In these communities, the average diet of the pregnant woman has an energy intake of 1400-1800 kcal/day (Rogo and Oniango, 1987)

Other studies have documented undernourishment among pregnant women in many developing countries. Chowdhury (1987) carried out a study in Bangladesh showing that the calorie and protein intakes of pregnant and lactating women were far below those of non-pregnant and non-lactating women. Investigations in a maternal dietary intake done in the village of Keneba, Gambia, reveal that the energy intake of the pregnant mother varied from

a mean of 1302 kcal/day during part of the wet season to 1483 kcal/day during the dry season. These energy intakes are far below the recommended daily allowances.

These findings corroborate with studies done in Machakos District of Kenya, where the diets provided only an average of 1339 to 1591 kcal/day. These Machakos studies report a total weight gain of 6.4 kg in women in rural Machakos, as compared to 7.9 kg in the middle and upper class pregnant women (Jansen et al, 1981). Similar studies in India showed that the average energy intake of pregnant rural women was 1420 kcal/day (Gopalan and Rao, 1972) and 2055 kcal/day (Rao, 1984; Smithells et al., 1974 ; Cassidy , 1997; Smithells et al., 1983; Sharper et al., 1981; Shapiro et al., 1980).

In contrast, the average western healthy pregnant mother is more advantaged than the mother in the rural areas of developing countries. She gains an average of 12.5 kg of body weight, with an equivalent gain of 450g per week in the last trimester. This weight gain is associated with the optimum clinical outcome of pregnancy. Furthermore, in affluent communities, the curtailment of physical activity is common, especially in the last trimester..

The rural pregnant mother, however, cannot afford to lessen her physical activities during gestation, particularly in the wet season which usually coincides with the intense farming activities. In most developing countries, women do the majority of the work in the fields and also prepare meals for the family. They work harder than men on average of whom are either employed in the formal and informal sectors in cities. But they spend more time socialising. In fact, most of the women have been found to engage in strenuous manual labour till the last stages of pregnancy (Gopalan and Rao, 1972; Rogo and Oniango, 1987; Paul et al, 1979). Therefore, pregnant women are doubly subjected to energy deficits and these conditions impose considerable stress on the mother (Lawrence, 1985 and Ashworth et al., 1982).

A World Federation of Public Health Association (WFPHA) (1983) study concluded that women in developing countries were 20 times more at risk of becoming anaemic than women in developed countries. The daily intake of iron in poor communities in the tropics, for example, is 18 mg compared to 40 mg recommended during pregnancy. A WHO report (1982) states that women need three times as much iron as men while often their food intake is lower than that of men. Pregnant women are considered to be among the most vulnerable groups (Mayet, 1985 and Colton et al., 1974)). During pregnancy, the iron requirements

increase in order to meet foetal needs.

Studies carried out in North Africa found that 38 percent of pregnant women in Tunisia were anaemic (WHO 1982). Another study conducted on Bangladesh women, showed that only 77 percent of those with anaemia gained weight up to the fifth month of pregnancy; the situation became worse after six months, decreasing to only 73 percent of the standard. Arm circumference decreased and anaemia increased from 10 percent to 50 percent, with an average weight gain of 4.7 percent (Raman, 1981; Coauthor, 1987). Studies done among Indian and black women showed that there was a progressive increase in the prevalence of anaemia as the pregnancy increased. A prevalence of 47 percent and 28.6 percent was noted among Indian and black women respectively during the third trimester of pregnancy (Mayet, 1985 and Coronios-Vagas et al., 1982).

Mayet notes that the prevalence of serious anaemia during pregnancy is often associated with maternal mortality. Similar findings show that nutritional anaemia is a major cause of maternal deaths (Gopalan and Rao, 1972; Rogo and Oniango, 1987) and that maternal mortality was 3.5 per thousand in non-anaemic mothers in Kuala Lumpur, while in the anaemic it was 15.5 per thousand. Similar studies concluded in Malaysia and Indonesia showed that women with anaemia were at four times a higher risk of dying during childbirth than their counterparts without anaemia (Chi, 1987; WFPFA, 1983; Asindi et al., 1988 and Antonov, 1947).

Anaemia reduces the capacity of women to be productive, increases the degree of fatigue, lowers the resistance to infection and exposes them to complications of pregnancy and childbirth, thus increasing the risk of mortality. All these studies underscore the importance for pregnant women to increase their intake of food rich in iron.

Poverty can affect the food intake of the pregnant mother. A large proportion of the rural population in developing countries are poor and often unable to afford a balanced diet. Because of poor economic status, pregnant women suffer from low purchasing power, poor health care, frequent pregnancies, large family size and poor food supplies and excessive household responsibilities. They also experience stress leading to bacterial infections and

parasite infestations. All these poverty-induced factors generally influence the food intake of the pregnant mother and hence the mother's nutritional status (Shah, 1981; Gopalan and Rao, 1972; Susser et al., 1972; Thompson et al., 1997; Tripathi et al., 1987 and Underwoods, 1994)

The reports mentioned in this literature review point to considerable energy deficits during pregnancy in many rural regions of developing countries. Although it is tempting to generalise these findings, it is important to remember that there are often wide variations between socially and geographically defined groups within national populations.

A UNESCO (1993 b) report indicates that a normally fed woman gains between 12 kg and 12.5 kg weight during her pregnancy. A mother suffering from malnutrition has a strong chance of giving birth to a premature baby. Both mother and baby have very low weight and can suffer from retardation. The mother's undernourishment has a bearing on breast feeding and milk production as the fat accumulation during pregnancy is a necessary reserve for the energy demanded by the unborn foetus.

Although it has been long appreciated that maternal weight gains during pregnancy is essential for foetal growth and development, nevertheless, attitudes among nutritionists, obstetricians and anthropologists remain inconclusive. (Brems and Berg (1985) unpublished.)

The prevalent idea that has persisted for years is that overeating resulted in delivery of over-weight children, which makes delivery difficult putting both the mother and foetus at high risk, especially in developing countries where the majority of women deliver at home under the supervision of traditional birth attendants (TBAS) due to lack of adequate medical services (Eschelman, 1975 ; Worthington-Roberts, 1985).

An in depth elucidation of Dutch famine during World War II (Smith, 1947) revealed the following: -

- Number of birth weights were markedly reduced by severe malnutrition at conception;
- Famine during the first World War among the Dutch pregnant women caused increased premature births;

- Maternal under-nutrition at the first late gestation retarded foetal growth, increasing the incidence of low birth weight substantially, (Smith , 1947).

Another analysis of 301 obstetric records of white, middle class infant birth weights revealed that both pregnancy weight and birth weights were correlated. Another international survey of pregnancy and birth weights showed that during the course of some "typical" 40 weeks pregnancy, maternal weight gain of 24 lbs. can be considered as normal. However, more than half of this gain resides in fetus, placenta and amniotic fluids, while the remainder is stored in the maternal reproductive tissues, fluids, blood and protein, which is largely body fat (King et al., 1973; Klein et al, 1976).

The subject of low birth weight, weight gain or loss during pregnancy, parity, gestational duration and mother weight gain have remained significant predictors of pregnancy outcomes (Siega riz et al, 1993; Scholl et al, 1988; Hediger et al, 1990 ; Villard et al., 1987; Rehan et al., 1981 and Watts, 1970). Various studies conducted in different parts of the world have shown that women with lighter pregnancy gain more weight than those women with normal pregnancy weights. The Egyptian study to determine pregnancy outcome and newborn behaviour showed that early pregnancy (3 months) weight and weight gain during trimester 2 and 3 were significantly related to birth weight. When a best predictor model is examined, early pregnancy weight and maternal intake of animal source foods were significantly positive predictors of the weight of new born babies (Kirksey et al, 1991; Brazelton et al, 1984; Brezenzinskin et al., 1947).

It has been widely recognised that body weight of the mother in early pregnancy and weight gain during pregnancy are the strongest factors, other than length of gestation in influencing birth weights. Furthermore, mothers' height indirectly influenced both weight and neonatal behaviour, because taller mothers deliver heavier babies and heavier babies often score higher on neonatal behaviour (Kiresky et al, 1962; ALS et al, 1977; Anderson et al, 1984).

A problem at times occurs from a statistical point of view in analysing maternal weight

and weight in pregnancy. If weight is standardised against height, the effect of height will be underestimated. On the other hand, if height is omitted, weight will be exaggerated. Thus, analysis of pregnancy outcomes should include both height and height-standardised weight (Kirksey et al, 1962).

The effects of maternal nutrition on total growth and development have been assessed severally. It is widely believed that maternal and child malnutrition plays a significant role in retardation of infant growth and causes neo-natal death (death under 1 year). According to a study sponsored by the Pan American Health Organisation (PAHO 1976; Funk et al., 1990; Gebremedhine et al., 1987 and Harrison et al., 1985), supplementation during pregnancy and infancy showed an association with reduction of both infant mortality and physical growth retardation (Klein et al., 1976). Majority of studies focussing on maternal weight show that mothers with underweight pregnancy had a higher risk of pregnancy outcome compared to mothers with adequate or normal weight during pregnancy (Naeye et al., 1981; Fawzi et al., 1997; Freedman et al., 1997; Frisancho, 1985 and Frinkel, 1980).

In general, during pregnancy, women are reminded that they need an additional 300 Kcal/day or at least 36 Kal/KG body weight (Thomson and Hytten, 1973). Although data on food restriction during pregnancy are limited, nevertheless, major adaptations occur in protein and amino acid metabolism (Kohrs et al, 1976; Hufman et al., 1986; and Hussain et al ., 1983). However, these have not been fully defined with a large population-based study to support the data.

During pregnancy mothers go through a series of experiences. As maternal blood supply increases markedly during pregnancy, the demand for iron correspondingly increases (Kitay et al ., 1975). Iron supplementation is often acknowledged as an effective means to prevent maternal anaemia during pregnancy (Crosby, 1971; Cross et al., 1966; Davies et al., 1974; Delvoeye et al., 1980 and Devadas et al., 1986) have suggested that iron deficiency may lead to a pica - which causes women during pregnancy to crave for unusual food sources.

- a) Discovery of a pica may be the first clue in establishing the existence of iron deficiency;
- b) Abnormal craving is not always for a strange food or substance.

- c) Local cultural habits for a pica may suppress or influence a certain type of pica selection; .
- d) A sense of shame or guilt may interfere with a history of the pica under particular circumstances.

The underlying cause of high infant mortality rates in developing countries is a low birth weight. Children born below 2500 g are three times more likely to die before celebrating their first birthday compared to their counterparts weighing > 2500 g (Shah, 1981, Chi et al., 1987; Crawford et al., 1993; Cobge et al., 1996 and Harrison et al., 1985). Data published by WHO in 1980 showed that the incidence of low birth weight in sub-Saharan Africa, South east Asia and Latin America exceeded 10% across the spectrum compared to industrialised countries which showed quite low incidence rates.

Although these data are almost two decades old, the situation has, nevertheless, improved significantly. There are different variables that predispose to low birth weight (LBW) including but not limited to:

- maternal age < 20 and > 35;
- clinical conditions before and during pregnancy;
- maternal height < 150cm and poor antenatal care.

A study on predisposition carried out in East Africa showed the above indicators as primary causes of LBW. The important factors affecting LBW are premature delivery and retarded foetal growth or development. However, among the chief causes of LWB, the mothers age and height appeared to be leading causes of her weight gain. Further studies (Prentice et al., 1987; Hamill et al, 1977; Cross et al., 1966; Burke et al., 1943; Devadas et al., 1986; Donovan et al et al., 1986; Dorty et al., 1979 and Donovan , 1984) concur with the findings.

LBW babies suffer more from neonatal mortality than their counterparts - i.e. normal birth weight babies. Neonatal mortality is defined as the number of deaths occurring during the first month of life per 1000 live births. A review of paediatric data at Ibadan hospitals, Nigeria showed that 77.3 % of LBW infants died within the first month of delivery compared

to LBW mortality of 8.5 per 1000 live births in Birmingham UK. The majority of LBW infants in Nigeria died of synergistic effect of opportunistic infections, as they were slow in developing an adequate immune capacity at the normal rate at the early stage of life (Durnin, 1987; FAO/WHO, 1985; Garn et al., 1983; Garn et al., 1982).

The subject of LBW and maternal nutrition has been a major focus for nutritionists and clinicians and has sparked debate both for and against regarding the importance of maternal birth weight pre and during pregnancy as causal factors. The importance of maternal nutrition both before and during pregnancy has been consistently emphasised. Those mothers with low socio economic status specially in the regions or communities with chronic under-nutrition has suffered from low birth weight compared to mothers from affluent communities. (Berganer et al., 1970; Sevehuysen et al., 1987; Gebriel et al., 1987). The data collected from 18 countries held in the Oxford data base of Perinatal Trials (ODPT) was analysed and controlled for maternal nutrition, nutritional supplementation and , meta analysis.

The analysis focussed on the effects of energy and protein intakes on a pregnancy outcome (birth weight). To achieve more objective statistical results, the author applied a randomised clinical trial to reduce bias and formal quantitative method to overcome inadequate sample sizes. The findings exhibited no significant association between modest maternal weight gain and total growth. Furthermore, neither balanced isoenergetic protein supplementation nor protein supplementation appeared beneficial to either mother or infant. The finding is relatively supported by other studies (Thompson et al, 1968; Niswander et al., 1974 and Carr-Hill et al, 1983; FAHO/WHO, 1985; Garaza et al., 1994; Garner et al., 1992 and Brems et al , 1985).

Another study by Kramer (1987) and Thompson et al., (1968) ; Peller et al., (1997) ; and Elwood, (1983) focussed on modelling maternal weight and height in pregnancy bearing in mind the independence of each in understanding the uniqueness between maternal height and weight and recommend adjusting weight for height in examining the effect of pregnancy weight on birth weight, while Garan et al, (1992) ; suggests that weight adjusted for height has no advantage over unadjusted pregnancy weight predicting birth weight. Methods of adjusting weight for height have received a broad-based support. However, Garner et al., (

1992) suggest that efforts to increase birth weight might have an adverse impact on the mother and foetus. However, despite such differences of opinion, recent studies conducted in different parts of the world continue to show consistency in the correlation between maternal weight and height.

Differences in physical growth between LBW and normal birth weight child have been refuted. Martell and colleagues (1981) found that differences in weight and length between premature, small-for-dates and normal children disappeared after 18 months of birth in Batti, Ethiopia 2860 g and Leningrad, Russia 2790 g (Sevenhuysen et al., 1987; Gabremedhine et al., 1987; Smith, 1947; St. George et al., 1970; Romieui et al., 1987). On the other hand, a significant retardation in weight, stature, head circumference and osseous development was observed even at the age of three years. LBW children showed significant stunting up to the age of 7 years (Masarone et al, 1977, Kirsky et al., 1991; Gebremedhine et al., 1987; Similar findings were observed in other studies, Dutch study 3150g, Smith, 1947; in Ethiopia 2860 g Sevenhusen et al., 1985 and Leningrad, Russia 2790 g Antonov, 1947). The overall conclusion was that LBW children showed significant stunting ranging 5 cm to 7 cm shorter than control groups (Masarone et al., 1977).

Disparity in pregnancy outcomes among various ethnic groups had been frequently attributed to a list of variables: - parity nutrition, socioeconomic status, maternal education, access to prenatal care, other health and social services (Gortmaker et al., 1979; Gould et al., 1988). Birth weight is an interesting predictor of infant mortality (Kramer, 1987), while infant mortality is an indicator of a population's health (Edwards et al, 1994; La Doint et al., 1991; Murray et al, 1988). Thus, the overall synergism between nutrition, pregnancy and birth weight has to be assessed within this endemic reality.

It is a widely discussed view that excessive weight before and during pregnancy might be associated with abortion, "a foetal outgrowth of the womb" and a variety of other disorders (Eschelman, 1975). The prevalent idea has been that overeating by expecting mothers will result in larger baby size, which complicates the process of labour and delivery. This argument could be controversial in those communities where WVI works, medical care is inadequate and the majority of the women in the rural areas deliver with the assistance of traditional birth

attendants (TBAs). Cesarean sections are quite rare and complication of simple delivery can be fatal. (Eschelmann, 1975, Liskin, 1988 and Kings, 1994).

Difficulty in labour arises when there is an imbalance between the size of foetus and the size or shape of maternal pelvis. This explains how disproportion originating from nutrition and biological factors can occur:

- Due to early under development resulting from under nutrition in childhood or early age of marriage;
- Too large baby size for mother to deliver normally;
- Combination of the two phenomena could result in maternal mortality or combined maternal and foetus deaths.

Large birth weight babies are frequently found when both pre-pregnancy weight and weight gain by mother during the pregnancy are high. This view has been further confirmed by Gormican et al., (1980) and Kirchoff, (1967).

In underweight women, mean infant birth weights increased by 214 grams with a corresponding 10% increase of maternal post partum weight (Lunn, 1994). Analysis of the data from the collaborative perinatal project of the US National Institute of Neurological and Communicative Disorder and Stroke showed that normal weight mothers gained 20 pounds, while under-weight mothers gained 30 pounds. Although the study finding may not be generalised out of context, nevertheless, it is suggestive that there must be a desirable gain during pregnancy which should relate in part to the pre-pregnancy weight status of mothers.

The whole issue of nutrition, pregnancy and child birth in the developing world appears to have a significant synergism, which often results in complications. As a result the views of nutritionists with regard to maternal nutrition and pregnancy weight gain remain less than conclusive.

Currently available data suggest varying views about the issue. Studies of obstructed labour cite rates ranging from 18 - 20 percent among women delivering in hospitals in Zaire; and 10 - 12 percent in Bangladesh with similar rates in India, Brazil and Jamaica (Liskin, 1988). Studies conducted in Nigeria showed that 83% of cases of obstructed labour were due

to foetopelvic disproportion, while in Zimbabwe 70 percent of the incidence of caesarean sections were thought to be caused by Letopelvic disproportion.

The role of nutrition in pregnancy is quite a complex issue that needs a careful evaluation of its impact on maternal and foetal health. At times, its adverse effect on both has to be considered within the context of maternal nutrient stores, placental weight, uterine blood flow and gestational changes in maternal plasma volume,(Beard et al,1994 and Coetzee et al.,1980).

Food Customs, Nutrition and Pregnancy

Specific cultural beliefs and taboos that restrict or favour specific foods during pregnancy appear to be widespread. Some communities have no specific preferences during pregnancy; others give various reasons for either restricting or advocating special foods during pregnancy. In those cultures which are strict on diets during pregnancy, the food intake of pregnant women is affected by deep-rooted beliefs and customs and lack of knowledge regarding the nutritive value of the locally available foods. Whenever consumption of foods is restricted, it is mainly intended to reduce foetal growth and mother's weight in order to ensure easy delivery. This has been observed among the Maasai people of Kenya (Rogo and Oniango, 1987). Other studies (WHO, 1982; Reye et al., 1993 and Romieu et al., 1997) found that the cultural practice in developing countries, whereby men generally are given more food than women, tends to disadvantage pregnant women. Dietary restrictions, however, could have very adverse effects on the nutritional status of the mother, and these effects could be particularly disastrous in chronically malnourished mothers.

In some cultures, some foods are not eaten by certain groups of people like women, children and young men, because of accompanying beliefs regarding them. The Maasai, for example, believe that milk is the best food; therefore, maize meal intake is curtailed when the milk supply increases (Nestel, 1984). Rao's study in India (1985) and Kinyunjui, (1979) among the Kenyan Maasai found that there were certain foodstuffs which were not to be taken or avoided during menarche, pregnancy and lactation. The study also found that most women received diet information from in-laws, a tradition preserved for generations.

In some societies girls commonly receive less nutritious food than boys, leading to malnutrition and impaired physical development. Since early undernutrition can lead to underdevelopment of the pelvis, girls who are underfed during childhood may have stunted growth and similar problems during pregnancy and child birth. The disadvantages suffered by the girl children at an early age have far-reaching implications for mothers and children.

This cycle is affected by poor enrolment and graduation of girls from high school, cultural misgivings about girl child education, as well as ignorance and poverty -- all of which have a negative impact on women in developing countries (UNESCO, 1993).

Shah (1981) carried out studies in India and found that food intake by all women was affected by deep-rooted customs and lack of knowledge regarding the nutritional value of locally available foods. Shah also noted that diet, during pregnancy, was strongly influenced by overall customs and taboos in developing countries. He states that, in India, beliefs about hot and cold foods were highly relevant, and various foods were prescribed during pregnancy to make childbearing easier -- beliefs similar to those in the Maasai studies. Ebomoyi, 1988 and Prentice et al., 1987 found that in Nigeria foods rich in protein, like meat, were avoided during pregnancy due to socio-cultural beliefs. Ebomoyi also found that urbanisation led to dietary diversity, but this did not necessarily show an improvement in the quality of diet due to urban poverty.

An Iraqi study revealed that special foods, mostly meat, chicken, eggs and milk during pregnancy and lactation were consumed by only 27 percent of the study subjects. Forty-nine percent of the women had no special diets during pregnancy. Food avoidance was investigated in the same study where 31 percent of the women avoided melons, onions and leeks, while 55 percent avoided a particular food. A similar investigation in the Sudan showed that food avoidance was more prevalent than in Iraq. Fifty-seven percent of the mothers studied indicated aversion to protein food, such as meat, fish and poultry. These foods are some of the best sources of protein, important requirement for foetal development. The main reasons given for the food aversion were that these foods caused nausea, heartburn, colic, and diarrhoea (Osman, 1985 and supported by other findings ; Lathan, 1982; Lamb et al., 1984; Lapoint et al., 1991).

Other reasons given for the avoidance of some foods included ease of labour. In Kenya the adequacy of nutrition is only marginal in the majority of the population and little seems to be known about maternal nutrition during pregnancy, as it occurs in a diversity of circumstances. What is known is that the Maasai of Kenya restrict certain foods during pregnancy to ensure a safe and easy delivery (Rogo and Oniango, 1987). In the Machakos area of Kenya, mothers often mentioned that they would not like to eat too much during pregnancy to avoid difficult labour in the case of a large baby.

The specific foods that would be avoided, however, were not mentioned in the study. The Akamba's traditional diet of maize, beans and little fat reveals types of diet restriction related to pregnancy (Kusin and Jansen, 1986 and Lomas et al , 1989).

Investigations into food beliefs in India reveal that food habits were observed at each stage of pregnancy. During pregnancy, nutritious foods, like milk, fruits and ghee (butter), were used to enrich the diet. Food restrictions were mainly observed in order to prevent nausea, indigestion and abdominal discomfort (Rao, 1985). In another Indian study, foods like pawpaw and drumstick leaves were avoided for fear of causing abortion and indigestion (Devadas and Easwaran, 1986; Peller et al., 1995 ; Murtaugh, 1995).

The diet consumed during pregnancy deserves special consideration to ensure that it is not a limiting factor on the good health of both mother and foetus. A successful pregnancy requires additional nutrients like protein, calcium, iron, vitamins and additional energy. These dietary requirements during pregnancy can only be met if adjustments are made in the foods eaten. The Iraq study confirms that there is a tendency to continue with the pre-pregnancy, dietary habits during pregnancy, regardless of whether the dietary habits are appropriate or not. In this study, 49 percent of the women sampled did not change their eating habits during pregnancy. However, the type of food accessible is also important, since the pregnant mother can only eat what is available and affordable.

These studies suggest that culture plays a significant role in dietary patterns and that many women of childbearing age in developing countries may subsist on diets deficient in calories, protein and vitamins. These studies also suggest the need for appropriate knowledge of individual communities, institutions, educational programmes and cultural practices.

General community education, with specific emphasis on girl child education, may bring a positive change. Communities need to be educated to change their attitudes about dietary habits during pregnancy, since nutrition has a bearing on the unborn child, the mother and the family as a whole (Osman, 1985).

Factors affecting Pregnancy Outcome

Birth weight is an important health indicator, because it is one of the major factors determining survival in the perinatal and neonatal periods. Birth weight is not determined by maternal nutrition alone, but is affected by a variety of factors, including mother's height, pre-pregnancy weight, previous nutritional history, scope of physical activities, income and education. Actual nutrition supplementation during pregnancy accounts for not more than six percent of the factors listed (Metcoff et al, 1981 and Bandini et al., 1997; Liewellyn-Jones , 1965; Loris et al., 1985 and Lunn, 1984). Other general variables that affect birth weight include parity, illnesses during pregnancy, history of previous pregnancy i.e., gestational ages, number of foetuses, gender of foetuses, frequency of birth intervals, placental abnormalities and congenital malformations.

Studies done in various parts of the developing world have shown a strong synergism between maternal height and birth weight (Asindi et al ., 1988; Klein et al, 1976) and maternal weight and birth weight (Shah, 1981; Woods et al., 1981; St. George et a. l, 1970). Other studies have exhibited a relationship between mothers' weight and height and baby's birth weight (Mckenna et al., 1997; Mosley, 1978; Biss et al., 1971 and Bradly et al., 1992).

In a study in Nigeria, maternal height was found to be a significant predisposing factor in low birth weight for mothers 150 cm and below; these women had about five times more risk of having low birth weight babies than of taller mothers. This particular study revealed that about 20 percent of the small-for-date babies have short mothers compared to 11.8 percent of the pre-term babies (Oni et al., 1986).

Studies done in India, South Africa and Trinidad showed that maternal weight affects foetal growth. In the Indian study, pre-pregnancy was found to be an important determining

factor in infant weight at birth. The birth weights of infants whose mothers weighed 38 kilograms or less before pregnancy were significantly lower than those who weighed over 41 kgs (Hira et al., 1986; McGuire et al., 1986; Peller et al; Metcooo et al., 1981). In a study in South Africa, both foetal growth rate and duration of pregnancy were reduced in the underweight mother. Again, maternal weight gain during the third trimester was found to be a significant decisive factor in gestational age at birth, with heavy women tending to have larger babies than lighter women.

In the village of Keneba, Gambia, the effects of maternal height, mid-pregnancy weight gain and late pregnancy weight gain were investigated. Height and late pregnancy weight gain had the greatest influence on birth weight. These findings agree very well with the Trinidad studies where it was demonstrated that taller or heavier mothers delivered heavier babies. The Machakos study in Kenya also showed that weight gain per month and height had a great influence on birth weight (Kusin and Jansen, 1986 and Mosley , 1978).

It is surprising, though, that the incidence of low birth weight is not as high as the incidence of mothers consuming poor diets. The incidence of low birth weight was 6.5 percent in Kenya (Jansen et al, 1981), 25 percent in Tanzania (Metetnlema and Bavu, 1981), 30 percent in India; (Gopalan and Rao, 1972) and 8.8 percent in Nigeria (Oni and Ariganjoye, 1986). It would, be logical therefore, to make the observation that, although weight gain is necessary during pregnancy, a lot of weight gain may not be necessary as long as the mother has an energy balance which could be accounted for by additional dietary intake or reduced physical activity (Lawrence et al., 1987).

The successful outcome of a pregnancy, then, depends on several factors. In spite of the multiplicity of factors, it now has been well established that maternal nutritional status has a far reaching effect on the weight of the infant at birth (Hira et al., 1986; Paul et al, 1979; Kusin and Jansen, 1986 and Makokha, 1980). Additional nutrients during pregnancy could go a long way in improving maternal nutritional status and ensuring normal birth weight babies. The pregnant mother may not control the internal processes, but if she can manage her diet to maintain adequate nutritional status during pregnancy, it could result in a significant improvement in birth weight.

Bantje (1983) studied seasonal birth weight distribution in Ikwiriri Village, Tanzania and found that consistent seasonal variations affect birth weight and that incidences of low birth weight occur in rural societies mainly dependent on agriculture. He found that these variations were due to a combination of food intake and labour output required by women.

Prentice et al., (1983) and Neligan et al., (1970) indicate that among Gambian pregnant women the main sources of calcium were leaves, fish, cereals groundnuts and local salt. Cow milk only contributed 50 percent of calcium intake. The seasonal availability of leaves, cereals and groundnuts resulted in variations in calcium and potassium intakes. The rainy season was associated with an increase in calcium intake (16 percent), but a corresponding decrease in potassium composition (15 percent). Here, the researchers went further to show what food component is available at what period of the year and how this may influence maternal diet and birth weight.

In the Tanzania finding , there were relatively high birth weights in periods of food shortage without agricultural labour, suggesting that heavy female activity also has a negative effect on birth weight under conditions of inadequate food intake. In the same study, food shortage and peak labour reflected in a low mean maternal weight gain (Bantje, 1983). These findings are similar to those in a Gambian study where intense agricultural activity by pregnant women coupled with low food intake, probably were the main factors responsible for the remarkable drop in birth weight observed around the wet period of the year. During the dry season, the mean birth weight (sexes combined) was 2.94 kg as compared to 2.78 kg during the wet season (Prentice et al., 1981; Roberts et al., 1982 and Nyanza province, Kenya, 1985). Thus, this means that pregnancy and birth weights are affected by various factors, but each has a different level of impact on the course of pregnancy and its outcome (birth weight).

CHAPTER FIVE
LITERATURE REVIEW TWO :
NUTRITIONAL SUPPLEMENTATION, BIRTH WEIGHT AND ADOLESCENT
PREGNANCY

This chapter describes the relationship between nutrition supplementation, birth weight and adolescence pregnancy.

The direct relationship between maternal nutrition and birth weight can be shown by measuring the effect on birth weight after dietary supplementation (Kusin and Jansen, 1986). Studies done in various parts of the world have shown that supplementation, especially among the mothers who are severely malnourished, has a positive effect on weight gain. In Keneba, Gambia, it was shown that during the wet season, when food was scarce and agricultural workload heavy, maternal dietary supplementation improved birth weight by 224g on average. The incidence of low birth weight was reduced significantly from 28.2 percent to 4.7 percent (Prentice et al., 1983 ; Willen et al., 1997).

In India poor pregnant women were fed on additional 500 kcal and 10g of protein during the last four weeks of pregnancy, providing a daily intake of 2300 kcal and 60g protein. Initially, they had been getting an average of 1800 kcal and 50g protein. The birth weight of the babies born to supplemented mothers was 300g heavier than the babies of mothers who had no supplementation. (Gopalan and Rao, 1972). These findings are similar to those obtained from a study of Zulu women in South Africa, who were supplemented to determine the effect on foetal growth of bulk dietary supplements after mid-gestation. Two types of supplements were provided, one bulky and the other less bulky. Birth weight was greater in both cases, but the low bulk supplement resulting in higher birth weights. These findings are similar to a Guatemalan study where two food supplements demonstrated a significant association between food supplementation during pregnancy and low percentages of low birth weight babies (Klein et al., 1976 and Willen et al., 1997).

Studies carried out in the same countries have shown that supplementation of the necessary nutrients during the later stage of pregnancy has a great benefit for both the pregnant

mother and the unborn child. Underwoods, (1994) and Worthington-Roberts, (1985) indicated that, even late in pregnancy, a vitamin deficient mother may still obtain benefits from low dose Vitamin A supplementation. Prentice et al., (1987) studied rural Gambian women who had received an energy dense pre-natal dietary supplement action. Birth weights were lowest during the months of July to October in the pre-supplement years, showing the seasonal variation of food intake. Supplementation was associated with a significant improvement in birth weight. During the dry season, when there was plenty of food, supplementation had no effect on birth weight (-3g); however, during the wet season, when food was scanty, supplemented babies were 186g heavier than those of unsupplemented mothers. Several studies have shown that low supplement action to low weight pregnant women has significant impact both on mother's weight and that of the unborn infant (Prentice et al, 1983; Gopalan and Rao, 1972; Klein et al, 1976; Underwood, 1994 and Prentice et al., 1987; Wynn et al., 1991; Williams et al., 1985).

Effect of Age and Parity of The Mother on Birth Weight

In traditional societies, early marriages are encouraged and girls tend to be married without their active participation in rationale decision making regarding the marriage. Reports of the World Bank (1994) and WFPHA (1983) state that the population of women giving birth during their teenage range from 10 to 50 percent, varying from region-to-region and from country-to-country. The report indicates that early child bearing is very common in developing countries where tradition dictates early marriage as the norm. The same report states that early pregnancy can hamper a girl's social and economic opportunities. Such girls often drop out of school (if they ever did enrol), their general education is affected and their future employment opportunities are limited. According to the two reports, the harmful effects of adolescent pregnancy can hardly be over-emphasized.

A 1989 study in Botswana found that one in seven girls who dropped out of school did so due to pregnancy, and only one in five of them returned to school subsequently.

In addition, a WHO (1989) report states that adolescents seek illegal abortions to avoid being expelled from school. Studies of hospital records in several African countries found that between 38 percent and 68 percent of women seeking care for complications of abortion were under 20 years of age (Anderson et al., 1994).

Adolescent girls are not physiologically and psychologically ready for child birth, since growth is not completed until around the age of 18 years and the reproductive system or the birth canal does not fully mature until two to three years later (i.e. 19 to 21). Girls are not given adequate food to assist them to achieve full growth and development and, therefore, experience many preventable physiological problems at childbirth than older mothers.(UNESCO, 1990 ; Nestel, 1984; Shah, 1981; Ebomoyi, 1988).

Girls' nutritional needs increase in early adolescence, because of the growth spurt associated with puberty and the onset of menstruation. In the cultures of most third world countries, however, girls are underfed because more food is given to boys. Malnutrition commonly results in iron deficiency anaemia among young girls. Malnutrition also delays skeletal growth and maturation and results in a small pelvis canal which, in turn, may lead to prolonged labour and obstructed delivery (World Bank, 1994).

In a study carried out in Nigeria, 17 percent of 14-year-old girls developed hypertensive disorders in pregnancy, compared with 3 percent of women aged between 20 and 34 years (WHO, 1989 and Thompson et al., 1997). The same study showed that 33 percent of all cases of fistulae involved women under 16 years. The reports indicate that adolescent mothers experience at least 20 percent greater risk of maternal or infant mortality than women in their twenties.

The risk of low birth weight can be very high with far-reaching implications, if the problem of young maternal age (< 20 years) is compounded with maternal malnutrition. Teenage pregnancy has been associated with low birth weight. Low levels of education, poverty and ignorance adversely affect the health and nutritional status of their infants who already have low birth weight. Investigations carried out in Trinidad (St. George et al, 1970), Kenya (Ngoka and Mati, 1980) and Nigeria (Adedoyin et al., 1989) confirmed that teenage mothers had smaller babies compared to adult mothers.

In the Kenyan study, the younger mothers (< 20 years) also had more pre-term deliveries, while a study in Nigeria showed that anaemia in pregnancy was more prevalent among adolescent mothers than among adult mothers. Anaemia is one of the chief factors leading to low birth weight (Ngoka and Mati , 1980) .

Both infant and maternal mortality, among other causes, are largely attributed to maternal and child malnutrition. It is known that babies born with low birth weight (<2500g) in developing countries are less likely to live beyond five years, compared to children born with a normal birth weight (2500g). Nutrition plays a significant role in the child's physical size, mental development over all health status and various other development indicators (Klein et al., 1976; Gebremedhine et al., 1987 and Smith, 1947). During the 1984/5 famine in Ethiopia, it was observed that birth weight in the relief camps was lower than in the urban population of the same region and that there was a proportionally higher number of low birth weight infants. This was similar to the findings of the Dutch famine study quoted above.

The Ethiopian study further revealed that young mothers were unable to sustain pregnancy to full term during severe famine, due to severe nutritional stress, while older women were able to do so. This finding concurs with that of the Leningrad famine study in which older women, despite the severe famine, had managed to obtain more food compared to younger women (Antonov, 1947). Even under normal circumstances, younger pregnant women are at greater risk of i.e. anaemia, toxemia and excessively low birth weights (Oni et al., 1986; Sevenhuysen et al., 1987).

A longitudinal study carried out in Machakos, Kenya, revealed that the habitual diet of pregnant women provided about 1600 kcal and 50g of protein per day. Despite the low calorie intake, the birth weight was acceptable, this was attributed to acceptable nutritional status (weight) of pregnancy. The incidence of still birth is still influenced by the mother's weight gain in the third month of pregnancy, her overall weight gain and her height (Kusin et al, 1986). The contribution of maternal and child health is best reflected at birth, which determines the infant's physical, mental and intellectual development processes and his/her very survival.

The incidence of low birth weight was reduced to 8% among the women who had supplementation compared to 17% among those who had no supplementation (Kusin et al., 1986). A dietary habit study conducted among pregnant Sudanese women showed that dietary practice during pregnancy influences nutrition and foetal growth. Furthermore, it has been documented that severe reduction in protein and calorie intake during pregnancy will result in

a reduced birth weight pre disposing the infant to infection and early mortality (Burke et al., 1983; Ebbs, 1943 and Burke et al., 1983).

The whole subject of maternal nutrition during pregnancy and its impact on birth weight has been widely discussed. It has been established that, especially in developing countries, under nutrition and malnutrition have contributed to impaired maternal, foetal and infant health and vitality. The subject of nutrition, pregnancy and pregnancy outcome linkage still remains open to varying arguments and opinions. However, one cannot over-emphasize the importance of moderate weight gain during pregnancy among the rural and urban poor of the developing countries to ensure better survival chances of the infant. Thus, where possible and when necessary, nutritional supplementation during pregnancy to the urban-rural poor in developing countries becomes crucially important nutrition resource for both the mother and the infant (Rogo et al., 1987).

The recognition of the importance of nutrition during pregnancy is a growing phenomenon as evidence suggests that the nutritional status of the mother during gestation could affect not only the mother's health, but also that of her offspring. Due to ignorance and social or cultural dietary habits, the diets of pregnant women during gestation can be worse than in their non-pregnant state (Gopalan et al., 1972 ; Durnin, 1987; Prentice et al., 1980; Prentice et al., 1983). Pregnancy experience of poorer women in developing countries is often very poor as undernutrition and malnutrition are exacerbated by a host of other problems e.g. anaemia, parasites and prevalence of other, often preventable, infections. A study conducted among the young primigravidae in Zaire showed that over 40% of them were anaemic with 28% having severe iron deficiency (Fleming et al., 1983); in absence of good pre-pregnancy nutrition status, and poor supplementation during pregnancy, the pregnancy outcome could be negatively affected. A prospective study conducted in the Sudan showed that in a period of 18 months, 232 children, with a history of a low birth weight for height, died. This finding revealed that low birth weight for height was associated with an increased risk of child mortality (P0.001).

Even children with S.D of 2 scores between -1 and -2 were per cent more likely to die in the subsequent six months than those children with 2 scores < -1 (multivariate mortality; 1.5; 95% Ci:1.1,2.2).

A significant synergy was also observed between infection and wasting and stunting as predications of child mortality (P for interaction = 0.001 and 0.02, respectively). The study showed that children born to under nourished mothers with low birth weight, and -27 weight-for-height may be at increased risk of death. (Fawzi et al, 1997; Pelletier et al, 1995; Graham, 1990).

In recent years the importance and value of maternal nutrition and supplementation during pregnancy has been debated. Several investigators have reported a strong correlation between maternal supplementation, weight gains during pregnancy and birth weight. In a prospective study carried out in India, Shah and Shah had found that, among the many environmental factors taken into consideration, pre-pregnancy and during pregnancy maternal nutrition plays a significant role in determining birth weight (Butz et al., 1995).

Other studies (Pelletier et al., 1994) suggest that the major factors which contribute to low birth weight include, but are not limited to: the mother's chronic malnutrition from childhood to pregnancy (Kusum et al., 1970) and severe anaemia resulting in a low birth weight (2.4 kg) average for infants born to mothers with an average haemoglobin level of 6.5g as compared to 2.8 kg for those infants whose mothers had a hemoglobin level of 10.5 g.

The member countries of WHO have adopted a strategy with the target that by the year 2000 at least 90 % new born children will have a birth weight of at least 2500 g. Attaining this goal is a formidable task unless the key issue of maternal malnutrition is addressed effectively. Since we are in the 4th quarter of 2000, it is clear that the goal of having 2500g babies across the globe is not possible.

In an effort to lower the incidence of low birth weight in the developing countries, a variety of studies have been carried out on the effects of supplementation during pregnancy. The overall findings from such studies show that nutritional supplementation during pregnancy, especially in the third trimester, increases birth weight (Lechtig et al, 1979; Iyengar 1979). It has been widely established that dietary supplementation during pregnancy will increase birth weight of the infants. In a Guatemala study, it was observed that birth weight for those mothers requiring progressive dietary supplementation during pregnancy increased, while risk

of low birth significantly decreased; for those with less supplementation, incidence of low birth weight infants increased (Iyengar, et al., 1979). Other studies by Kusin et al., (1978) in Kenya ; Nesor (1963) in Burma and Jansen et al., (1980) in Kenya showed that maternal weight gain among the urban socioeconomically advantaged was higher than that for the rural poor. However, in the second Kenya study (1980), low birth weight was only in the order of 6.5%, which was similar to that of 6.7% repeated by Thompson et al., (1957). In dealing with pregnancy and nutritional supplementation, one cannot avoid confronting the socioeconomic status of the population. Among different ethnic groups, there could be significant differences with regard to nutrition, pregnancy and pregnancy outcomes as the strong influence of socioeconomic condition on birth weight has been established (St. George et al., 1970 ; Mayet, 1985). Foetus development is dependent on the maternal organism, which provides the oxygen and nutrients required for growth. These substances are often transferred from maternal blood into fetal blood across the placenta (Babson et al., 1970; Lunn et al., 1980; Lunn et al . , 1984 and Bantangalia et al . , 1978).

On average, the birth weights in the rural areas of developing countries range between 400-1000 g lower than those in industrialised countries (WHO, 1980; WHO, 1983). Prentice et al., (1987) in their prenatal dietary supplementation study among the Gambian women found that for those women who had received supplementation intervention the birth weight gain was lowest during the rainy season. Without supplementation, the incidence of low birth weight was highest 23.7 % compared to 12.5 % in the dry season. In this case, dietary supplementation played a significant role in lowering the incidence of low birth weight during wet seasons compared to dry seasons, when local food was available.

In the early stage of pregnancy, a foetus may not need as much nutrient. However, by the time pregnancy advances to the trimester, the foetus will be requiring an appreciable quantity of nutrients. Studies among the pregnant healthy and undernourished women have shown that a significant change in foetal weight occurs between the twenty-fifth and fortieth week of pregnancy (Ebrahim, 1983).

Thus, growth of the fetus can be regarded as a result of an interaction between genetic potential and the intrauterine environment. It is well-known evidence in that mothers who

experience pregnancy in good health, with sound reproductive physiology and without nutritional deprivation of any sort, will have a greater chance of delivering healthy, normal birth weight infants compared with those who suffer from malnutrition and ill health (Rush, 1981; Kusin et al, 1987).

The nutritional status of pregnant women is, among other things, affected by their education and their socioeconomic status and that of their family as a whole. A study carried out in Punjab, India, showed that energy and protein intakes of women significantly increased with improved education, while protein and calcium intakes were significantly affected by economic status (Hira et al, 1986; Lamb et al, 1984).

Recent studies on the validity of reported energy intakes in pre-adolescent girls suggest that the use of food records to determine energy intakes to provide more accurate results for younger than older women. However, the accuracy of method decreases with increased energy intakes (Bundini et al., 1997). A further analysis of the same study of multivariate regression suggested that only a total daily energy expenditure and ages were significantly and independently related to reporting accuracy. This shows that subjects who ate more food reported their energy intake less accurately (Baundini et al, (1997). A similar study carried out in Kenya showed that, when carefully planned and implemented, dietary recall studies may provide essential information on supplementation or any other nutrition assessment. In the cases of supplementation pregnancy diet, the challenge is to maintain accuracy and reliability about the amount and frequency food eaten. However, quality and reliability of recall data mainly depend on quality of questionnaires, the cooperation of participants, qualification enumerators and the experience of investigators (Kigutha, 1997; Dwyer et al, 1997; Garza, 1997).

It is a widely held view that among the poor of the developing countries, women during pregnancy experience little weight gain due to the chronic under nutrition they have been subjected from childhood, local customs often harsh and discriminatory to women, early marriage and induced dietary restriction (Watts, 1970; Shaha, 1981; Cassidy, 1994; Cobgs et al., 1996; Carroll et al., 1997).

Prenatal life has two major phases. The embryonic phase and the foetal phase. The rate

of embryonic growth is dependent on high rates of oxygen and nutritional intakes per unit of embryonic mass. Any excessive deficiency of oxygen or nutrients at this stage of embryo development may have a detrimental effect, resulting in a permanent growth anomaly or malformation (Woods et al, 1981; Swenson, 1978). The maternal condition pre-pregnancy, during pregnancy and the subsequent to child birth has a direct impact on the growth, development and survival of the child. Among other things, children's development is affected by quality and quantity of maternal nutrition (Woods et al., 1981; Shaha, 1981). Thus, the potential effect of maternal nutrition on the cause and outcome of pregnancy, and subsequent nutritional status of infants is profound. Hence, the future development and maturity of infants are proportionally dependent on maternal nutrition. Weight gain during pregnancy has been quite variable ranging from 11.7kg and 17.0 kg in the United Kingdom and United States, (Ebbs et al, 1942), while in South India average of 5.3 kg in primigravidae and 6.2 kg multipara respectively. Clements, in Sri Lanka (1957) and Gebre-Medhine, (1977) in Ethiopia, observed that a large proportion of women gained only 6.5 kg during pregnancy, whereas in the Gambia the proportion varied from 2.7 to 5.5 kg depending on the season of the birth. This was supported by Poppitt et al., (1993) study which showed a wide range of variation in weight gain during pregnancy among the Gambian women. The total metabolic rates were more than 36 weeks of pregnancy far less than that reported among the western populations (Peppitti et al., 1993; Lawrence et al., 1987; Donovan, 1984).

The subject of a positive correlation between maternal nutritional status and infant development has been an interesting subject, clearly demonstrating a positive correlation between maternal nutrition and infant development.

Maternal nutrition plays a significant role in meeting the requirements of infant physical and mental development. It is indicated that some 70 % of individual brain cells of the foetus have divided before birth. This process occurs at an early stage of embryo development, which is strongly influenced by the quality and quantity of maternal nutrition. Future physical growth and development, along with intellectual and psychological development of the foetus may be entirely dependent on the maternal nutrition (Crawford et al., 1993; Preston et al., 1980; Pollit, 1990).

Many women in developing countries are at higher risk due to chronic malnutrition and ill health (Kwofie, 1979); suffer from nutritional anaemia (Turchetti et al, 1966); and are in desperate need of supplementation to change the situation and improve the pregnancy outcome (Lawrence et al., 1985). A precise relationship between supplementation and pregnancy outcome has to be taken into broader context including maternal work load in the rural areas, availability and accessibility of health care services, parity and maternal age, and height (Thompson et al., 1997; St. George et al., 1970; Freedman et al., 1997; Freinkel, 1980; Garaza, 1994; Olusi et al., 1979 and Olson, 1974; O'sullivan et al., 1965 and PAHO, 1991).

In addition to these factors, other variables such as environmental, genetical and ethnic variation have to be taken into account in explaining pregnancy outcome. A longitudinal study carried out in Kenya showed that despite a low average weight gain during pregnancy 6.4 kg (12.3 %) by rural primigravidae and weight gain of 7.9 kg e (13.1 %) by the urban women, the incidence of low birth weight was as low as 6.5 % of all infants born to the study population (Jansen et al., 1980).

The outcome of poor maternal nutrition is not limited to retarded growth, but it is one of the major predisposing factors to infection and neonatal mortality within the first 12 months of life (Ashworth, 1982 and Elwood, 1983). In developing countries, protein energy malnutrition is widespread. According to WHO data in 1980 it was affecting more than 400 million children per annum (WHO, 1980 (a)). Another WHO report indicates that an estimated 11 percent of live births in Latin America, in Asia and Africa, with even higher percentages in some countries in these regions reaching up to 50 %, are low birth weights (WHO, (1980(b))). These findings emphasise the importance of good maternal nutrition during pregnancy. Supplementation during pregnancy has to be supported by increasing access to prenatal care, targeting the care to those at higher risk i.e. over aged and under aged i.e. <20 and >35. On the other hand, it may be important to note the fact that low bulk supplementation was shown to have more positive birth weight gain than high bulk supplementation among low weight pregnant women in South Africa (Ross et al., 1985; in Taiwan Black Well et al., 1973; India, Lechtig et al., 1978 and Mosley et al., 1978; Mora et al., 1979). In general, nutritional supplementation, depending on pre pregnancy and during pregnancy conditions, will have a positive impact improving birth weight.

(Geberemedhine et al., 1987 and Hesel et al., 1992) carried out a study in Ethiopia during the time of acute food shortage; their findings showed that maternal age was an important determinant of birth weight, when the range of ages included adolescent mothers. They found that younger mothers were unable to reach full term under conditions of severe nutrition stress. This study highlights the importance of a woman becoming pregnant at favourable age range , if she is to have a normal child at delivery.

Investigations carried out in India (Gopalan and Rao, 1972) and Nigeria (Laditan, 1974; Asindi et al., 1988) demonstrated that low birth weight is associated with neonatal and perinatal mortality. In the Indian study, neonatal mortality was as high as 45 percent of total infant deaths. A more detailed analysis showed that 93 percent of those deaths occurred in babies weighing less than 2.5 kg, suggesting that low birth weight contributes to a high rate of neonatal mortality. In Nigeria, 77 percent of all children who weighed less than 1.14 kg died within the first 28 days in life. The Nigerian study concluded that low birth weight was one of the major causes of neonatal mortality, second only to tetanus.

Ngoka and Mati (1980) studied primigravidae patients under 20 years who delivered at Kenyatta National Hospital, Nairobi, Kenya. They confirmed that these patients tend to have pre-term deliveries and low birth weight babies, due to poor education and poor use of antenatal services as adolescents. The study highlights the need for good antenatal care during pregnancy, and public health education about the risks facing adolescence pregnant and child birth.

In summary, what has been covered so far in the preceding literature review shows the importance of maternal nutrition during pregnancy in rural communities like the Maasai in Kenya. Since majority of the primigravidae are under aged , without maternal nutrition, supplementation is key for a successful pregnancy (King, 1994; Kings et al., 1991).

CHAPTER SIX

LITERATURE REVIEW THREE : FEMALE EDUCATION, MARRIAGE AND MOTHERHOOD

Complicating the empowerment of women through literacy, however, are the cultural norms in traditional societies. UNESCO , (1993) reports that women and men are placed in bipolar categories by numerous cultural factors in society. Family practices, religious myths, the social division of labour, marriage customs, the educational system and civil laws combine to produce hierarchies and internalised beliefs which are constraining social development of women in many developing countries i.e. E and SE Asia..

In most societies in Africa, women are conditioned to be submissive from an early age. Sex roles in the socialisation of women have included attributes of learned helplessness. Through the repeated experience of uncontrolled effects, many women come to believe that they cannot modify their environment or personal situations and thus their opportunity for problem-solving is diminished UNESCO , (1992).

Further more, girls are made aware from a very early age of their domestic roles. This limits their opportunities to find paid jobs; hence most girls are employed as unskilled domestic workers. Many of these girls probably have not obtained a good education (Van Beers and Ureeburg, 1993; Van Beers, 1994). In a study in Ethiopia, Gebremedhine et al., (1987) concluded that the socialisation of boys and girls corresponds to the roles each is expected to assume in society, and that their education reinforces the same pattern. Boys are encouraged in ways which will enable them to achieve, to compete and to win, while girls are discouraged from developing these traits.

Wnikikoff et al., (1991) provide a useful insight into the considerations explaining why Bhutanese families do not send their daughters to school. The girl is perceived as a weaker, softer person who , having before her a life of struggle should not be burdened more with education.

Girls have to help with the care of younger siblings, do housework and look after the elderly. Some parents consider education to be of no relevance for a housewife or for life in the village.

Female education still lags behind in many developing countries. It is considered less important to educate a girl child, since she must get married and let the husband look after her. As important may be the help the elder girls give their mothers in household services. A conference on education for girls held in Burkina Faso in 1993 concluded that the formal system of education has failed to reach millions of school-age children, particularly girls (UNESCO, 1993 a and UNESCO, 1993 b). This study highlighted the cultural problems adversely affecting girls and the need to change female cultural stereotypes at all levels, i.e. family, community and nation. The key means was seen to be a National Strategy aimed at improving girl child education both in terms of enrolment and graduation from high school at least.

Women need to be empowered through combined interventions i.e. education, access to economic development and reforming unbalanced and unhealthy customs, which discriminate against women, so that they can be in a position to participate fully in the social and economic development in their society. Removing those restrictions which unjustly affect their social development paves the way for their empowerment. The cognitive component of empowerment refers to women's understanding of their conditions at both micro and macro levels of society. It involves understanding the self and the need to make choices that may go against unjust cultural and social expectations; it involves understanding patterns of behaviour that create dependence, interdependence and autonomy within the family and society at large. This reveals the importance of women being able to make informed judgements, a result of having been educated and empowered. Empowerment requires involving women directly in planning and implementing those decisions which affect their development (Alexander, 1993 and Amadi, 1992).

Literacy skills can also be empowering, providing they are participatory. Evidence from Asia and Latin America indicates that women with newly acquired literacy skills have moved into self-help organisations ranging from neighbourhood soup kitchens to public health groups. Studies underscore the importance of changes that occur as women become more literate. These changes, however, should not be limited to only women, but should be seen in terms of

an overall national development package, as "any development without women, is half a development."

The girl child's commitment to the household has far reaching effects. Malentanlema et al., (1991) carried out studies in Tanzania which found that everywhere girls were required to do much more housework than boys. Therefore, girls had very little time to study and, as a result, they were not considered as clever as their brothers. This study also found that at times of financial hardships, the fathers paid the school fees for boys first and girls received only last minute consideration compared to their brothers. Another study of 200 primary school children in a Nigerian town showed that housework for girls was associated with low achievement in school. This could be due to greater physical and emotional involvement of girls in domestic and economic chores than that of boys and younger children, an involvement that becomes a hindrance to studying.

The above studies reveal global disparities, with boys being accorded a higher status than girls who are made to accept a lower status and live under endemic disparities. The studies suggest how society has dictated gender inequalities for both boys and girls. These conditions lead girls to consider themselves less intelligent than boys. Thus, marginalisation of girls and destruction of their self esteem, affect their social and economic development. Until the issue of girl children is adequately addressed and the existing disparity between boy and girl education is effectively narrowed, the imbalance may continue for years to come.

These studies further reveal that educating girls results in girls marrying at a proper age and also making informed decisions on their day-to-day lives. In addition, girls with education, have a better chance in deciding family size and time of pregnancy. Schultz (1989) states that girls who attended school, especially through to the secondary level, were more likely to delay marriage, child bearing, tend to have smaller families and used health care facilities more effectively than those who did not attend school. Women in industrialised countries often marry later, which generally implies postponed child bearing and permits women to stay in school longer (World Bank, 1994). This study highlights the relationship between early marriage and socio-economic situation, implying that in developed countries women spend longer years in education before marrying.

Greater participation of community representatives in identifying curriculum content and delivery methodology can contribute to more effective improvement in female education. Such education can discourage teenage pregnancies, improve nutrition and sanitation technology, and encourage crafts more relevant to the local situation; this in turn will be beneficial in improving the quality of life in communities (UNICEF, 1994 and UNESCO, 1993 b and Young et al., 1982). The same study highlights the need for community involvement at all stages, to increase commitment towards achievement of female education and to narrow the imbalance that exists between girls and boys education. UNESCO (1993 b) studies encourage governments to put the education of girls on their priority list, and argues that existing structures in every country should be strengthened to function effectively in improving girls' education. It was suggested that governments and communities should support girls education as an integral part of an overall national development (WBK, 1989 and Zuspan et al., 1968).

CHAPTER SEVEN

THE STUDY METHODS AND INSTRUMENTS

7.1 Study Population and Sampling

Before the study commenced, its purposes and expected benefits were discussed with community committee members, women's groups in the study area and appropriate Ministry of Health (MOH) staff. Although the study focused on describing the dietary habits of pregnant Maasai women, this was not academic; instead it was considered as part of ongoing health and development project activities. Pregnant women usually came to outreach centres set up for check-ups, antenatal care, post-natal baby care and immunisation as an integral part of child survival project.

The study sample included cases of 125 primigravidae who became pregnant and delivered between January 1993 and June 1995. Three hundred multipara were registered and monitored until delivery as the control group over the same period. The pregnant Maasai women, primigravidae as cases and multipara as controls, were registered to compare their dietary habits and to describe other similarities and differences. The study samples attempted to draw the two groups in the following proportions:

- a) 125 primigravidae, young Maasai women who were in their first pregnancy as cases.
- b) 300 multipara, Maasai women who were in their second or subsequent pregnancy as a control group.

A sub-sample of $n = 50$ "Key Informants," either elderly women or Traditional Birth Attendants (TBAs), Community Health Workers (CHWs) or mothers-in-law were also interviewed to confirm information given by the young pregnant women and to provide background information on dietary habits, beliefs and pregnancy.

The total sample cases 125 primigravida and 300 multipara were registered at least by three months of pregnancy. Subsequently they were interviewed /contacted monthly. The

sampling frame comprised all women resident in the Loitokitok Division, known to be pregnant in October, 1992, or subsequently, and who were to give birth no later than 30 June, 1995. Pregnant women were enrolled in the study irrespective of the period of the pregnancy, as long as it was less than seven months. In addition, children born to parents in the study were weighed within 24-hours of delivery. All the 425 women were registered and monitored for 24 hours after birth.

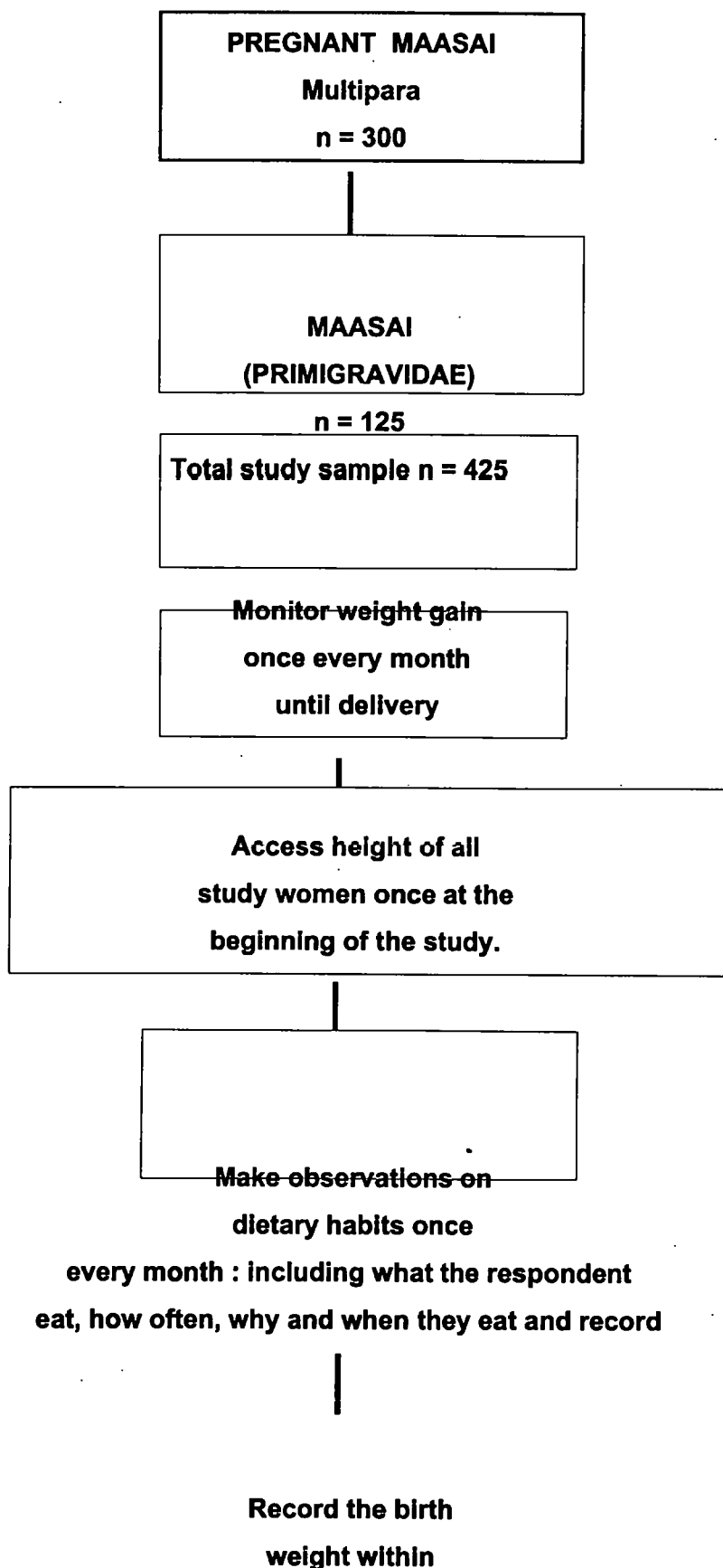
The questionnaire was administered to all participants or respondents and covered:

- a) dietary habits, social-nutritional information, amount and type of food eaten by the respondents in relation to pregnancy experience and childbirth;
- b) pregnancy history;
- c) age of the pregnant women i.e . estimated using age set of Maasai traditional clanendar.

Information was collected using previously designed and pre-tested questionnaires. The questionnaire elicited both qualitative and quantitative data. The descriptive data obtained from the respondents were converted into quantitative measurements in order to make reasonable tabulation and inferences from the data and information collected. All information collected from the field was edited for accuracy and reliability by trained field supervisors to minimise response bias . Five such supervisors (field workers) were employed full time in the field overseeing fifteen field data collectors or interviewers. *(Copies of the questionnaires used in the survey are presented in Appendix B.)*

Since sanitation is one of the major health problems in Maasai land, a bar of soap was given to each pregnant woman during the visit. This acted as an incentive to the study subjects to respond truthfully and encouraged simple hygienic practices among the respondents. In addition, a small token of K.Shs. 50.00 was given to a mother or any community member who communicated information on any new deliveries to the enumerators within 24 hours of the delivery. During recruitment, the purpose of the study was explained to the women and their questions were answered. The explanation was given in the local languages as interviewers and supervisors were locally recruited community residents.

7.2 Study Design



24 hours of delivery



Complete data collection

on

June 30, 1995

7.3 Study Implementation

7.3 I. General procedures

Preparation for the fieldwork started in December 1992. A 12-month period was used to carry out appropriate preparation with commencement of the study in January 1993. During this period, interviewers (data collecting staff) were recruited from the community. The staff spoke the local language and they were known by the community.

The following steps were followed in the process of study implementation:

- a) Informing the local authorities (MOH), community leadership and members of the community committee about the study objectives, design, its usefulness and importance of their cooperation; .
- b) Development of the study tools, questionnaire and forms and the pretesting of them with relevant training support; .
- c) Identification and procurement of relevant equipment (i.e. electric scales and Pens, pencil bicycles) for the interviewers.
- d) Identification and training of field investigators on
 - i.) understanding of the questionnaires
 - ii.) interviewing techniques
 - iii.) obtaining quantitative measurements and qualitative information

- anthropometric: weight and height measurements
 - dietary intake measurements
 - use of relevant equipment: height measuring rods, weighing scales, measuring cylinders and household equipment.
 - data coding (in a later stage);
- e) Pretesting and modification of the questionnaire, with a subsequent pretest;
 - f) Review of techniques prior to initiation of data collection -- depending on time elapsed between training and data collection and joint training and attempts to respond to the questionnaires by the field staff;
 - g) Data collection;
 - h) Data processing: coding, entry into the computer, data analysis;
 - i) Interpretation of results;
 - j) Report preparation and editing of drafts.

7.3 2. Training of field investigators (Interviewers/Data Collectors)

Fifteen field investigators (FI's), responsible for data collection from specified geographical areas, were trained in the course of two weeks (three sessions). Five supervisors oversaw the interviews and checked the internal consistency and reliability of the data collection process. These field investigators were recruited for a period of 24 at least months commencing October 1, 1992 through June, 1995. However, during the final stage of data collection we kept only six of them. The first six months were used to give them training on how to collect the data and on its importance. Training included the following activities:

- a) Developing a sampling frame;
- b) Interviewing techniques;
- c) Taking heights and weights of mothers and children;
- d) Recording 24-hour dietary recall and direct observation;
- e) Weighing method of dietary intakes of at least 35 percent of interviewees
- f) Making summary reports of pregnant mothers on regular basis to monitor possible biases and to minimise them through adjustment of approach and instruments.

7.3.3. Pre-testing

After training, each investigator pretested at least five questionnaires. This was done to assess the familiarity of the investigators and to identify any problems that an interviewer might encounter with the questions. In this process, the interviewers responded to questionnaires as if they were actual interviewees. This served three purposes:

- a) to familiarise interviewers with the questions;
- b) to ensure questionnaires were designed appropriately and relevant to local custom and culture;
- c) to see that interviewers participated in the questionnaire design and had actively participated in the study process.

After consultations with the Community Motivators (CMS), a draft questionnaire was developed and pretested on a group of women in a small sample (which was not included in the overall study sample). Following the pretesting and any modifications and corrections, the final questionnaire was completed. The interviews were carried out mainly by the field investigators with the assistance of community motivators working in the Loitokitok Child Survival Outreach Centres and specially trained supervisors.

The field investigators were trained in the use of the tools employed in the survey in order to reduce the inter-and intra-interviewer variations. Although all the interviews were conducted in the local Maasai language, the responses were recorded in English. The interviewers were both assisted and monitored by the principal investigator and project technical staff and their supervisors. There were five such supervisors, one supervisor per pair of interviewers.

7.4 Description of Data Sets

7.4.1. The interviews

The questions were asked mainly to understand the pregnancy history of the mother, including associated factors such as her age, height, income and education during first pregnancy, and food habits.

At the commencement of the study, the Loitokitok Child Survival Project staff comprised 18 local community motivators (CMs) who resided in the communities and were responsible for specific geographic areas of the project community. There were also 185 active traditional birth attendants (TBAs) and 125 community health workers (CHWs) who had been identified and trained by the project staff and who had actively participated for the previous five years in the project implementation activities in their communities.

Although this study commenced on 2 January 1993, identification and registration of Primigravidae cases started in the end of December 1993. The existing teams of CMs, TBAs and CHWs, in collaboration with the trained investigators (15) and their supervisors (five), identified and located the cases of Primigravidae and the controls of multi paras, and followed up the pregnant women until delivery.

The investigators, with the assistance of the CMS, administered the questionnaires, recorded weight and height, and made observations. A Maasai anthropologist, who had been a consultant since the inception of the project, assisted in collecting ethnographic data, primarily listing key information for in-depth interviewing techniques and providing background information.

Each pregnant woman was visited once a month and a record was made on what she had eaten and drunk the previous day (24-hour recall): how much, how often. A rationale for having chosen specific food items was elicited. In addition, the field investigators spent a day with all the pregnant Primigravidae women, observing and weighing what and how much they had eaten. Thirty-five percent of the cases were observed while eating in order to reduce recall-related bias, which is an ongoing concern of such studies. They recorded how often and the rationale behind the kind of food the pregnant women ate. This was intended to limit the bias associated with 24-hour recall. A combination of observation and recall was necessary. It would be almost impossible to depend on only observational data.

Each respondent was approached at least three times before childbirth to ensure consistency and reliability of the study outcome, even if she was due to deliver only three months after the start of the survey. However, those identified during the early stage of pregnancy were visited at least five times before delivery. All efforts were made to weigh the infant and mother within the first 24 hours after delivery; through the assistance of CMS and TBAs, and this attempt was successfully carried out.

The 21 Centres distributed within the Division, the experienced and well-trained staff, the commitment and proven cooperation of the local people and the existing programme related activities contributed to the survey of pregnant women. The staff were very familiar with the local population and the majority of them had been employees working in the same community with previously on going a child survival and development project.

Questions on food habits, traditions, taboos and food preparation were open-ended. These questions attempted to describe and account for both the antenatal and post-natal dietary habits of the mothers.

7.4.2 Food consumption

Food consumption was assessed using two methods: the recall method and the weighing/observation method.

Method I

A 24-hour recall was made of the types, quantities and frequencies of food consumed by each Primigravidae and multi para pregnant woman for the previous day and night. Starting with the first dish of the day, all subsequent dishes (including drinks and snacks) were recorded. The women were asked to demonstrate the portions consumed using plates or cups similar to the ones actually used at home. For measuring purposes, containers/cylinders were provided: (250 cc with 10 cc marks for the information of the interviewers only). Water was used to estimate the different volumes. All the volumes were converted into corresponding weights with the help of a conversion table which was developed using Method II below. For foods served piecemeal, such as meat, fruits, chapati/bread, respondents were asked to estimate the respective sizes of the pieces consumed.

These in turn were converted into standard weights. In case of left overs from meals, the volume of the unconsumed food was estimated separately. However, this was determined only from a random sample of pregnant women since it was not possible to document all the leftovers for all pertinent study subjects. It would have been difficult to keep leftovers for study purposes, especially since they are usually consumed by the younger members of the household.

Method II

With the help of a nutritionist, observation and weighing of all foods prepared were carried out amongst all Primigravidae households. In each of these households, an enumerator visited a family in the morning and stayed with the mother the whole day. Whenever the mother prepared anything to eat, she was asked to demonstrate the cooking procedure. All ingredients used in food preparation were weighed and volumes measured.

The amounts of each type of food eaten by the pregnant woman in the household were weighed and the volumes measured. This was used to ensure the reliability of the 24-hour recall -- both the validity and internal reliability of their recall.

7.4.3. Assessment of nutritional status

Each mother was weighed once a month using an electronic scale (to an accuracy of +/-0.1 kg) while in light clothing. Their heights were measured using a leicester height metre (+/- 0.5 cm.). They also were examined for signs of anaemia, such as pale, conjunctiva, by registered and experienced nurses and at least four on occasions during the course of the study. On the same assessment form, the weights(s) of the newborn were eventually recorded using electronic scales. The mother or the person helping in delivery, such as the TBA, was asked to send a message to the enumerators as soon as the child was born. The enumerators were in the neighbourhood, since the communication among enumerators and TBAs was already established and known as a part of programme activity. The child was weighed within 24 hours of birth. The weights of the babies were taken by a trained enumerator. The socioeconomic statuses were considered as an integral part of data collection.

7.5 Data Analysis

7.5. 1. Variability in the data collection

The study kept in mind variations in the measurements taken during the survey. These were likely to be in the areas of anthropometric and dietary intake measurements. High intra-observer variations, always encountered in such studies, were reduced by repeated observations for each measurement and by a reasonably large sample size of $N =$ at least 425.

The 24-hour dietary recall data were validated by comparison with the observations and food weighing which was carried out on a sub-sample of the study population. Large variations between the two methods, however, were not expected due to the monotony of the diets eaten in the community (Nestel, 1985).

Confounding factors were reduced or eliminated by use of statistical methods, such as multiple regression. The measure to control for confounders included education, age, parity income and mother's height:

- a) Education: The educational standards of both women and husbands were assessed to determine the impact on pregnancy, its outcome and dietary habits;
- b) Age: The age of the pregnant women had to be assessed, if the variation were to have any impact on the pregnancy, its outcome and dietary habits;
- c) Mother's height: the height was measured to determine the impact on pregnancy and its outcome;
- d) Primigravidae: First pregnancy or Primigravidae was identified and assessed for protein-rich diet utilisation.

The data collected during the first six months of the study period (January through June 1993) were analysed to assess the appropriateness of kinds of data collected and necessary adjustments were employed.

7.5.2. Treatment of the final data

All the questionnaires received from the field were edited and coded by a senior nutritionist and the principal investigator. The data were then transported to Nairobi, aggregated and entered into the computer primarily using Dbase III plus. The analysis was done using SPSS 3 Plus and EPI5 software computer packages which were available in the World Vision Kenya, Office, Nairobi.

The baseline variables for the Primigravidae with a history of protein-rich diet

restriction and those Primigravidae with no restriction were compared using the Chi-square (X^2) test, the student "t" test and a regression analysis. (See Appendix C).

Due to the cross-sectional nature of some variables collected in the study, a sequential dependency among certain variables (a nutrient intake, weights change during pregnancy) was expected. Auto-correlations and multiple regressions were used to find the determinants of birth weight in the survey community and the linear associations between the different dependant and independent variables. By using multi variant analysis, the author was able to adjust for some of the potential confounders (such as socioeconomic status of the households, education and age).

The results of the 24-hour recall were presented in absolute figures (the moving averages) for energy and protein consumption analyses. Suitable "food composition tables" were used to estimate the energy and protein content of the foods.

The intakes were also presented as intake (calorie/or g of protein) per kilogram of body weight and compared with the levels recommended by the Food and Agriculture Organisation (FAO) and the World Health Organisation (WHO) (FAO/WHO 1974 standardisation). Anthropometric measurements of the mothers were presented as weight changes during pregnancy and their weight-for-height ratio or the body mass index was recorded.

7.5.3 Data entry and analysis

Data were entered into the computer using a statistical programme, Statistical Package for the Social Sciences (SPSS). Range and consistency were checked to edit the data to minimise bias and increase reliability of the data.

A further SPSS application was used to generate descriptive statistics constituting percentages, mean and standard deviation. A chi-squared test was applied to analyse associations between qualitative factors when expected frequencies were greater than five. In the case of expected frequencies being less than five, Fisher's exact was used. Student's test was used to compare the distributions of continuous variables between factors. Pearson's product moment correlation coefficient was used to analyse for a linear association between

continuous variables.

Furthermore, multiple linear regression analysis in a statistical programme, Generalised Linear Interactive Modelling (GLIM), was employed to produce adjusted effects of the factors. Only significant factors were considered in the multiple linear regression analysis. Results yielding a P value of less than five percent were considered statistically significant, the rest excluded.

CHAPTER EIGHT

RESULTS

A total of 451 pregnant women were recruited for the Study, of whom 301 were multipara and 125 were primigravidae. Information was not available on 25 other pregnant women included in the study, as to whether they were multipara or primigravidae. The proceeding analyses are done for multipara and primigravidae separately, because there are intrinsic differences between mothers having their first baby and those having their second or subsequent babies.

Description of the sample

Demographic and economic factors

The distribution of demographic and economic factors of multipara and primigravidae are shown in table 1. The majority of the multipara (49.7%) were aged 22 to 31 years, while a large number of primigravidae (95.2%) were aged below 22 years. A total of 135 (45.0%) multipara were aged 21 years or below. Nineteen (15.3%) of the primigravidae were single. Meanwhile 23 (7.8%) of the multipara were not married (either single, separated, divorced or widowed). Significantly more primigravidae (23.4%) than multipara (12.7%) were schooled ($p < 0.001$). However, there was no significant difference in schooling between the husbands of multipara and those of primigravidae ($p = 0.715$). Most of the *bomas* (63.7% of multipara and 74.0% of primigravidae) had an average economic status.

Table 1. Distribution of demographic and economic variables of the multipara and primigravidae.

	Multiparous Total=301 n (%)	Primigravidae Total=125 n (%)	p value
Age group (years)			
12-21	135 (45.0)	119 (95.2)	<0.001
22-31	149 (49.7)	5 (4.0)	
32-42	16 (5.3)	1 (0.8)	
Marital status			
Married	274 (92.3)	103 (83.1)	<0.001
Single	7 (2.4)	19 (15.3)	
Separated/divorced	7 (2.4)	1 (0.8)	
Widowed	9 (3.0)	1 (0.8)	
Attendance of school by the respondent			
Yes	38 (12.7)	29 (23.4)	0.009
No	262 (87.3)	95 (76.6)	
Attendance of school by husband			
Yes	69 (23.5)	24 (21.2)	0.715
No	224 (76.5)	89 (78.8)	
Status of the boma			
Rich	56 (19.2)	15 (12.2)	0.110
Average	186 (63.7)	91 (74.0)	

Poor	50 (17.1)	17 (13.8)
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Obstetrics

The majority of multipara were of parity one (24.9%), had had one miscarriage (42.9%), no still births (54.5%) and had one child alive (24.9%). The distributions of these characteristics are shown in figures 1 to 4.

Anthropometric measurements

Distribution of parity

(Total = 301)

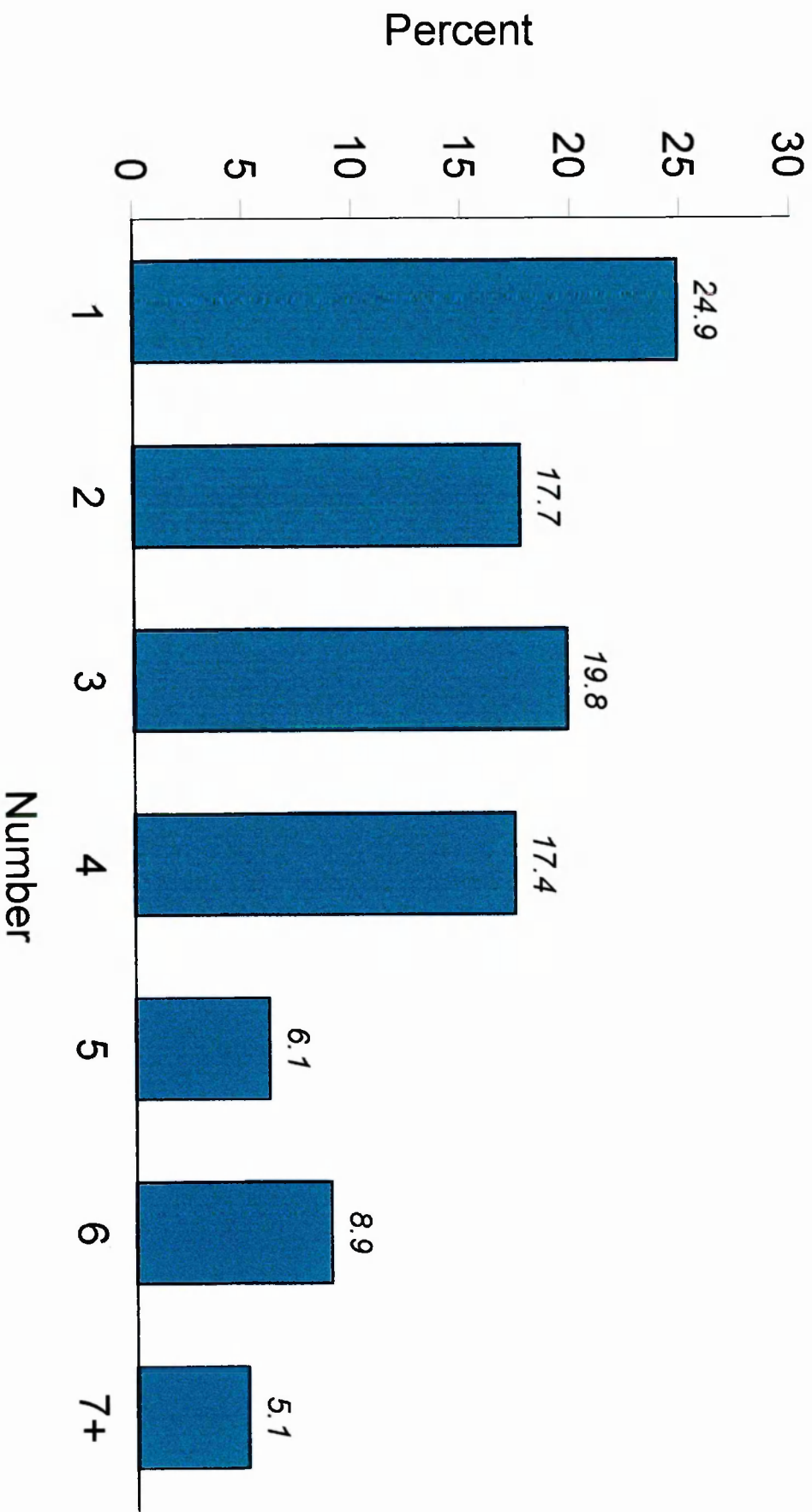


Figure 2

Distribution of miscarriages

(Total = 84)

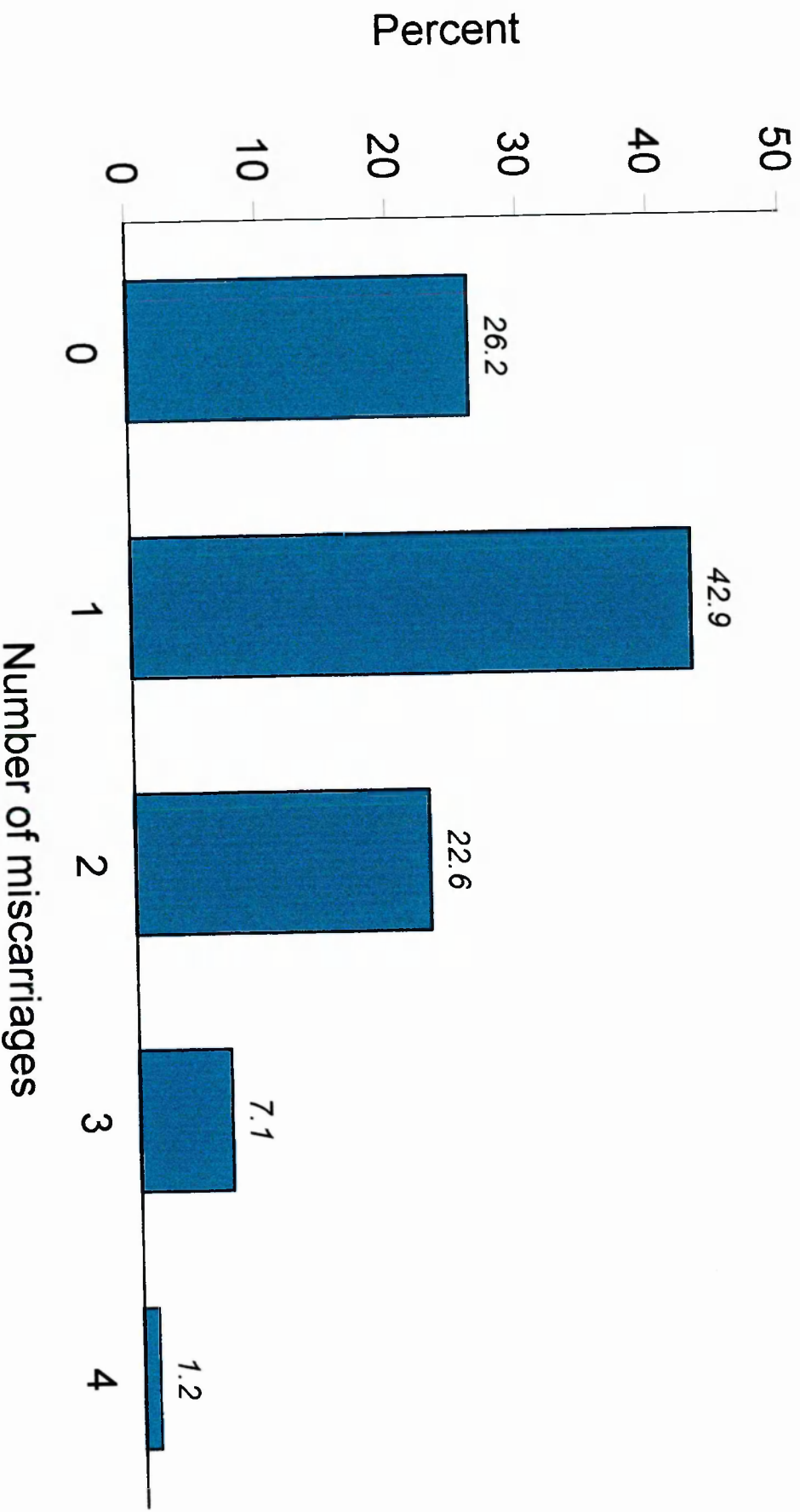
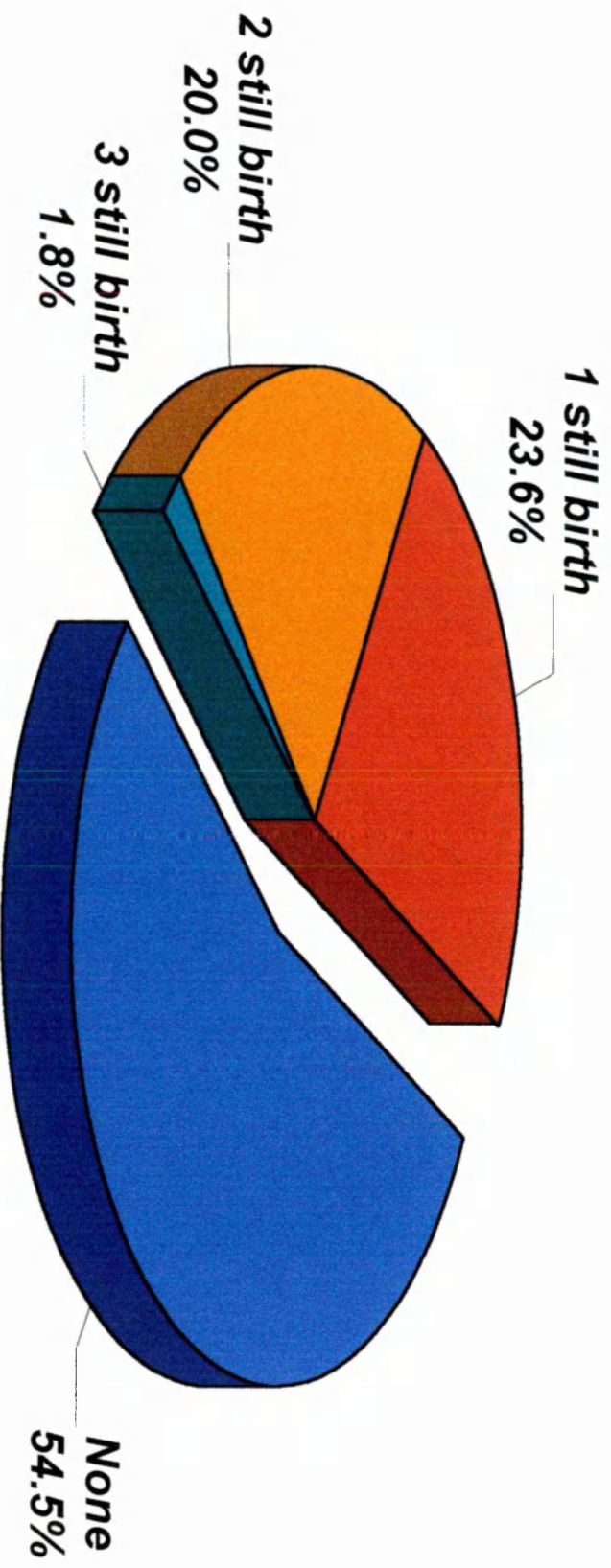


Figure 3

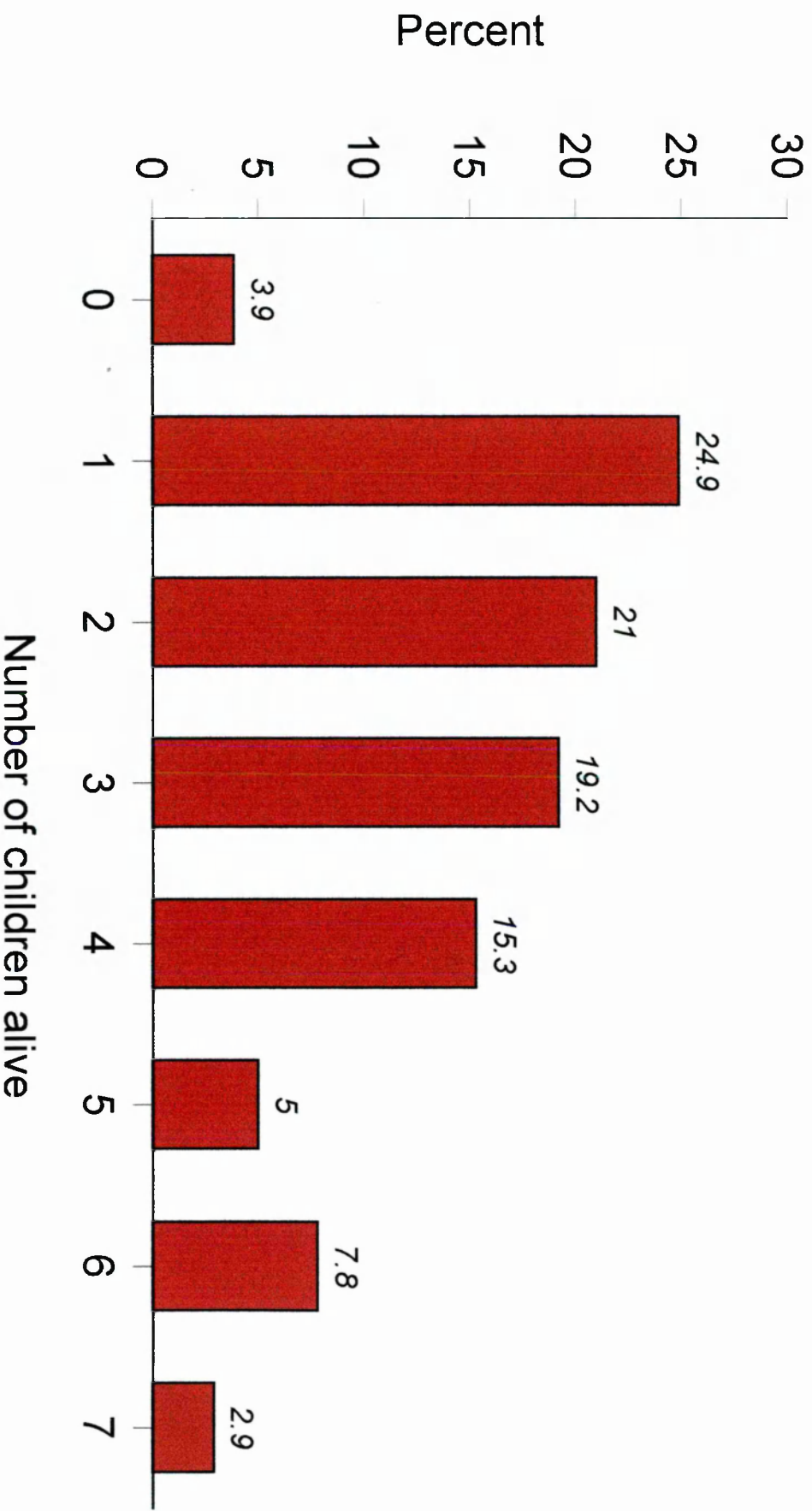
Distribution of still births

(Total = 55)



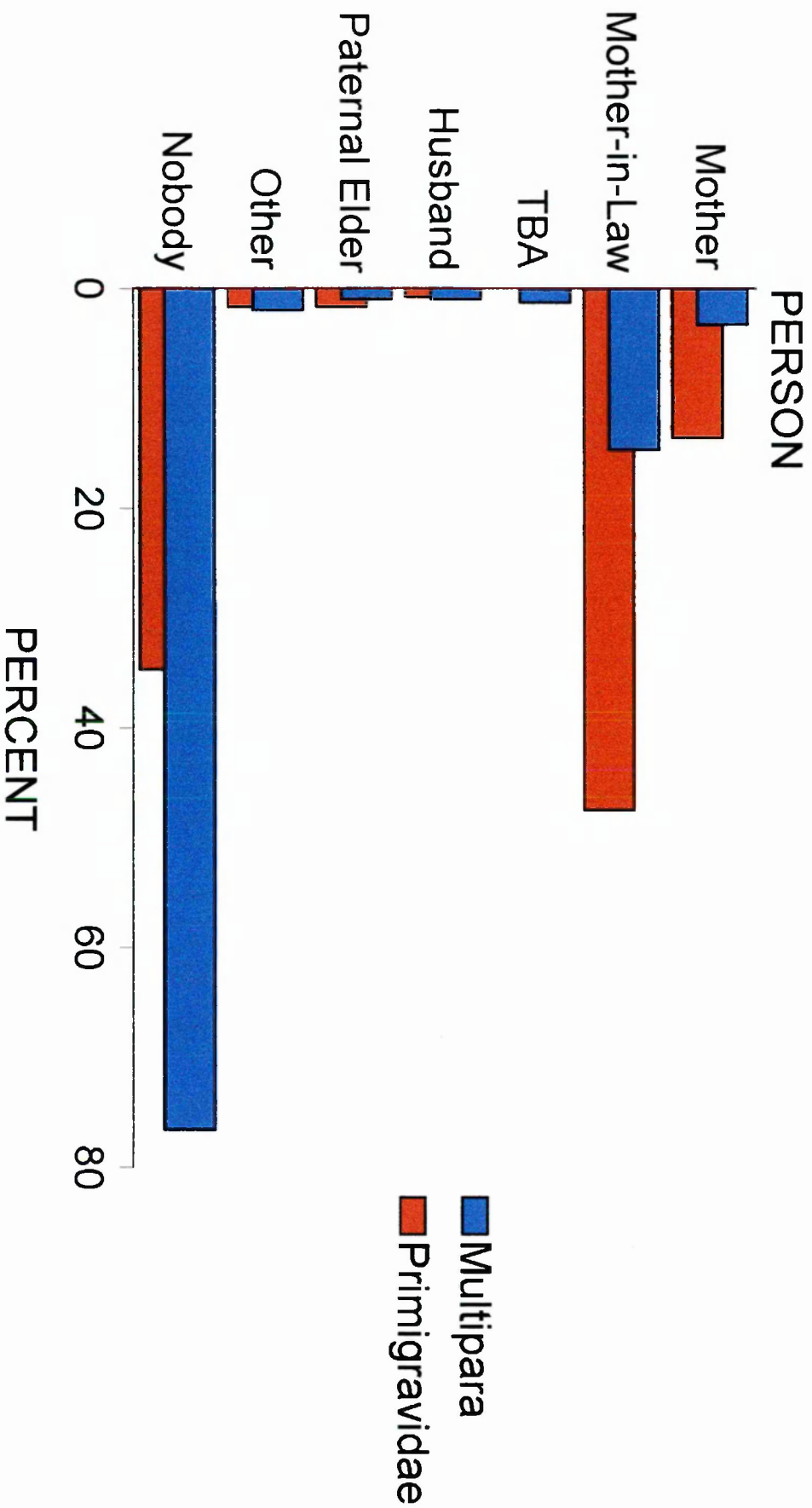
Distribution of children alive

(Total = 301)



Persons who influenced pregnant women on food

(Totals: *multip* = 299; *primi* = 118)



Comparing the results on associations of birth weight with possible confounders and associations of weight change from eight to nine months of pregnancy with possible confounders (Table 2), none of the factors considered as possible confounders were identified as such.

Induced vomiting and protein restricted diet

The distribution of induced vomiting and protein-restricted diet among the multipara and primigravidae are shown in table 3. Significantly more primigravidae (71.4%) than multipara (48.5%) had induced vomiting ($p=0.001$) at nine months of pregnancy.

Persons who influenced pregnant women on food

The majority of primigravidae (47.5%) were influenced by their mothers-in-law as regards food quantities and types. Meanwhile, most multipara were not influence from any one on food (76.6%). Figure 6 shows the distribution of persons who influenced pregnant women in their food intake.

Fresh milk was avoided by 43 (45.3%) multipara in their previous pregnancy because it would make the baby too big for delivery and thereby endanger both the baby and the mother. Unslaughtered animal meat was avoided by 40 (46.0%) multipara because it would cause disease, and 24 (34.3%) multipara avoided the meat of young animals because of tradition or culture. Reasons for avoiding certain foods among the multipara during their last pregnancy are listed in table 4.

Table 2. Associations of weight change between 8 to 9 months of pregnancy with possible confounders.

p-value	Weight change from 8 to 9 months of pregnancy					
	Multipara			Primigravidae		
	n	Mean (SD)	p-value	n	Mean (SD)	p-value
Age						
<22	43	0.54 (2.03)	0.026	43	-1.57 (2.41)	0.343
22+	70	-0.37 (2.09)		3	-2.97 (3.00)	
Marital status						
Married	104	0.02 (2.10)	0.907	37	-1.68 (2.50)	0.902
Not married	8	-0.08 (2.07)		8	-1.56 (2.30)	
Education (self)						
Yes	14	0.19 (2.33)	0.683	11	-1.00 (2.08)	0.358
No	99	-0.05 (2.08)		33	-1.78 (2.52)	
Education (husband)						
Yes	28	0.12 (1.96)	0.650	7	-0.70 (1.89)	0.283
No	81	-0.10 (2.21)		32	-1.81 (2.54)	
Status of <i>boma</i>						
Poor	18	-0.09 (1.39)	0.996	6	-0.67 (1.17)	0.292
Average/rich	90	-0.09 (2.20)		38	-1.82 (2.59)	

Table 3. Distribution of induced vomiting and protein restricted diet by Multipara and Primigravidae.

	Multipara	Primigravidae
P-value	n (%)	n (%)
Induced vomiting at nine months		
Yes	82 (48.5)	55 (71.4)
0.001		
No	87 (51.1)	22 (28.6)
Protein intake at nine months		
Breakfast		
Yes	112 (83.0)	35 (72.9)
0.196		
No	23 (17.0)	13 (27.1)
Lunch		
Yes	62 (62.0)	27 (67.5)
0.677		
No	38 (38.0)	13 (32.5)
Supper		
Yes	76 (61.3)	32 (74.4)
0.172		
No	48 (38.7)	11 (25.6)

Figure 6

Food craved by the multipara in their last pregnancy

(Total = 144)

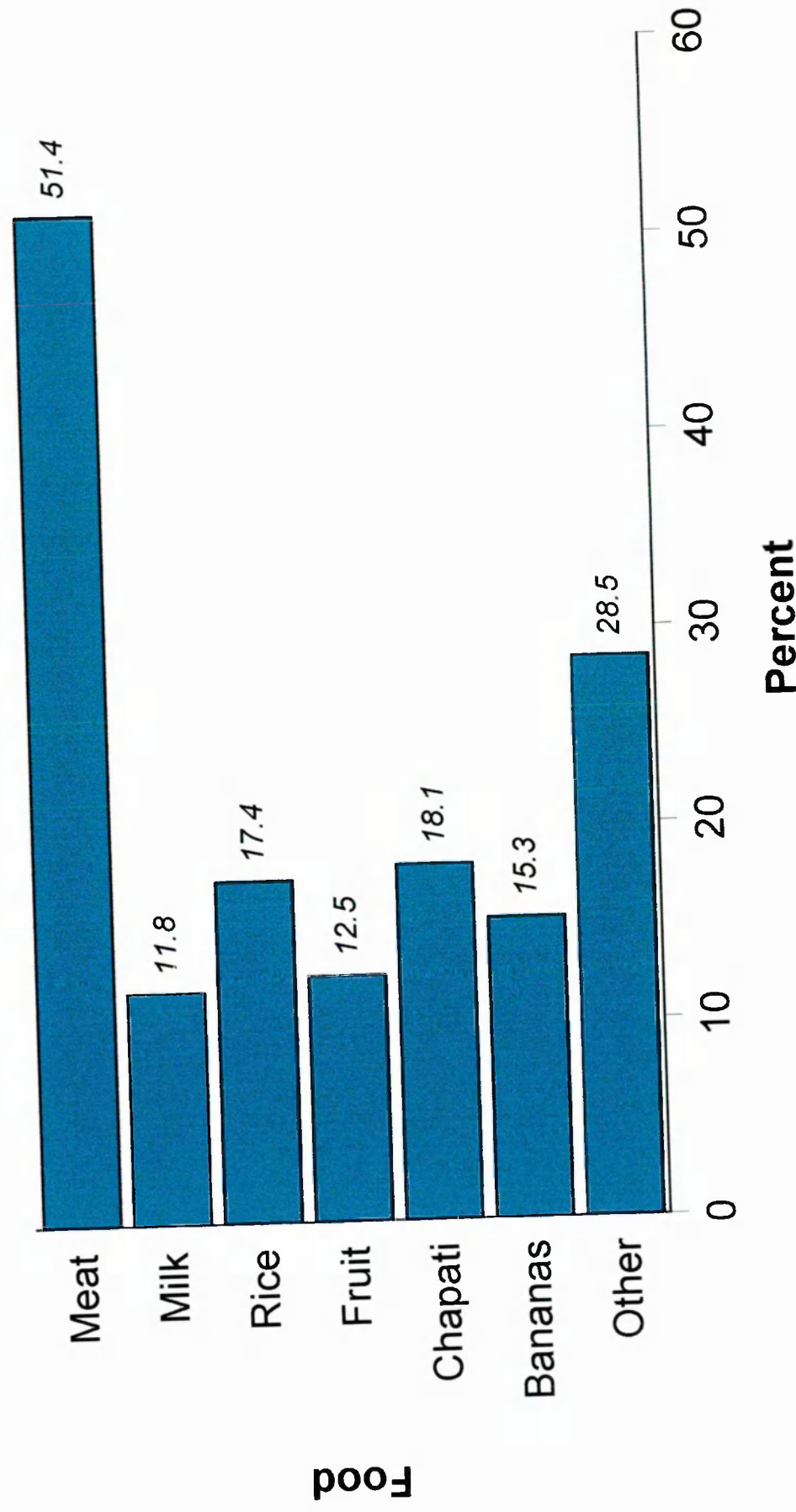


Table 4. Reasons for avoiding certain food among the multipara during their 9th month of pregnancy.

	Fresh milk	Un-slaughtered meat	Meat of young animal
	Total=95	Total=87	Total=70
	n (%)	n (%)	n (%)
Tradition/culture	32 (33.7)	22 (25.3)	24 (34.3)
Will make baby big	43 (45.3)	4 (4.6)	2 (2.9)
Will cause disease	2 (2.1)	40 (46.0)	19 (27.1)
Will cause heart burn	4 (4.2)	1 (1.1)	5 (7.1)
Was asked to avoid	2 (2.1)	13 (14.9)	14 (20.0)
Others	12 (12.6)	7 (8.0)	6 (8.6)

About half (51.4%) of the multipara craved for meat in their last month of pregnancy (Figure 5).

Association of demographic and economic factors with protein restricted diet at nine months of pregnancy at breakfast, lunch and supper

At nine months of pregnancy, there was evidence suggesting that marital status was associated with protein restricted diet at breakfast ($p=0.084$) and lunch ($p=0.095$) among multipara (Tables 13 and F5).

Among the primigravidae, marital status ($p=0.045$), respondents' education ($p=0.018$) and husbands' education ($p=0.034$) were associated with protein restricted diet at nine months of pregnancy (Table 7).

Association of demographic and economic factors with induced vomiting

There was evidence to suggest that husbands' education was associated with induced vomiting among the multipara ($p=0.036$) and primigravidae ($p=0.029$). In addition, marital status was strongly associated with induced vomiting at nine months of pregnancy among primigravidae ($p=0.008$). These associations are shown in table 8.

Table 5. Associations of protein restriction at breakfast during the 9th month of pregnancy, with possible confounders

	Protein restricted diet					
	Multipara			Primigravidae		
	Yes	No	p-value	Yes	No	p-value
Age						
<22	10	42	0.787	12	33	1.000
22+	13	69		1	2	
Marital status						
Married	18	104	0.084	11	27	1.000
Not married	4	7		2	7	
Education (self)						
Yes	2	18	0.525	3	5	0.666
No	21	94		10	29	
Education (husband)						
Yes	7	31	0.931	1	6	0.504
No	15	79		12	23	
Status of <i>boma</i>						
Poor	7	16	0.127	3	4	0.370
Average/rich	16	91		10	31	

Table 6. Associations of protein restriction at lunch during 9th month of pregnancy, , with possible confounders.

	Protein-restricted diet						
	Multipara			Primigravidae			
	Yes	No	p-value	Yes	No	p-value	
Age							
<22	17	24	0.749	13	26	1.000	
22+	21	37		0	1		
Marital status							
Married	30	58	0.095	11	21	1.000	
Not married		7	4		2	6	
Education (self)							
Yes		6	8	0.915	5	8	0.722
No		32	54		8	19	
Education (husband)							
Yes		8	19	0.446	5	4	0.103
No		28	41		6	20	
Status of boma							
Poor		8	9	0.577	1	6	0.388
Average/rich		29	51		12	20	

Table 7. Associations of protein ion at Supper during 9th month of pregnancy, with possible confounders.

		Protein-restricted diet					
		Multipara			Primigravidae		
		Yes	No	p-value	Yes	No	p-value
Age	<22	16	29	0.789	11	29	0.558
	22+	31	47		0	3	
Marital status							
	Married	42	70	0.506	8	31	0.045
	Not married	5	5		3	1	
Education (self)							
	Yes	6	10	1.000	6	5	0.018
	No	42	66		5	27	
Education (husband)							
	Yes	11	20	0.784	4	3	0.034
	No	36	53		5	28	
Status of <i>boma</i>							
	Poor	10	11	0.530	1	5	1.000
	Average/rich	37	62		10	27	

Table 8. Associations of induced vomiting during the 9th month of pregnancy with possible confounders.

	Induced vomiting					
	Multipara			Primigravidae		
	Yes	No	p-value	Yes	No	p-value
Age						
<22	36	36	0.860	52	21	1.000
22+	46	51		3	1	
Marital status						
Married	74	79	1.000	51	14	0.008
Not married	7	7		4	7	
Education (self)						
Yes	8	14	0.306	9	7	0.213
No	75	73		45	15	
Education (husband)						
Yes	15	29	0.036	5	6	0.029
No	66	56		46	12	
Status of <i>boma</i>						
Poor	16	13	0.604	11	2	0.325
Average/rich	64	70		43	20	

Associations of demographic and economic factors with mothers' weight

There was evidence suggesting that age was associated with mothers' weight at nine months of pregnancy ($p=0.066$) among primigravidae (Table 9).

Association of demographic and economic factors with birth weight

Table 10 shows the associations of demographic and economic factors with birth weight. There was evidence suggesting that husbands' education was associated with birth weight among the primigravidae ($p=0.046$).

Crude analysis of associations of protein restricted diet, induced vomiting and mothers' weight with birth weight

Out of all the exposure factors considered in the study (Table 11), only protein-restricted diet at nine months of pregnancy, at supper, among primigravidae was associated with birth weight ($p=0.013$).

There was a slight evidence ($p=0.060$) to suggest that induced vomiting at nine months of pregnancy was associated with birth weight among multipara (Table 12).

Table 9. Associations of mothers' weight during the 9th month of pregnancy with confounders.

	Mothers' weight					
	Multipara			Primigravidae		
	n	Mean (SD)	p-value	n	Mean (SD)	
p-value						
Age						
<22	52	54.4 (7.2)	0.162	49	50.2 (6.4)	
0.066						
22+	82	56.0 (5.9)		3	57.7 (12.0)	
Marital status						
Married	122	55.2 (6.4)	0.412	43	50.1 (6.7)	0.176
Not married	11	56.8 (6.4)		9	53.7 (7.8)	
Education (self)						
Yes	15	57.7 (6.0)	0.138	13	51.2 (9.7)	
0.786						
No	119	55.1 (6.4)		38	50.4 (5.8)	
Education (husband)						
Yes	35	56.3 (7.2)	0.292	8	52.5 (4.8)	
0.248						
No	94	55.0 (6.0)		38	49.6 (6.7)	
Status of boma						
Poor	21	54.3 (6.0)	0.432	7	51.1 (7.3)	
0.927						
Average/rich	108	55.5 (6.4)		44	50.9 (6.6)	

Table 10. Birth weight with possible confounders.

p-value	Birth weight					
	Multipara			Primigravidae		
	n	Mean (SD)	p-value	n	Mean (SD)	
Age						
<22 0.163	107	2.92 (0.69)	0.783	88	2.63 (0.56)	
22+	129	2.90 (0.60)		4	3.03 (0.13)	
Marital status						
Married	211	2.92 (0.64)	0.145	77	2.62 (0.58)	0.383
Not married	22	2.71 (0.61)		14	2.76 (0.36)	
Education (self)						
Yes 0.349	28	2.78 (0.64)	0.270	17	2.76 (0.57)	
No	208	2.92 (0.63)		74	2.62 (0.55)	
Education (husband)						
Yes 0.046	56	3.03 (0.68)	0.090	16	2.38 (0.70)	
No	173	2.86 (0.63)		65	2.69 (0.52)	
Status of boma						
Poor 0.172	42	2.90 (0.77)	0.965	11	2.85 (0.47)	
Average/rich	187	2.90 (0.61)		80	2.61 (0.56)	

Table 11. Crude analysis of associations of protein restriction with birth weight.

p-value	Birth weight				
	Multipara			Primigravidae	
	n	Mean (SD)	p-value	n	Mean (SD)
Protein-restricted diet at					
nine months of pregnancy at:					
Breakfast					
Yes	22	2.98 (0.47)	0.531	10	2.74 (0.38)
0.766					
No	95	2.89 (0.58)		31	2.79 (0.52)
Lunch					
Yes	35	2.93 (0.58)	0.837	12	2.84 (0.60)
0.311					
No	52	2.95 (0.55)		21	2.61 (0.63)
Supper					
Yes	39	2.87 (0.47)	0.547	11	2.96 (0.48)
0.013					
No	67	2.93 (0.55)		25	2.40 (0.63)

Table 12. Crude analysis of associations of induced vomiting with birth weight.

p-value	Birth weight				
	Multipara			Primigravidae	
	n	Mean (SD)	p-value	n	Mean (SD)
Induced vomiting at					
nine months of pregnancy					
Yes	75	2.82 (0.53)	0.060	43	2.64 (0.55)
0.532					
No	74	2.99 (0.56)		18	2.74 (0.58)

No linear relationship was observed between weight change from eight to nine months of pregnancy and birth weight for multipara ($r=0.16$, $df=97$, $p>0.05$) nor primigravidae ($r=0.09$, $df=34$, $p>0.05$). Mothers' weight at nine months of pregnancy was not linearly related to birth weight for multipara ($r=0.16$, $df=113$, $p>0.05$) nor primigravidae ($r=0.05$, $df=37$, $p>0.05$).

Adjusted analysis of the associations of induced vomiting and protein restricted diet with birth weight

After adjusting for husbands' education, induced vomiting at nine months pregnancy of was associated with birth weight among multipara (adjusted mean birth weight difference was 0.18 with a standard error of 0.09, $p<0.05$). However, among primigravidae, protein-restricted diet, at supper, at nine months pregnancy was associated with birth weight (adjusted mean birth weight difference was 0.84 with a standard error of 0.21, $p<0.001$).

Table 13 shows the distribution of the mean weight by month of pregnancy for multipara and primigravidae. Among the multipara, there was no mean weight change from 4 to 8 months pregnant (slope=0.10, SE=0.11, $p>0.05$). Meanwhile, a significant upward trend in mean weight was observed among the primigravidae from 4 to 8 months of pregnancy (slope=0.3, SE=0.09, $p<0.05$). As from 8 to 9 months pregnancy, no significant change in the mean weight was observed among the multipara (mean weight difference=-0.024, SE=0.198, $p>0.05$), but a significant reduction in mean weight was observed among the primigravidae (mean weight difference=-1.66, SE=0.364, $p<0.001$).

Multipara were heavier than the primigravidae during the ninth month of pregnancy ($p<0.001$). There were no significant differences in mean height ($p=0.103$) and body mass index ($p=0.823$). Babies born of multipara were 2.9 (SD 0.6) kg compared to babies of primigravidae who weighed 2.6 (SD 0.6) kg on average ($p=0.001$).

Table 13 : Distribution of mean weight (kg) by month of pregnancy for multipara and primigravidae.

Month	Multipara		Primigravidae		p value
	n	Mean (SD)	n	Mean (SD)	
April	35	54.0 (6.4)	17	52.5 (5.6)	0.419
May	59	54.0 (6.3)	34	52.6 (6.1)	0.319
June	111	54.7 (6.1)	56	52.5 (5.5)	0.024
July	183	54.0 (6.1)	90	53.4 (6.7)	0.412
August	199	54.5 (6.3)	93	53.6 (6.3)	0.289
September	134	55.4 (6.4)	52	50.7 (6.8)	<0.001
At birth	187	49.6 (6.7)	76	47.6 (6.5)	0.028

CHAPTER NINE

DISCUSSION AND CONCLUSIONS

Anecdotal reasoning substantiates the cultural influence of such food habits as aversion and craving during pregnancy (Coronios and Vargas et al, 1992). This study had prospectively investigated the cultural influences on the dietary habits of N= 425 Maasai pregnant women, n= 300 multi para and n= 125 Primigravidae in Kajiado District, Republic of Kenya. Descriptive survey tools were created and implemented among the pregnant Maasai women in a period of 30 months, January 1993 through June 1995 to describe the dietary habits of Maasai pregnant women and the impact on pregnancy and birth weight.

Several studies have shown that low birth weight is associated with neonatal and perinatal mortalities (Gopalan and Rao, 1972; Laditan, 1974; Asindi and Ekanem, 1988). Consequently, it is of paramount importance to identify factors that may be associated with low birth weight in order to institute appropriate interventions to improve the situation.

This study showed that both food avoidance and induced vomiting had some impact on the reduction of the birth weight and weight of mothers among the Primigravidae compared to multi para. At the time the subjects enrolled in the Study, the weight differences between Primigravidae and multi paras were not statistically significant. However, by the ninth month, multi para had a significantly higher mean weight than Primigravidae.

Birth weight is an important health indicator, because it is one of the most decisive factors for survival in the perinatal and neonatal period. However, it is not determined by maternal nutrition alone, but is affected by many other factors, including mothers' height, pre-pregnancy weight, previous nutritional history, scope of physical activities, income and education, height and parity (Metcoff et al., 1981).

It was observed by another study conducted in Kenya that the incidence of low birth weight was only 6.5 percent (Jansen et al., 1981); Tanzania, 25 percent (Maletnlema and Bavu, 1981); India, 30 percent (Gopalan and Rao, 1972) and Nigeria, 8.8 percent (Oni and Argionye, 1986). It would, therefore, be logical to assume that it is not necessary to gain a lot of weight during the pregnancy as long as the mother has positive energy balance, which could be supplied by an additional dietary intake or reduced physical activity during

pregnancy and preceded by reasonable pre-pregnancy weight.

In most developing countries, pregnant women have been found to engage in strenuous manual labour till the last stages of pregnancy (Gopalan and Rao, 1972; Rogo and Ninango, 1987; Paul et al., 1979). Thus, they are doubly subjected to an energy deficit and these conditions impose considerable stress on them (Paul et al., 1979; Lawrence, 1984).

Socio-demographic characteristics

The study population was generally young, married, not formally educated (both respondents and spouses) and of average economic status. None of these factors, except spouses' education was significantly associated with the birth weight. Non education of husbands has been associated with poor pregnancy outcomes which confirms the findings of other studies. The husband's level of education was identified as a confounder in the association of induced vomiting at the ninth month pregnancy with birth weight among multi para. The lack of association of other socio-demographic factors to the birth weight can be partly explained by the relative homogeneity of these factors among the study subjects, who spoke the same language, shared the same culture and environment, and had access to similar socioeconomic opportunities.

Almost all Primigravidae (95.2 %) were less than 22 years old. Actually, the majority of Primigravidae could have been 16 or even younger, but it was not possible to verify as the participants lacked birth certificates to verify their actual birth dates. As a result, their ages were pre-recorded utilizing the Maasai calendar.

Based on the local custom, marriage is often arranged by parents and early initiation of girls starts as early as the age of 10 years. This observation is in keeping with previous reports which show that similar practices leading to early child bearing are common in developing countries (World Bank, 1984; Shah, 1982.; WHO, 1989; UNESCO, 1993). There, was no association between age and birth weight for multi para nor Primigravidae in the current study. However, investigations carried out in Trinidad (St. George *et al*, 1970), Kenya (Ngoka and Mati, 1980) and Nigeria (Addition and Adedoyin, 1989) showed that teenage mothers had smaller babies compared to adult mothers (multi para).

In Ethiopia, during the time of acute food shortage, Gabremedhine *et al* (1987) found that maternal age was an important determinant of birth weight. The salient reason for the lack of

association between age and birth weight in this study could be attributed to the absence of birth certificates to verify the exact date of birth for both multi para and Primigravidae.

Obstetric history

About a quarter of the multi para in the present study reported having had no miscarriages, while about half of them reported having had no stillbirths. These events were likely to have been under reported because, culturally, they are too sensitive to be reported to outsiders. Maasai mothers are unaccustomed to discussing their pregnancy losses, i.e. miscarriages and abortions with individual outsiders. The use of TBAs alone may not overcome this problem.

The traditional Maasai diet consists of meat and milk as the main component. Meat, in addition to being popular, is provided during convalescence, subsequent to childbirth, and during special community occasions. Furthermore, blood drawn from cows' jugular vein is given to individuals who need to replace the blood they lost due to attack by wild animals or following child birth (Saitoti, 1980).

However, based on ten years of ongoing interaction with the Maasai community in health and development programmes, it is clear that they are receptive to new ideas as long as those ideas are contextual and relevant. There is evidence that they are gradually adapting new ways of life including modified dietary habits and utilisation of modern health care. While meat and milk are still prominent dietary sources among the Maasai, maize and other maize products are becoming major sources of staple food.

Dietary restriction during pregnancy appeared to have been maintained across the board, but it was more prevalent among the Primigravidae than multi para for the following reasons.

1. Primigravidae are too young and lack previous experience in pregnancy and childbirth, which makes them susceptible to strict restriction instituted by elderly women, i.e., mothers -in law, traditional birth attendants (TBAs) and grandmothers.
2. They are not educated, which makes them more susceptible to heavy cultural influence, and is not necessarily followed so closely by their multi para counterparts.

3. Their knowledge of nutrition and its impact on birth outcome is very limited, as they have no education or training to understand the value of nutrition.

In this study, a quarter of the multi para indicated that they are still subjected to dietary restriction of some sort during pregnancy, while three quarters of them were not influenced by anyone. During pregnancy, about half the Primigravidae were influenced, in their food intake, by their mother in-law. This observation tallies with a previous finding (Saitoti, 1977), that, customarily, the Maasai pregnant woman's diet was restricted (excluded rich foods such as fatty meats and milk) starting from the sixth month of pregnancy or even earlier, in the case of Primigravidae. The Maasai believed that excessive weight gain during pregnancy will adversely affect either the mother or the foetus, making the process of child delivery difficult and dangerous.

Induced vomiting

In order to clean the stomach, purify the mother's bloodstream and keep her healthy, vomiting was often induced by taking bitter roots and herbs or taking large quantities of fat (Mpoko S, Johnson K.E., 1993; Saitoti, 1980). There was no significant difference between the proportion of multi para who induced vomiting in the sixth month of pregnancy and that of Primigravidae. However, in the ninth month of pregnancy, significantly more Primigravidae than multi para had induced vomiting, indicating that dietary restriction was more stringent during the first pregnancy. What, how often and what quantity Primigravidae eat to ensure safety of the mother and foetus was only loosely monitored and not controlled.

Among the Primigravidae, at the ninth month of pregnancy, those who were married and had no education were more likely to have induced vomiting. Similarly, a multi para, at ninth month of pregnancy with no education, was more likely to have induced vomiting. After adjusting for husbands' education, induced vomiting at the ninth month of pregnancy was associated with birth weight.

Protein-restricted diet

Protein-restricted diet, during supper, at the ninth month of pregnancy, among Primigravidae, was associated with marital status and primary education. There was some evidence that primary and non-formal education had only limited influence on nutrition,

pregnancy and its outcome. This may suggest that to achieve a desired outcome (educational influence on nutrition, pregnancy and its outcome), the girls have to complete at least high school. It suggests, at least, how deep-rooted the Maasai tradition and culture is among the Maasai women. After adjusting for husbands' education, protein restricted diet among Primigravidae at supper at the ninth month pregnancy was associated with birth weight. During pregnancy, therefore, dietary restriction is consistently retained in Maasai culture (Quinn et al., 1987).

In some cultures, some foods are not eaten by certain groups of people like women, children and young men, because of accompanying beliefs concerning them. The Maasai, for example, believe that milk is the best food, therefore, maize meal is curtailed when the milk supply increases (Nestel, 1984; Mpoke et al., 1993; Rao, 1985). Rao, in his study findings, stated that in India certain food stuffs were avoided during the menarche, pregnancy and lactation. The study also found that most women received dietary information from the in-laws, a tradition which had been preserved for generations.

In some societies, girls commonly receive less nutritious food than boys, leading to malnutrition and impaired physical development. Since early under-nutrition can lead to underdevelopment of the pelvis, girls who are underfed during childhood may have stunted growth leading to the problem during pregnancy. The disadvantages suffered by the girl-child at an early age have, far-reaching implications for them as mothers and for their children.

Thus, the diet consumed during pregnancy deserves special consideration to ensure that it does not adversely affect the health of both the mother and baby. A successful pregnancy requires additional nutrients like protein, vitamins and iron. However, the type of food available in each case is a limiting factor as gleaned from a study conducted in Iraq, where 49 % of women during pregnancy did not change their food. In Kenya, the adequacy of nutrition in some communities of the country is only marginal and the extent of knowledge about maternal nutrition is limited.

What is known is that, during pregnancy, the Maasai women of Kenya, restrict the intake of certain foods to avoid difficult labour and delivery (Rogo and Oniango, 1987). In the Machakos area of Kenya where the Akamba are neighbours to the Maasai, mothers mentioned having avoided large meals during pregnancy, even though the specific foods avoided were not mentioned. Nevertheless, the Akamba's traditional diet composition, which is well

known (maize, beans and very little fat) suggests what was restricted during pregnancy (Kusin and Jansen, 1986).

Educational Levels

There is evidence that education appears to be more effective in influencing a positive change. However, more information is needed based on a larger sample size and more intensive questions on aspects of education. Although this variable was a specific focus of the study, the small sample size of women with secondary or higher education limits the significance. Nevertheless, a comparison was made among women with informal, primary and secondary education with respect to weight performance during the entire pregnancy. This suggests that higher levels of education may have an influence on nutrition, pregnancy and pregnancy outcome.

According to the findings of this study, therefore, it is clear that dietary restriction in Maasai society during pregnancy continues. Milk and meat still maintain their historical prominence, followed by maize and maize products as the main staples. The traditional practice of protein restriction during pregnancy among the Maasai Primigravidae remains dominant. The data show that restriction became significant during the ninth month of pregnancy to avoid dystocia-- difficult childbirth. This practice is based on instructions from traditional birth attendants (TBAs) and other older women to prevent foetopelvic disproportion (Williams et al., 1982; Berms et al., 1985). This is a society where more than 80 % of deliveries are assisted by traditional birth attendants (TBAs) (Mpoke et al., 1993, Mammo et al., 1991). Dietary restriction becomes serious among the Primigravidae due to their young age, lack of sufficient education and previous experience with pregnancy and child birth. Although dietary restriction starts at an early stage of pregnancy, it is more stringent in the latter part of pregnancy among the Primigravidae.

Naturally, pregnancy of Primigravidae is confirmed by TBAs, who, in addition to breaking the good news of pregnancy, introduce strict instructions for the commencement of dietary restriction.

In addition, strict restriction of both specific foodstuffs and sexual intercourse with the husband are concurrently introduced and intensified at the advanced stage of pregnancy,

when intercourse is believed to adversely affect the foetus (Johnson et al., 1993). Studies done in other parts of the World have shown cultural uniqueness of each society. Although level of restriction, types of food and stage of restriction vary from society to society, the overall rationale seems to be similar worldwide.

Current findings and observations show that the Maasai are gradually adjusting their traditional practice to improved, appropriate way of a rather careful pace. If they think a given change is going to yield a desired outcome, they are more receptive to it than if they were suddenly confronted with it or when a change was imposed. During the child survival projects implementation, whenever complications occurred during child delivery or other illnesses, the Maasai sought transportation to take their loved ones to the hospital. They brought their children to immunization sites, walking on average 5 km, and participated actively in project implementation, monitoring and management activities.

There was no apparent resistance to a process of transformation from a traditional practice to improve health care practice. The concern is to keep a healthy balance and create mutual synergy between the two aspects of life. *It is of paramount importance to understand local customs in order to appreciate the history, context and change and to design the change within that context.*

This study suggests the need for future research to assess further the impact of cultural practices on dietary habits, pregnancy and birth weight, which may or may not require subsequent intervention. Further to the specific sample study, there should be a following up of the children born to these women to their fifth birthday along with the children born to the control groups, to determine further the impact of low birth weight (< 2500g) on the growth, development and survival of the children, which goes beyond the scope of this present study.

Like many other developing countries, the nutritional status of a pregnant woman has a great effect on the unborn child. Ramsay et al., (1983) observed that low birth weight in Kenya was associated with maternal vitamin deficiencies. In a separate study, Gopalan and Rao (1972) found that pregnant women in Guatemala increased birth weight progressively as dietary

intake increased.

To solve the problem raised by this study, it is suggested that multi centre, multi country collaborative studies with larger sample sizes be designed jointly by clinicians, epidemiologists, nutritionists and anthropologists. However, in the case of this study, the following suggestions can be used as a starting point:

- (1) training of field staff (TABS, CHWS, Community Motivators (CMs) etc) ;
- (2) training /teaching of women leaders as part of Women Groups to enhance preventive and promotive health training;
- (3) antenatal and postnatal training in MCH clinics and other health posts to reduce infant mortality rates;
- (4) basic training materials on pregnancy, nutrition and informal education at all stages of primary and secondary schools must be available and accessible to girls.

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APPENDIX A

OPERATIONAL DEFINITIONS

Low birth weight: Infant birth weight of less than 2500g or 5.5lb.

Culture/Customs: Food habits during the primigravidae pregnancy of Maasai women and other cultural habits affecting pregnancy and the out come among the pregnant Maasai women.

Community Motivater (CM): An individual recruited from the community and employed by the Loitokitok Child Survival project. The CM lives in her or his own house within the community and works in the area. The same individuals were needed to collect data for this study.

Traditional Birth Attendant (TBA): A woman experienced in attending and assisting normal deliveries in the community. The study survey indicated that about 85 percent of Maasai women have their babies delivered at home by TBAs.

Community Health Workers (CHWs): Mainly women, but a few men who volunteer to train members of their community in prevention, promotion and basic curative service delivery, such as dispensing malaria prophylactics. These include some TBAs and non-TBAs.

Other Volunteers (OVs): Individuals who have volunteered in the past and were willing to participate in this study exercise. They include high school students, school teachers and other educated segments of the community who are interested in learning about their community as much as possible.

Zones: The 21 out reach Centres in the Loitokitok Division established by Loitokitok Child

Survival Project staff as the centres of outreach areas, further condensed into six zones.

Centres: Twenty-one centres in the Division services, visited once a month by the project's technical teams who provided immunisation, ante-natal and post-natal cares to the mothers and children. They supply basic curative and health promotion services. At these centres, mothers are taught how to prepare and utilise oral rehydration solution (ORS) and give oral rehydration therapy (ORT) to their children during diarrhoea. Furthermore, growth monitoring, basic nutritional interventions, environmental hygiene and other aspects of basic primary health care based on simple prevention and primitive care are taught at these centres.

EPI: Expanded programme for immunisation. In addition to the other above-mentioned services, the EPI Services are delivered at the 20 other outreach centres as part of Child Survival interventions.

Field Nutritionist: A regular employee of the Child Survival project who assisted the field investigators and was solely hired for the purpose of this study.

Field Investigators: Fifteen investigators specifically trained in interview skills who participated in the questionnaire development. All the enumerators were form 4 level or equivalent to grade 12.

Chief Nutritionist: Who held a masters in applied nutrition, who was responsible for overseeing the overall direction of the study -- the feasibility, reliability and validity of nutritional data and data gathering aspect of the study on the ground. This individual closely worked with the principal investigator and field nutritionist in all aspects of the study.

Principal Investigator: The author of this study, who is a primary health care (PHC) specialist and professional epidemiologist. He was responsible for ensuring the study met scientific criteria and epidemiological credibility. He is responsible for initiation design and implementation of the study. He over saw the overall validity and reliability of the study.

Neonatal Mortality: The probability of dying within the first month of life per 1000 live births.

Postnatal Mortality: The difference between infant and neonatal mortality per 1000 live births.

Child Mortality: The probability of dying between the first birthday and fifth birthday.

Infant Mortality: The probability of dying before first birthday per 1000 live births.

Under-five Mortality: The probability of dying between birth and fifth birthday per 1000 live births.

B. REGISTRATION QUESTIONNAIRES

**TO BE ADMINISTERED ON EVERY PREGNANT WOMAN ON THE
FIRST VISIT**

DATE :/...../.....

SUB ADP :

VILLAGE :

NAME OF ENUMERATOR :

NAME OF RESPONDENT :

CAMP NUMBER :

--	--	--	--	--

1. WHICH AGE GROUP SUNG FOR YOU?

Ilkimunyaki (12-21) years

1. Illkishomu (22-31) years

2. Iseuri (32-42) years

2. HAVE YOU ATTENDED SCHOOL?

Yes

1.No

(If no, skip question 3)

3. IF YES, TO WHAT LEVEL?

Adult education only

1.Std 1-4

2.Std 5-8

3.Secondary

4.Post secondary

4. MARITAL STATUS OF THE RESPONDENT

Married

a)Single

b)Separated / divorced

c)Widow

5. DID YOUR HUSBAND ATTEND SCHOOL?

Yes

a)No

6. IF YES, TO WHAT LEVEL?

Adult education only

a)Std 1-4

b)Std 5-8

c)Secondary

d)Post secondary

e)Don't know

7. HAVE YOU BEEN PREGNANT BEFORE?

Yes

a)No

8. IF YES, HOW MANY TIMES HAVE YOU BEEN PREGNANT?**(EXCLUDE CURRENT PREGNANCY)****9. HOW MANY OF THESE PREGNANCIES RESULTED IN****MISCARRIAGES?****10. HOW MANY OF THESE PREGNANCIES RESULTED IN****STILLBIRTHS?****11. HOW MANY OF YOUR CHILDREN ARE ALIVE?****12. DID YOU ATTEND THE ANTE-NATAL CLINIC?**

Yes

a)No

13. DID YOU AVOID ANY FOODS DURING YOUR LAST PREGNANCY?

Yes

a) No

14. IF YES, WHICH OF THE FOLLOWING FOODS DID YOU AVOID AND WHAT WAS THE MAIN REASON FOR AVOIDING THIS FOOD?**CODE FOR FOODS**

a) Fresh milk

a) Sour milk

a) Meat

a) Unslaughtered animal meat

a) Meat from young animals

a) Others (specify)

FOOD	REASON

CODE FOR REASONS

a) Tradition / culture

b) Will make baby big

c) Will cause disease to the baby

d)Will cause disease to the mother

e)Will cause heart-burn

f)Was asked to avoid

g)Others

15. IF YES, WHICH FOOD DID YOU AVOID DURING DIFFERENT TRIMESTERS? (TICK APPROPRIATELY)

- a) Fresh milk
- a) Sour milk
- a) Meat
- a) Unslaughtered animal meat
- a) Meat from young animals
- a) Others (specify)

1ST	2ND	3RD

16. ARE THERE ANY FOODS YOU CRAVED FOR DURING THE LAST PREGNANCY?

17. IF YES, WHICH OF THE FOLLOWING FOODS DID YOU CRAVE FOR. TICK APPROPRIATELY)

- a) Meat
- a) Milk
- a) Rice

a) Fruits

a) Chappati

a) Bananas

a) Others (specify)

b)

18. WHO MAINLY INFLUENCES WHAT YOU EAT WHEN YOU ARE PREGNANT?

a)Mother

b)Mother in law

c)Traditional birth attendant

d)My husband

e)Nobody (myself)

f)An elder in the Manyatta

g)Others (Specify)

19. HAS VOMITING BEEN INDUCED WITHIN THE LAST SEVEN DAYS?

a)Yes

b)No

20. IF YES, HOW MANY TIMES HAS VOMITING BEEN INDUCED WITHIN THE LAST SEVEN DAYS? (NUMBER OF TIMES)

21. PLEASE TELL US WHAT YOU ATE YESTERDAY, STARTING WITH THE FIRST MEAL TO THE LAST. DEMONSTRATE TO US WHAT AMOUNT YOU ATE.

	TIME	DISH	SOURCE OF THE INGREDIENTS	AMOUNT CONSUMED	INGREDIENTS IN LITRES
BREAKFAST					
SNACKS					
LUNCH					
SNACKS					
DINNER					

CODE OF SOURCE:

a)Own Produce

b)Bought

c)Gift (donation)

d)Others

22. STATUS OF THE BOMA

a)Rich

b)Average

c)Poor

23. HEIGHT OF THE MOTHER

--	--	--	--

24. WEIGHT OF THE MOTHER

--	--	--	--

B1. FOLLOW-UP

**TO BE ADMINISTERED ON EVERY PREGNANT MULTIPARAE
MAASAI WOMAN ON EVERY FOLLOW-UP VISIT.**

DATE :/...../.....

SUB ADP :

VILLAGE :

NAME OF ENUMERATOR :

NAME OF REPOUDENT :

CAMP NUMBER :

--	--	--	--	--

FOLLOW UP NUMBER :

--

**1. HOW MANY MONTHS IS THE PREGNANCY NOW ?
(NUMBER OF MONTHS)**

--

2. PLEASE TELL US WHAT YOU ATE YESTERDAY, STARTING WITH THE FIRST MEAL TO THE LAST. DEMONSTRATE TO US THE AMOUNT YOU ATE.

	TIME	DISH	SOURCE OF THE INGREDIENTS	AMOUNT CONSUMED	INGREDIENTS IN LITRES
BREAKFAST					
SNACKS					
LUNCH					
SNACKS					
DINNER					

CODE FOR SOURCE

a) Own produce

b) Bought

c) Gift (donation)

d) Others

3. ARE THERE FOODS THAT WERE COOKED YESTERDAY THAT YOU DID NOT EAT?

a) Yes

b) No

4. IF YES, WHICH OF THE FOLLOWING FOODS DID YOU NOT EAT AND WHY?**CODE FOR FOODS**

a) Meat

a) Fat

a) Fresh Milk

a) Chappati

a) Ugali

FOOD	REASON

a) Fried Foods

a) Sour milk

b)

a) Tea with milk

b)

a) Uji

b)

a) Others (specify)

b)

CODE FOR REASONS

a) Tradition / culture

b) Will make baby big

c) Will cause disease to the baby

d) Will cause disease to the mother

e) Will cause heart-burn

f) Was asked to avoid

g) Others

5. HAS VOMITING BEEN INDUCED WITHIN THE LAST 7 DAYS?

a) Yes

b) No

6. IF YES, HOW MANY TIMES HAS VOMITING BEEN**INDUCED WITHIN THE LAST 7 DAYS?****(NUMBER OF TIMES)****7. DID YOU EAT THE FOLLOWING FOODS LAST WEEK AND DO YOU EAT THEM NORMALLY?**

a) Meat

a) Fat

a) Fresh Milk

a) Potatoes

a) Chippati

a) Vegetable

a) Ugali

b)

	ATE LAST WEEK	NORMALLY EATS
a) Meat		
a) Fat		
a) Fresh Milk		
a) Potatoes		
a) Chippati		
a) Vegetable		
a) Ugali		
b)		

- a) Fried food
- b)
- a) Maize
- b)
- a) Tea with milk
- b)
- a) Beans
- b)
- a) Porridge
- b)
- a) Millet / Sorghum
- b)
- a) Sour milk
- b)
- a) Others (specify)
- b)

8. DO YOU HAVE LACTATING COWS/GOATS?

a)Yes

b)No

9. SIGNS OF ANAEMIA

a)Yes

b)No

10. WEIGHT OF THE MOTHER

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C. MAP OF KENYA



Figure 8