



MOTHER'S PROTEIN INTAKE DURING THE FIRST 1000 DAYS OF A CHILD, IN MOYAMBA TOWNSHIP, SOUTHERN SIERRA LEONE

Mohamed Paul Ngegba¹ & Abibatu Bah²

¹Department of Extension and Rural Sociology, School of Agriculture, Njala Campus

²Master Degree in Nutrition and Dietetics, Institute of Food Technology Nutrition and Consumer Studies (IFTNCS), School of Agriculture, Njala University Njala Campus

ABSTRACT

Protein nutritional intake by women at inception and during pregnancy is very essential and has great influences on the growth and potential development of the foetus. Poor Nutrition during pregnancy however affects not only foetal development but chronic diseases situations can develop in the infants. The study investigated protein intake by mothers in Moyamba-township and its effect on development of a child during the critical “*window of opportunity*” period that seems to occur from conception to 24 months of age, and is now commonly referred to as the “*first 1000 days*” of the baby. The research adopted descriptive and longitudinal survey designs. It used multistage and purposive simple random sampling techniques to select both the mothers and children. Structured and semi-structured questionnaire were administered to 160 participants in Moyamba Town in Moyamba District to collect data for this study. This study revealed that in Sierra Leone today, there is a strong link between foetal development and consequent development of chronic diseases in children due to poor nutrition (21.3%). It also revealed that breastfeeding has increased dietary needs because of the extra energy and nutrients needed to produce breast milk (18.8%). It was concluded that most of the mothers and their children have access to enough and varieties of protein sources which has led to mothers' wellness, as a result of the nourishment of their bodies to enable them to endure greatly in most of their life pressing issues. Likewise, most diseases that easily affect children have been prevented. It was recommended that humanitarian organizations assist women in this township to own large vegetable farms which can provide enough yield for marketing and self-consumption. This would be done by organizing women into Agricultural Organizations with the capacity to own farm lands, swamps and boli-lands for maximized agricultural production throughout the year.

KEY WORDS: Pregnant Mothers, Protein intake, First 1000 days, Foetus Malnutrition, Development.

INTRODUCTION

Protein nutritional intake by women at inception and during pregnancy is very essential and has great influences on the growth and potential development of the foetus. According to Zeisel (2009), foetal development can be less optimal if certain nutrients are not available during particular sensitive stages of the development process. It is therefore; generally acceptable nowadays that poor Nutrition during pregnancy affects not only foetal development, but also creates the risk of chronic diseases occurring in infants which, may continue into their adulthood (Koletzko, 2009). Burke *et al.*, 2011 and Barker *et al.*, 2005) also established in their study that there is a strong link between foetal development and consequent development of chronic diseases in children due to poor nutrition. In fact, according to the U.S. Department of Agriculture's Dietary Reference Intakes, breast feeding mothers need about 71 grams of protein/day. This is an increase of 35% for most adult women, who are recommended to consume 46 grams of protein/day. However, not all breastfeeding mothers will have the same protein needs as the needs may vary based on age, body weight, activity level and other health issues. A breast feeding mother has increased dietary needs because of the extra energy and nutrients needed to produce breast milk. One of the many essential nutrients needed in a nursing

mother's diet is Protein. Proteins are the building blocks for many tissues and organs in the body. When a mother is breast feeding, she needs additional calories, protein and other nutrients to maintain her own body and provide protein and other essential nutrients in her breast milk for her baby.

Generally in developing countries such as Sierra Leone, it is an established fact that pregnant and lactating mothers are the most vulnerable group nutritionally. Due to nursing processes, mothers are subjected to nutritional stress; thus frequent pregnancies may increase the health-risk of mothers and this may result in a high maternal mortality. Consequently the health status of the fetus and infants depends entirely on the type of diet consumed by women during pregnancy and after delivery. Diets consumed by many mothers in our country are poor and lack in many nutrient-values. Protein deficiency in mothers build over months or years, changes with time in severity, and consequently affects different inter-related psychobiological domains such as cognition, emotion, and locomotion (Pollitt, 2001). Nutrition is a basic foundation for health and development. Better nutrition means stronger immune systems, less illness and better health. Healthy people, especially mothers, are stronger, and much more productive. Improved nutrition is a prime entry point to ending poverty and a milestone to achieving better

quality of life. All forms of malnutrition in the broad spectrum are associated with significant morbidity, mortality and economic costs.

The "Barker Hypothesis" first described the link between foetal development and later development of chronic diseases over 20 years ago. The critical "window of opportunity" seems to occur from conception to 24 months of age, and is now commonly referred to as the "first 1000 days" of the baby.

Health professionals working with mothers and babies during this key time have a unique opportunity to influence lifelong health of the mother, infant and the family unit by encouraging them to eat appropriate diet.

Poor protein nutrition can also increase adult risk of cardiovascular disease (Kajantie *et al.*, 2005), high blood pressure (Ketz *et al.*, 2005), obesity (Tounian, 2011) and metabolic syndrome (Barker *et al.*, 2005). Even babies with seemingly normal birth weight have increased risk of cardiac death in later life if malnourished in uterus (Barker *et al.*, 2012). Obese women are more than twice as likely to give birth to a large gestational age baby compared to normal weight women (Sebire *et al.*, 2001), which significantly increases the risk of complications associated with delivery (Boulet, 2003). Maternal diet can influence the type of foetal adipose tissue, which may explain the baby's risk of developing insulin resistance and subsequent diabetes in later life (Symonds *et al.*, 2012). The fuel-mediated in utero-hypothesis suggests that increased glucose and lipid intake during pregnancy results in obesity in later life for the baby (Koletzko *et al.*, 2012). Improved diet and lifestyle regimens potentially reduce this risk (Nelson *et al.*, 2010; Moses *et al.*, 2005). For example, replacement of high glycaemic index foods with low glycaemic index foods has been shown to significantly reduce gestational weight gain in obese women (Walsh *et al.*, 2012).

Obese women are at an increased risk of developing Gestational Diabetes mellitus (GDM) which further increases complications in pregnancy (Dennedy and Dunne, 2010). GDM patients, who are overweight or obese, have higher risks of complications (Owens *et al.*, 2010). Pre-pregnancy weight loss is recommended for all obese women and is particularly beneficial in nulliparous women considering their first pregnancy (Dennedy and Dunne, 2010). GDM recurs in second and subsequent pregnancies (Kim, 2007), where patients will require more intensive monitoring and management with dietary intervention indicated from the outset. Pregnancy is a time which provides a unique opportunity to influence the long term health of the infant and mother. Many women are self-motivated to make positive changes to diet and lifestyle while pregnant. Just as targeting pregnant women and their partners for smoking cessation interventions during the antenatal period has been shown to be particularly effective (Zeisel, 2009), diet and lifestyle change should be promoted at this opportunity to improve long term health outcomes.

Protein is essential in the development of a healthy baby as it forms the structural basis for all new cells and tissues in the mother and foetus. It is important to ensure the adequate balance of protein to energy as high protein alone can cause harm to the foetus (Ota *et al.*, 2012) and protein

deficiency can result in thin babies (Godfrey *et al.*, 1997). Balanced intake of energy and protein seems to improve foetal growth (Ota *et al.*, 2012). However, evidence is emerging on the relationship between the type of protein and foetal growth. Consumption of processed meats (such as sausage, burgers and chicken nuggets) increases the risk of small for gestational age babies (Knudsen *et al.*, 2008) while fish and eggs seem to reduce the risk (Ricci *et al.*, 2010). Choosing foods high in fat, salt and sugar, seems to further increase risk for age of the baby (Thompson *et al.*, 2010). According to O'Neill *et al.* (2011), most women will not meet their requirements for protein as the typical population intakes are only adequate for pregnancy with two servings of protein a day. Particular attention should therefore be paid to women who are at risk of inadequate protein intake or sub-optimal protein choices. Women who have experienced nausea or vomiting during pregnancy are likely to have reduced their intake of protein rich foods due to aversions resulting from vomiting in early pregnancy. Vegetarian women should be encouraged to consume adequate protein sources during pregnancy by increasing their intake of foods rich in protein including beans, lentils, chick peas, tofu, dairy products and eggs. Vegetarian women should be advised on the importance of adequate protein sources to ensure optimal intake of essential amino acids, for example combining cereals and legumes in a meal. The adequacy of dietary iron intake should also be addressed within this group. Women following a vegan diet may need dietetic review to ensure nutritional adequacy. Women from lower socioeconomic groups are at higher risk of inadequate protein intake due to the associated costs. They are also more likely to choose less expensive processed foods which would put them at risk of small for gestational age babies

Hidden hunger commonly results from poor food utilization; that is, a person's diet lacks the appropriate balance of macro- (calories) and micronutrients (vitamins and minerals). Individuals may look well-nourished and consume sufficient calories but be deficient in key micronutrients such as vitamin A, iron, and iodine. People may live in unhealthy environments with inadequate hygiene and sanitation, which results in frequent illnesses and compromised nutritional outcomes despite sufficient food being available. Infants and very young children may have mothers who are sometime constrained, particularly at peak times in the agricultural calendar, that they are unable to feed a child as often as necessary to provide good nutrition. Malnutrition is economically costly: it can cost individuals 10 percent of their lifetime earnings and nations 2 to 3 percent of gross domestic product (GDP) in the worst-affected countries (Alderman, 2005). And in situations where malnutrition is prevalent among all segments of the population, poor nutrition among women begins at infancy and continues throughout their lifetime (Chatterjee, 1990). Protein intake by mothers is equally essential for the nutritional requirements of children. A healthy diet is very necessary for each and every individual. In such circumstances, a well-balanced diet (which has a variety of nutrient-rich foods) is a must and in particular protein which contributes immensely to the replacement of worn-out tissues is very essential. In Sierra Leone, today, different age-groups of women and girls can

be seen as pregnant and expecting mothers. Manga (2010) in his work on women in the Yoni Chiefdom, a Chiefdom sharing borders with Moyamba District, revealed that the greatest number of Mothers is from school drop-out girls, teenage married-girls, and girls growing out of homes (street girls). In fact, Government of Sierra Leone is making several efforts in developing health and population policies so that mothers can afford nutritious food during the first 1000 days of their babies, as women with poor nutrition are more likely to give birth to low-weight infants. And in this unfortunate period of Ebola outbreak in Sierra Leone poor nutrition can equally contribute to high mortality rate. Majority of rural girls enter the adolescent stage with poor nutritional status due to early marriages leading to teenage pregnancies and motherhoods with little or no financial base. It is also a common culture in Sierra Leone for women to live and feed on even raw cassava during pregnancy. To some extent, pregnant women in Sierra Leone even feed on white clayey soils which they mix with salt and pepper; all these have little or no protein values. And despite the high child morbidity and mortality Sierra Leone, very little research (Manga, 2010) has been carried out to assess the protein intake of mothers during the child's 1000 days of growth and development. In such a situation, the questions one needs to ask are: What is the women's knowledge about nutritional intake (especially Protein) of women in general; what is the nutritional strength of these mothers with regards to Protein intake; what major nutrition do these women take in during the first 1000 days of the growth and development of their children? What impacts have this nutrition had on the health, growth and development of children during the 1000days period? What are the constraints such women encounter in attaining protein-nutritional security? It is therefore, the thrust of this study is to investigate the protein intake status of women during the first 1000days of a child and to ascertain whether these women fulfil the protein requirement of a healthy mother within the first 1000 days of a growing child; and whether mothers know the relevance of balanced nutrition in the growth and development of children during the first 1000 days. It is hoped that the findings of this study would be useful to the Government of Sierra Leone, NGOs and other humanitarian organizations that are interested in helping malnourished women and children. It is further hoped that this study would be used as a baseline- survey not only for Sierra Leone but the entire Sub-region. This study is purposely designed to investigate the status of mothers' protein intake in the first 1000 days of a child in Moyamba Township. The objective of this study to examine the socio-economic characteristics of mothers with children in their first 1000 days of development and growth; evaluate the quantity and quality of their protein intake; determine the effect of protein intake on the nutritional status of respondents; and Determine the knowledge and perception of mothers on their protein intake

METHODOLOGY

Research Design

The research design for this study was a descriptive survey type, designed to look into mother protein intake during the first 1000 days of child growth and development. The design is appropriate because it focuses on observation and perception of the existing situation, describes and interprets what is concerned with issues, conditions, practices, relationships, views, beliefs, attitudes, processes, and trends which are developing concerning the issues in mother protein intake during the first 1000 days of child growth and development in Moyamba Township. A Survey research design was also used because it is a procedure in quantitative approach which helps to administer questionnaire in order to identify trends in the attitudes, opinion, behaviour, or characteristics of the population. At the same time, this study employed qualitative technique to answer and understand the impact of the extension approaches. As Creswell (2007) mentioned, qualitative method is very much dependent to the nature of research question, qualitative technique is used in an attempt to understand the extension approaches, programmes, and functions to impact farm productivity. Quantitative methods were used in order to pursue in-depth understanding of the experiences and perceptions (Creswell, 2007). Considering investigation on the relationships between the variables, this study was also a descriptive–correlative one.

Study Area

The area selected for the study was Moyamba Township Sierra Leone. The selection of this Township was made for 3 reasons. First, the township is a typical rural agricultural setting where the local farmers have been in long contact with agricultural extension and research personnel. Second, the area contains several NGOs such as Plan International, ACF, Action Aid, World Vision, to mention but a few, that have been implementing food self-security and rural development programmes over the past decades. Third, the researcher was born and brought up in this Moyamba Township and it is with these people that she is best familiar. In view of these considerations, the region provides excellent field laboratory to study the extension approaches and their impacts on mother protein intake during the first 1000 days of child growth and development. Moyamba District is in the Southern Region of Sierra Leone. It is about seventy five miles (120 kilometres) away from the capital city, Freetown. Moyamba District is bounded to the North by Tonkolili District; to the south by Bo District; to the southwest by Bonthe District and to the West and North-West by the Mabam River. The entire district comprises fourteen (14) chiefdoms: Bagrewa, Bumpeh, Dasse, Fakunya, Kagboro, Kaiyamba, Kamajei, Komboro, Kori, Kowa, Lower Banta, Ribbi, Timindeh, and Upper Banta chiefdoms. The district has a population of approximately 261, 000 (SSL2004).

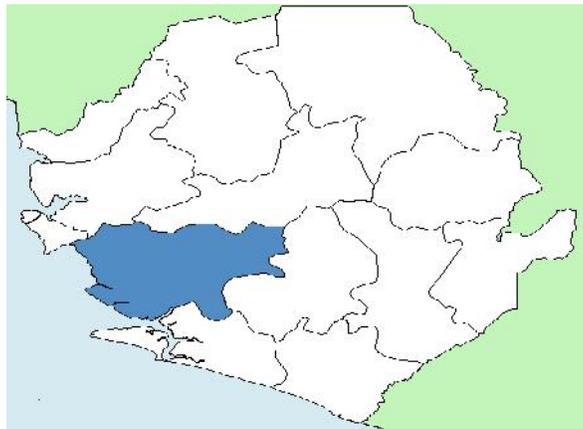


FIGURE 1: Map of Sierra Leone Showing Moyamba District, the Study Area

The district is relatively flat and dominated to the west and northern part by secondary bush. To the east, it is densely forested and potentially rich for timber production and wildlife conservation. It is sparsely forested in the north, making the region suitable for mechanized crop cultivation and livestock production, especially cattle. The upland soils are relatively fertile and most parts sandy-loam and clay-loam in nature, making the land easy for cultivation. It is also undulating with vast swamps, most retaining water throughout the year (perennial swamps), suitable for all year-round paddy production and fish farming, while those retaining water only in the rains encourage vegetable farming in the dry seasons.

The region has a hot dry season from November to April followed by heavy rainfall periods of the year from May to October. Average annual precipitation varies with up to 5,080 mm (200 inches) in the wettest parts along the coast. The prevailing winds are the South-West Monsoon during the wet season and the North-Eastern Harmattan which is a dust laden wind from the Sahara desert during the dry season. Average temperature in Southern region is from 21°C (73°F) to 31°C (88°F) all year round. There are many roads linking the district and Freetown and the head quarter town of Moyamba. However, these roads are all in very deplorable conditions, making it difficult for accessing most farming communities in this part of the country. Each of these chiefdoms in the districts has at least one health centre headed by a Community Health Officer (CHO). Nevertheless, most of these health centres are not well equipped, lacking medicines and other facilities. There are also many schools ranging from primary to secondary schools and vocational institutions; but only one university, Njala University, in the district. Despite all these educational opportunities, illiteracy rate is still very high in this region, and the people, especially women mostly depend on subsistence farming for their livelihood. The main arable crops they cultivate include rice, cassava, groundnut and vegetables; and a few cash crops such as oil palm, citrus, coffee and cocoa.

Target Population: The target population of this study consists of all Mothers in the first 1000day's period of child development and growth in the in the Moyamba District.

Sample Size and Sampling Procedure: Stratified multiple random sampling procedure was adopted to select the nutrition expert agents and key informants constituting the

sample for this study. The sampling aimed at selecting eligible persons with equal probability. Therefore, in the first instance, Moyamba Township was purposively selected because of the prevalence importance of malnutrition among women in the district.

The second stage involved selecting 160 Mothers within the Moyamba Township in order to investigate their protein intake during the first 1000 days of their children's growth and development.

Development of Research Instrument: The instrument was developed based on the observation and interviews during the pilot-test, a review of literature of Moyamba Township, mother protein intake during the first 1000 days of child growth and development and NGOs' official records. A set of structured and semi-structured questionnaires were used to collect data. The instrument was designed to elicit data on the characteristics of mother's protein intake during the first 1000 days of child growth and development.

Validity of the Research Instrument: Face and content validity were established by a panel of experts in the discipline of nutritional expert to determine the extent to which the instrument measures what it is designed to measure. According to subjective assessment of a panel of experts in food and nutrition and other related fields of study, relevant specialists in the Njala University were asked to assess the content and face validity of the instrument. Each of the experts on the panel was asked to examine the instrument for clarity, wording, length, format and overall appearance, and ensured that anything that would confuse respondents and research assistants were removed. The experts confirmed that the instrument contained items that would elicit the intended responses on the varied protein intake.

Reliability: The reliability of the instrument was determined by trial administration of questionnaires to 5mothers (0.3% of the sample) of children within the 1000-day growth and development in a township outside Moyamba, not included in the sample. This was done by test-retest administration of questionnaire within a six-week interval and the needed modifications made. The result of this test was followed by the needed modifications of the data collection instrument where necessary.

Data Collection: The use of primary and secondary data was employed for this study. Secondary data were the

information obtained from literatures, project reports, official documents, publications and consultations, and library materials among others. Primary data were obtained through the use of structured and validated questionnaire to elicit information from target respondents. Onsite data collection took place in October 2015. Prior to data collection, the first step after the development of research instrument was the recruitment and training of data collectors/enumerators. With the aim of enhancing the quality of data for the study, adequate and quality data collectors/enumerators were recruited. The selection and recruitment of data collectors considered sex, competency, academic and good command of local language of the study area. A total of thirty five (20 data collectors and 15 facilitators for the focus group discussions) were recruited and given two days vigorous training focusing on practical field experience. During the data collection period, the researcher made every effort to coordinate, manage and take part in all activities with the aim of maintaining the quality of data. Before commencement of data actual field work, the investigator visited the selected Sections in the Moyamba Township. The Mothers selected as respondents in these sections were first contacted and suitable time was agreed on to meet all of them again in their respective sections. Data was collected through administration of structured and semi-structured validated questionnaires consisting of both open and closed-ended questions to elicit information from target respondents. Before administering various tools, the aim and relevance of the study was explained to respondents, and they were assured that the information given by them would be kept strictly confidential. The instruction as how to respond to each tool was also explained to the respondents. They were asked to answer questions objectively and without discussing responses among themselves, so that the information reflects the reality of the situation on ground.

Also a focus group discussion was managed by two facilitators. The first facilitator introduces the purpose of the discussion and explains what was expected of the participants. He set the stage climate for the discussion and explained the procedure and rules; questions were asked, each participant was allowed to speak, and the facilitator moderates, but did not participate in the discussion. The second facilitator led the discussion, controlled the flow and records the responses in the field notebook. Detailed accurate notes in the notebooks were noted as key information sources because they become the raw data that would lead to focus group findings.

Data Analysis: Data was analysed using the Statistical Package for Social Sciences (SPSS) software. The descriptive statistics used for Tables and graphs obtained were frequency distributions and percentages.

RESULTS

Socio-economic characteristics of mothers

This section sought out information on the socio-economic characteristics of the mothers, and for this, variables such as age, marital status, level of educational, and number of children per mother were investigated. The data indicates that age ranges of majority of the mothers are 15-20 years (43.8%) and 21-35 years (31.2%). The rest are within 36-50 years (25.0%). Most of them are either single (35.6%), divorced (26.9%) or widowed (25.0%). Only a very small proportion of the mothers are married (12.5%). Also, most of the mothers are illiterates (41.9%). Twenty three point nine percent of those who are literates attained only secondary school education, 20.0% received primary school educations, and 15.0% of them attained University/tertiary education. Most the mothers also have only 1 child (43.8%), while others have either three children (19.0%) or 2 or 4 children, each scoring (18.0%) each.

TABLE 1: Socio-economic characteristics of mothers

	Age(in Years) N= 160			Marital Status (N= 160)				Level of Education (n = 160)			Number of per Mother (n =160)				
	15- 20 Years	21- 35 Years	36 -50 Years	Married	Single	Widowed/widower	Divorced	Illiterate	Primary education	Secondary education	University/Tertiary	1 Child	2 Children	3 Children	4 Children
No.	70	50	40	20	57	40	43	67	32	37	24	70	29	31	30
%	43.8	31.2	25.0	12.5	35.6	25.0	26.9	41.9	20.0	23.1	15.0	43.8	18.0	19.4	18.8

Quantity and Quality of Protein intake of Mothers Plant Protein

A protein source of excellent quality is one that provides all the essential amino acids in quantities that meet the needs of animals and in ratios that closely mimic the requirements of the particular animal (Woodham, 1969). For this reason, the quantity and quality of mothers'

protein intake in the study area was investigated. According to the data in Table, ground nut (31.1%, 18.8%, and 12.5%), cashew nut (21.9%, 16.3%, and 10.6%), bean (9.4%, 18.8%, and 21.9%), and Benni seeds (9.4%, 15.6%, and 22.5%) are respectively consumed once, twice, and three times per week. Benni (31.3%), cashew nut (13.8%), and Benni (10.6%) are also consumed five times per week.

TABLE 2 (a): Mothers' rate of consumption of plant vegetable proteins

No. of Times	Groundnut	Beans	Benni	Cashew nuts
Once	50(31.3%)	15(9.4%)	15(9.4%)	35(21.9%)
Twice	30(18.8%)	30(18.8%)	25(15.6%)	26(16.3%)
Thrice	20(12.5%)	35(21.9%)	36(22.5%)	17(10.6%)
Four Times	10(6.3%)	15(9.4)	16(10.0%)	5(3.1%)
Five Times	5(3.1%)	50(31.3)	17(10.6%)	22(13.8%)
Not At all	45(28.1%)	15(9.4)	50(31.3%)	55(34.4%)

TABLE 2(b) Mothers' rate of consumption of Animal Protein

No. of Times	Milk	Egg	Fish	Chicken	Pig Meat	Goat Meat	Cow Meat	Sheep Meat
once	28.1	18.8	3.1	25.0	0.1	44.4	51.9	46.9
Twice	12.5	16.3	21.9	23.1	25.6	16.9	16.9	12.5
Three Times	9.4	13.3	34.4	16.9	29.4	13.8	6.9	11.5
Four Times	6.3	6.3	26.3	6.9	16.9	10.7	3.8	1.3
Five Times	9.4	16.9	5.0	10.0	5.0	6.9	6.9	10.0
Not at all	34.4	28.8	9.4	18.1	10.6	7.5	17.5	17.5

The data reveals that milk, egg, fish, and chicken, are consumed once (28.1%, 18.8, 3.1%, and 25.0%), twice (12.5%, 16.3%, 21.9%, and 23.1), and three times (9.4%, 13.3%, 34.4%, 16.9%) respectively. Furthermore, pig, goat, cow, and sheep meats are consumed once (0.1%, 44.4%, 51.9%, and 46.9%), twice (25.6%, 16.9% each, and 12.5%), three times (29.4%, 13.8%, 6.9%, and 11.5%), four times (16.9%, 10.7%, 3.8%, and 1.3%).

Effect of protein intake on mothers

Even before conception, nutritional and other factors, both maternal and paternal sides may be playing a role in the determination of the eventual aging in an individual.

Maternal nutrition is particularly essential during the pre, peri- and postnatal years to ensure the proper development and growth of the offspring. For this reason, the effect of protein intake of mothers was investigated and the results are indicated in Figure 3. The data indicate that plant protein (21.3%), 15.6%, 8.8% and animal (16.3%), 9.6% and 6.7% has each nourished mothers bodies, increased the wellness, and body weight of the mothers, while 6.3% of both sources of protein intake has caused endurance in those mothers.. Only small proportions of plant (3.8% and 1.9%), and animal (2.5% and 1.5%) protein have lead sleepiness, weakness and constipation in mothers.

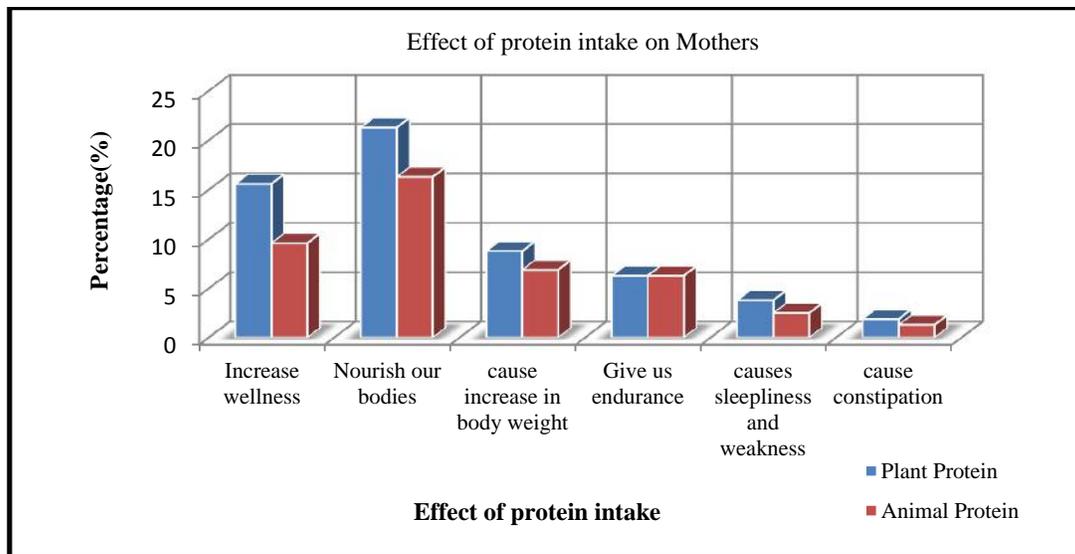


FIGURE 3: Effect of Plant and Animal proteins intake on Mothers

Effect of Protein intake on Children

Protein supports the growth, maintenance and repair of body tissues, particularly muscle. Protein makes up enzymes that are needed to facilitate chemical reactions within the body. Protein helps maintain fluid balance, transport nutrients and helps defend the body against disease (Adeyeye, 2010). As a result of this, the effect of protein intake on children in the study area was investigated and the results are shown in Figure 4.

According to the figure, plant (12.5%, 8.1%, 7.5%, 6.9%) and animal (18.8%, 10.6%, 3.8%, 8.8%) protein intake has caused increase in weight, prevented diseases, increased mental ability, and made children very active, while 4.4%, 1.9% and 6.9%, 1.3% plant and animal proteins respectively have caused increased sleeping ability and diarrhoea in some children. Only 0.6% of the protein intake has led to malnourishment in children.

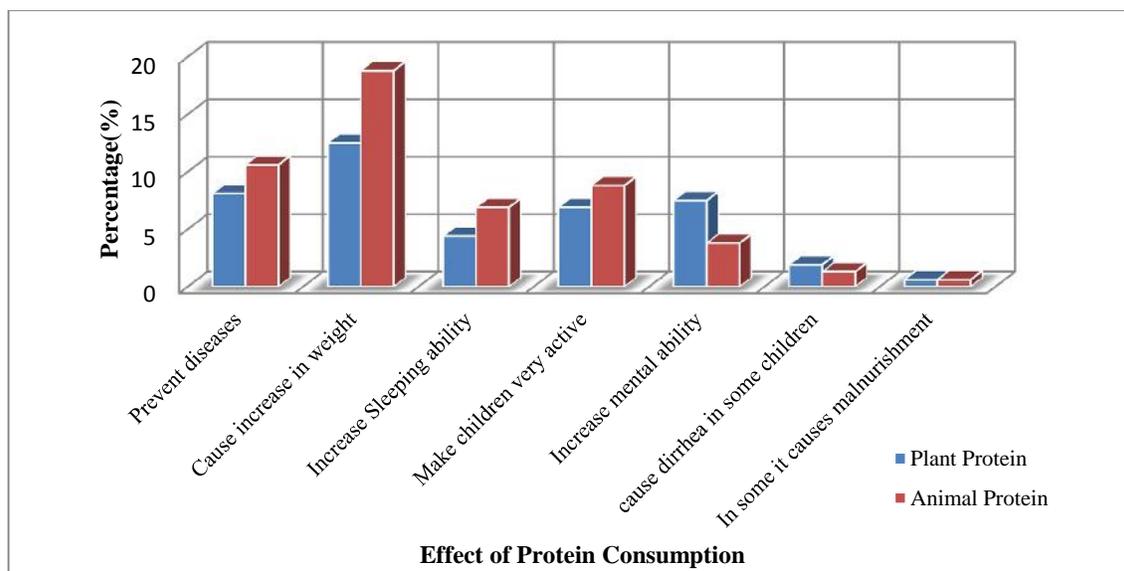


FIGURE 4: The Effect of plant and animal protein on Children in the study area

DISCUSSION

Socioeconomic characteristics of mothers

The study revealed that most of the mothers were within age range of 15 -20 years, indicating that most mothers within the study area are teenagers. This study in agreement of with the findings of Manga (2010) which showed that parenthood is the leading reason that teen girls drop out of school. She further espoused more than half of teen are mothers that never graduate from high school or neither go to college. Where teenage pregnancy and motherhood rate is high, semi-illiterate rate also increases. Such teenagers become more vulnerable in their societies. Also, women's age and parity are important factors that affect maternal depletion, especially in high fertility countries (Bistrrian, 2010). He further showed that a greater proportion of mothers age 15-19 and 40-49 that exhibit chronic energy deficiencies (CED). According to Teller and Yimar (2000) women in youngest age group (15-19) and women in the oldest age group surveyed (45-49) are the most affected by under nutrition. The study further showed that most of the mothers are single, indicating that these teenagers are also living as single parents. This is in contradicting the findings of (Sakkijha, *et al.*, 2010) which states that teen marriage is no longer unplanned as they happen in the past, but will occur only when a teen girl decides to have a child at such an early date. In fact, the problem for the society with teenage pregnancies is that teenagers are believed not to be ready emotionally and financially to raise their children even though they are indeed physiologically capable of producing offspring. Teenage girls who getting pregnant typically are involved in some form of school education and do depend on their parents and relatives at least to a certain degree. In most cases the father of the baby in teenage pregnancy is of similar age and thus is also financially and emotionally unprepared to raise a baby. Worst of all, most mothers living on low income are food and nutrition insecure. Such situation leads them to, malnutrition. If a pregnant woman is malnourished, her child may weigh less at birth and have a lower chance of

survival. Low birth weight babies are predisposed to many health and development problems. Malnutrition not only harms the body but leaves an imprint on the minds of those who survive it. Research has revealed that poor diet during early development (0-3yrs) leads to learning and memory deficits, lower IQ and school achievement, and behavioural problems in childhood and adolescence (Lui et al, 2004). Also, children living in poverty often battle with the added stress of material deprivation and unstable emotional lives, circumstances that leave them particularly at risk of malnutrition In addition, marital status of the women is associated with household headship and other social & economic status of the women that affects their nutritional status. Nutritional and social security's could be endangered by a negative change in marital status. A study on the SNNPR Region of Ethiopia showed that women's malnutrition is significantly associated with marital status indicating that compared to married women malnutrition is higher among unmarried rural and divorced/separated urban women compared to married ones (Teller and Yimar, 2000). The research also revealed that most of the mothers were illiterates and that those who were educated attained very low levels of educations. This is not in line with (Teller and Yimar, 2000) showed that the higher the level of education, the lower the proportion of undernourished women. Women who receive even a minimal education are generally more aware than those who have no education of how to utilize available resources for the improvement of their own nutritional status and that of their families. Education may enable women to make independent decisions, to be accepted by other household members, and to have greater access to household resources that are important to nutritional status (Costello, 2000). However, the relationship between parental education and dietary intake of pre-school children is a complicated one. More education is associated with greater awareness of children's needs and better child-care practices. Better educated parents are able to provide their children with a more nutritious diet at any income level because of their

increased knowledge. On the other hand, higher education may promote values detrimental to child health and nutrition. For example, it may lead women to work outside the home with a resulting drop in time spent on child care. This may lead to reduced breast-feeding and earlier weaning (Chaudhury, 1983). He further said when associated with improper use of bottled milk and inadequate feeding, the effects on health and nutrient intake of children can be extremely damaging. Data from another study also show that nutrient intake of pre-school children of working mothers is significantly lower than that of children of non-working mothers, holding other factors constant. In view of these counteracting effects of education on nutrient intake, the effect of parental education on nutrient intake of preschool children is difficult to predict. The study also indicated that most of the mothers have only one child, while still few have either two or four children. This is an indication that the family size of these mothers is reasonable. However, as most of these are teenage mothers, it still makes situation unbearable especially for those who have two or four children. Increased family size may adversely affect the nutritional status of every member of the household, including preschool children, because it may be associated with decreased per capita human inputs. In other words, the allocation of food per child is likely to decrease with the increase in the number of children, which, in turn, may adversely affect the nutritional status of children. Increased household size also implies acceptance of lower quality/quantity models of fertility decision. On the other hand, in some situations, as in the study area, family size may itself point to a less economic status of the household. In this case, larger family size may lead to worsening of nutrient intake of household members and children. One may also note economies of scale in nutrition because of more waste and the possibility to purchase in bulk associated with larger family size. It should be further pointed that the relative number of children in a household is the crucial factor influencing nutrient intake of children. In other words, the lower the dependency ratio, the higher the nutrient intake of children, especially pre-school children

Quantity and Quality of Protein intake of Mothers

From the study, it is revealed that most of the mothers used groundnut, cashew nut, and beans as their main sources of protein supply. This is in agreement with Marks *et al.* (2001) findings which stated that individual intake can be considered relatively stable, and change usually occurs relatively slowly. It also supports O'Neill *et al.*, 2010 findings that legumes are an important protein source as a substitute for animal proteins. Many aspects of the mother's health and lifestyle before pregnancy have been shown to affect her subsequent pregnancy with the potential to impact the health of her children, but one area of particular concern is the mother's weight before pregnancy. Mothers who is underweighted prior to becoming also puts her baby at higher risk for complications, mainly because of the association between underweight status and malnutrition (Burke *et al.*, 2010). The pattern of the changing food intake of children during the years of growth presents many interesting facets which merit further investigation. During infancy and

adolescence, when physical growth is most rapid, nutritional requirements are high and, in a child with good physical and psychological health, appetite increases and food intake becomes greater. Nutrients with intakes below recommendation in vegetarian diets are energy, protein, vitamin B12, Fe, Zn and foliate. In rural areas due to high intake of vegetables and fruits, vegetarian diets tend to contain higher folic acid and magnesium intakes than those of non-vegetarians (Sabate, 2001). Overall, the nutritional status of adolescent girls is critical given close associations that their growth status and reproductive health have with birth outcomes and child survival (Dennedy and Dunne, 2010). In fact, according to Dickerson (2011), malnutrition is highly prevalent in developing countries and is defined as failure to consume adequate energy, protein and micronutrients to meet basic bodily requirements for maintenance, growth and development. So the question here is whether the groundnut, cashew nut and beans that the mothers consume are adequate in the nutrients required for the development and growth and for the subsequence development of their children. It is also known that malnutrition is typically associated with low-income, linked to poverty, food insecurity, limited access to health care and exposure to unsanitary conditions. Nutritional status is an indication of the overall wellbeing of a population (Sylvia *et al.*, 2002; Demissie, Demissie *et al.*, 2003). It has been reported that lactation has different effects on maternal nutritional status depending on its duration, intensity, as well as cultural diversity. As a food, groundnut is one of the most concentrated products, since it is very high in calories due to its high fat and protein content. Groundnut flour is used as food in soup or stew, sauces, confectionaries, puddings, bakery products and in various other ways for human consumption (Adeyeye, 2010). Indigenous foods play an important role in the lives of rural populations. Therefore, the indigenous and traditional food systems of poor and rural communities need to be promoted in the search for solutions to the global problems of poverty, hunger and malnutrition (Faber & Wenhold, 2007). According to the authors, a decline in the use of indigenous foods results in nutritional deficiencies, especially among children in rural areas. The diets of most people in rural areas consist predominantly of plant-based staple foods, while indigenous fruit as well as other fruit, vegetables, including indigenous vegetables, and animal products are rarely consumed. The consumption of indigenous vegetables, fruits and legumes is the most sustainable way of reducing and controlling micronutrient deficiencies in resource-poor communities (Bistrián, 2011).

Legumes, also called dried beans are edible seeds that grow in pods. Beans contain a more complete set of amino acids than other plant-based food and they are high in iron, B vitamins and fiber. A good way to introduce beans to the diet is to replace the meat component in your favorite dishes, like casseroles, chili, curries, and adding beans to salad dishes. Examples are chickpeas or garbanzo beans, split peas, haricot, lentils (red, green or brown), kidney beans, lima beans, flageolet etc. In order for legume proteins to be a successful ingredient in foods, they must possess suitable functional properties, as well as having a

good protein quality and sensory characteristics (ACC/SCN, 2001). Protein is one of the important food components, essential to our body for maintaining fitness. Available protein from plant sources is minimal (except for soy bean) and they are relatively difficult to prepare into edible form without affecting the quality. Soy protein has been used for a long time in non-vegan foods (*e.g.* as meat extenders) to improve the functional properties and nutritional value of these foods. Interest in legumes that can act as a substitute for soy protein in foods has increased and one highly potential legume for this purpose is pea (O’Kane *et al.*, 2004). Accepting the fact that pea allergy is rare (Tounian *et al.*, 2011), studies also show that the functionality and protein quality of pea may be as good as those of soy protein (O’Kane *et al.*, 2004). Benni Seed, also known as Sesame (*Sesamum indicum* L.) is one of the most important oilseed crops worldwide, and has been cultivated in Korea since ancient times for use as a traditional health food. Sesame seeds are used in the making of tahin (sesame butter) and halva, and for the preparation of rolls, crackers, cakes and pastry products in commercial bakeries. Cashew nuts too are significant sources of iron (essential for red blood cell function and enzyme activity), magnesium (promotes energy release and bone growth), phosphorus (builds bones and teeth), zinc (essential to digestion and metabolism) and selenium (has important antioxidant properties, thus protecting the body from cancer). Cashew nuts also contain significant amounts of phytochemical with antioxidant properties that protects the body from cancer and heart disease. Cashews provide essential fatty acids, B vitamins, fibre, protein, carbohydrate potassium, iron, and zinc. Like other nuts, cashews are high in saturated fat; however, eaten in small quantities cashews are highly nutritious foods.

Animal Protein intakes

According to the study, mothers use various sources for their protein intake. This implies that mothers may have certain knowledge about nutrition requirement, and would therefore use specific skills to prepare these foods. This is in line with findings of Doig *et al.* (2008) which states that to attain good health and nutritional status, people need sufficient knowledge and skills to grow, purchase, process, prepare, eat and feed their families a variety of foods in the correct quantities and combinations. The most common sources of protein consumed by mothers in the study area consist of milk, egg, fish, chicken pig meat, goat meat pig meat, cow meat, and sheep meat. However, when the frequency of the consumption of these sources of protein is considered, fish and chicken dominate the consumption of all other animal proteins. Milk is but seldom taken in. Where adequate and sufficient nutrient intake is lacking in humans, it may lead to malnutrition (McNamara, 2002). Severe clinical malnutrition in early childhood, moderate and severe stunting, and underweight and iron-deficiency anaemia are associated with poor cognitive development, as well as poor behavior and academic attainment in later childhood. Poor nutrition and experience of hunger are inevitably associated with many other socio-economic disadvantages, which are likely to independently affect children's performance at school independently (Burke *et al.*, 2010). Milk is not only essential for the mothers, but also for the proper development and growth of the foetus and the child. They

provide essential proteins for cell growth. Animal protein intake helps the development of brains and other tissues of children and improvement of their health status. In fact, as growth and development starts from the womb, nutrition in prenatal period is really important because growth and development of the child depends upon the food taken by the mother. For good health status of mother and child it is important that mother takes proper diet during pregnancy. Foods rich in proteins are called body-building foods. Milk, meat, fish, eggs, pulses, oilseeds, nuts and low-fat oilseed flours are included in the group of bodybuilding foods. Foods rich in proteins, vitamins and minerals are termed protective foods. Milk, eggs, liver, green leafy vegetables and fruits are included in this group. Protective foods are broadly classified into two groups. (a) Foods rich in vitamins, minerals and proteins of high biological value, *e.g.*, milk, eggs and liver, and (b) foods rich in certain vitamins and minerals only, *e.g.*, green leafy vegetables and fruits (Sakkijha *et al.*, 2011). Deficiency of calcium in prenatal period affects not only the bone density of the mother herself but also that of new-born. Eggs are an excellent source of high quality proteins and have an ideal balance of amino acids. Also hen eggs are a rich source of linoleic acid, which is essential in human nutrition. Moreover, both egg white and egg yolk offer an excellent source of different individually or complexed protein components have a range of biological activities, including antimicrobial, antihypertensive, antioxidant, anti-adhesive and anticancer activities (Layman and Rodriguez, 2009). Egg proteins also contain a range of bioactive peptide sequences, which are encrypted within their primary structure.

Effect protein intake on Mothers

The study revealed that protein intake increased wellness, indicating that most of the women are in good health conditions as compared to other areas of the country. This finding substantiated Manga's (2010) work, which stated that most women in Yoni chieftdom were very healthy because of their high protein intake. Maternal nutrition during all the stages of gestation and lactation plays an important role in the control of type II diabetes risk. When mothers are well, they can easily engage in economic activities that lead to improving their lots. Since most of these mothers are teenagers, they can be very active in social activities, hence helping to improve the health of their children. Maternal malnutrition and over nutrition also increase the risk of obesity and chronic diseases in the offspring later in life (Taylor & Poston, 2007). The study also indicated that most mothers' bodies were nourished. This is a very good situation as maternal nutrition during pregnancy is an important intrauterine factor that results in persistent alteration of the offspring epigenome and associates with health outcome later in life. Usually, nourished bodies are signs of good living. As the mothers take in good diet, they put on more weight. However, the disadvantage of such increase in weight is that it may lead to obesity. When mothers have endurance, they can in most cases overwork themselves leading to tiredness, as a result of the weakness in the body systems. Therefore there is a high indication of mothers exhibiting good health and high standard of living.

Effect of Protein intake on Children

The study indicates that protein intake in the study area has prevented diseases. This is a very good sign of improved stand Doig *et al.*, 2011). It occurs when the body's need for energy and protein cannot be satisfied by the diet (Doig *et al.*, 2009). This leads to retarded growth, wasting, impaired mental development and in its severity death. Child malnutrition is also associated with lack of adequate, clean water, unsafe waste disposal systems and in hygienic environments, all of which are prevented in the study area. It is a very good idea that under nutrition which triggers an array of health problems in children, many of which can become chronic is not prevalent in the study area. This can also prevent extreme weight loss, stunted growth, weakened resistance to infections and even death among children. Children feed on adequate nutrition and balanced diet results in increase in weights. Such children become very active. Good nutrition intake also develops the brain making children very intelligent. Nevertheless, Dietary proteins differ in amino acid composition from the composition of body proteins. While proteins of animal origin provide all indispensable amino acids, most proteins of plant origin tend to be deficient in one or more of the indispensable amino acids. A mixture of dietary proteins with different amino acid patterns will usually compensate for the deficiencies in particular amino acids of single protein sources. Provided that the requirements for total nitrogen and indispensable amino acids are fulfilled, there is no particular need for the consumption of animal protein for normal growth and development of bone.

It is uncommon for well-nourished children to die from diarrhoea, therefore maintaining a good nutritional status can help with the improvement of child survival (Jackson *et al.*, 2006).

CONCLUSION

The vegetable/crop food items included Groundnut, Beans, Cashew nut, Bennie; and these form the core protein source crop-items in the Moyamba Township. The interpretation of Table (i) and the follow-up graph Figure (i) clearly shows that a reasonable proportion of these respondents did have access to groundnut as a good protein source. The idea that some people could not access it at all was revealed in their group discussion that they used palm oil as an alternative food ingredient since this is cheaper in cost to afford than groundnut seed. It is impressive to note that the Bean's consumption of beans was very encouraging. This might be due to its general availability of it in all the sections. Those who could not afford it revealed in their discussion group that they sold the little they had to augment their income for palm oil and imported ingredients such as Maggie-monosodium glutamate (MSG) – a common food additive. Cashew nut consumption is not at all encouraging. This can be attributed due to the high market demand and cost associated with it. Hence most farmers prefer to sell them and buy other cheap local food supplements. The consumption of Bennie is not generally encouraging. Like Cashew nut the high demand and cost make it scarcely affordable by the low income earners. The animal food items including animal milk, Butter (animal fat) – chicken

and eggs fish pig meat, goat meat, sheep meat, and cow meat were generally not popular amongst most respondents. Although they accepted in their group discussions that they reared these creatures in their farms, yet their own (the Mothers) livelihood was greatly sustained by these animal produce/products; as their market costs are so encouraging in providing finance for solving maintaining the socio-economic problems of their families, especially educating their children. From the summary, it can be that most of the mothers and their children have access to enough and varieties of protein sources, which have led to mother's wellness, as a result of the nourishment of their bodies, enabling them to endure greatly in most of their life pressing issues. Likewise, most diseases that easily affect children have been prevented among children, increased in weight and developed their mental ability. These children are not just very active, but also sleep enough for the development and growth of their tissues.

RECOMMENDATIONS

Considering the various cases presented above on crop products it is advisable that humanitarian organizations assist women in this township to own large vegetable farms which can provide enough yield for marketing and self-consumption. This can be done by organizing women into Agricultural Organizations with the capacity to own Farm Lands, Swamps and Boli-lands for maximized agricultural production throughout the year.

REFERENCES

- ACC/SCN (2001) What works? A review of the efficacy and effectiveness of nutrition interventions. In L. H. Allen, & S. R. Gillespie (Eds.), Geneva, WHO.
- Adeyeye, E. I. (2010) The chemical composition of liquid and solid endosperm of ripe coconut. *Oriental J. Chem.*, 20, 471-478.
- Alderman, S. L., Klaiman, J. M., Deck, C. A., & Gillis, T. E. (2012) Effect of cold acclimation on troponin I isoform expression in striated muscle of rainbow trout. *American Journal of Physiology-Regulatory, Integrative and Comparative Physiology*, 303(2), R168-R176.
- Bistrrian, B. R. (2010), Parenteral feeding and intensive insulin therapy. *Critical Care Medicine* 38(9):1922; author reply 1922–1923.
- Bistrrian, B.R. (2011) Is total Parenteral nutrition protective against hypoglycaemia during intense insulin therapy? A hypothesis. *Critical Care Medicine* (Published electronically February 10, 2011).
- Barker, D., Osmond, C., Frozen, T., Kajantie, E. and Eriksson, J. (2005) Trajectories of Growth among Children Who Have Coronary Events as Adults. *New England Journal of Medicine*. 353: 1802-1809.
- Barker, D.J., Larsen, G., Osmond, C., Thornburg, K.L., Kajantie, E., Eriksson, J.G. (2012) The placental origins of sudden cardiac death. *International Journal of Epidemiology*. Oct; 41(5):1394-1399.

- Boney, Verma, Tucker, Vohr (2005) Metabolic syndrome in childhood: association with birth weight, maternal obesity and gestational diabetes. *Pediatrics*; 115:290-6.
- Burke, P.A., Young, L.S. and Bistrain, B.R. (2010) Metabolic vs. nutrition support: A hypothesis. *Journal of Parenteral and Enteral Nutrition* 34 (5):546–548.
- Chatterjee, D.T. (1990) Low level of maternal education and the proximate determinants of childhood mortality: a little learning is not a dangerous thing. *Soc sci Med* 1990; 60:2011-23.
- Cho, J. and Trent, A. (2006) Validity in qualitative research revisited. *Qualitative Research*, 6(3), 319–340.
- Costello, A. (2000) Current state of the health of newborn infants in developing countries. in: A Costello, D Manandhar (Eds.) *Improving newborn infant health in developing countries*. Imperial College Press, London; 2000. Costello, A. Current state of the health of newborn infants in developing countries. in: A Costello, D Manandhar (Eds.) *Improving newborn infant health in developing countries*. Imperial College Press, London; 2000.
- Creswell, J.W. (2007), *Qualitative inquiry and research design: Choosing among !ve approaches* (2nd ed.). Thousand Oaks, CA: Sage. Thrived from: community.csusm.edu/.../Creswell_J.W._2007_-_Designing_a_Qualitative
- Demissie, T., Mekonen, Y., Haider, J. (2003) Agro-ecological comparison levels and correlate of nutritional status of women. *Ethiop J Health Dev* 2003; 17:189–196.
- Dennedy, M.C., Dunne, F. (2010) The Maternal and Fetal impacts of Obesity and Gestational Diabetes on Pregnancy Outcome. Best practice and research *Clinical Endocrinology and Metabolism* Aug; 24(4):573-89.
- Dickerson, R.N. (2011) Optimal caloric intake for critically ill patients: First, do no harm. *Nutrition in Clinical Practice* 26(1):48–54.
- Doig, G.S., Simpson, F., Finfer, S., Delaney, A., Davies, A. R., Mitchell, I. and Dobb, G. (2008) Effect of evidence-based feeding guidelines on mortality of critically ill adults: A cluster randomized controlled trial. *The Journal of the American Medical Association* 300(23):2731–2741.
- Doig, G.S., Heights, P.T., Simpson, F., Sweetman, E.A. and Davies, A. R. (2009) Early enteral nutrition, provided within 24 h of injury or intensive care unit admission, significantly reduces mortality in critically ill patients: A meta-analysis of randomised controlled trials. *Intensive Care Medicine* 35(12):2018–2027.
- Fray, J.M. (2005) Malnutrition in children under five in Zimbabwe: effect of socioeconomic factors and disease. *Soc. Biol.* 2005; 42(3-4):239-46.
- Gopalan, L.M. (2000) Role of micronutrients for physical growth and mental development; *Indian Journal of paediatrics* 2004; 71; 59-62.
- Katz, D.L., Evans, M.A., Nawaz, H., Njike, V.Y., Chan, W., Comerford, B.P. and Hoxley, M.L. (2005) “Egg consumption and endothelial function: a randomized controlled crossover trial”, *International Journal of Cardiology*, Vol.99, No.1, pp.65- 70.
- Kajantie, E., Osmond, C., Barker, D.J., Forsén, T., Phillips, D.I/, Eriksson, J.G. (2005) Size at birth as a predictor of mortality in adulthood: a follow-up of 350000 personyears. *International Journal of Epidemiology*. Jun; 34(3):655-63.
- Kim, C., Berger, D.K. & Chamany, S. (2007) Recurrence of gestational diabetes mellitus: a systematic review. *Diabetes Care*. May; 30(5):1314-9.
- Koletzko, B., Brands, B., Poston, L., Godfrey, K., Demmelmair, H. (2012) Early Nutrition Project and Early Nutrition Programming of long term health. *Proceedings of Nutrition Society*. Aug; 71(3):371-8.
- Koletzko, B., von Kries, R, Closa, R., Escibano, J., Scaglioni, S., Giovnni, M. (2009) low protein in fat formula is associated with lower weight up to age 2yr a randomized clinical trial *Am J cling nutrition* 2009 89 (6) 18 36-45.
- Layman, D.K. and Rodriguez, N.R. (2009) “Egg protein as a source of power, strength, and energy”, *Nutrition Today*, Vol.44, No.1, pp.1-6.
- Lui J., Raine A.D., Venables, P.H. and Mednick S.A. (2004) Malnutrition at Age 3 Years and Externalizing Behavior Problems at Ages 8, 11, and 17 Years. *American Journal of Psychiatry*. 161:2005–2013.
- Manga, E. (2010) Malnutrition Status of children in Yoni Chiefdom, Tonkolili District, Northern region of Sierra Leone.
- Marks GC, Webb K, Rutishauser IHE, Riley M. (2001) Monitoring Food Habits in the Australian Population Using Short Questions, Commonwealth of Australia, Canberra.
- McNamara, D.J. (2002) “Eggs and heart disease risk: perpetuating the misperception”, *American Journal of Clinical Nutrition*, Vol.75, No.2, pp.333-5.
- O'Neill, J.L., Keaveney, E.M., O'Connor, N., Cox, M., Regan, A., Shannon, E., Turner, M.J. (2011) Are Women in Early Pregnancy Following the National Pyramid Recommendations?. *Irish Medical Journal* Oct; 104 (9):270-2.
- Ota, Tobe, Mori, Farrar (2012) Antenatal dietary advice and supplementation to increase energy and protein intake. *Cochrane Database Systematic Review*. Sep 12;9

- Owens, L.A., O'Sullivan, E.P., Kirwan, B., Avalos, G., Gaffney, G., Dunne, F. (2010) ATLANTIC DIP: the impact of obesity on pregnancy outcome in glucose-tolerant women (2010) *Diabetes Care* Mar;33(3):577-9.
- Pollitt, E. (2001) The developmental and probabilistic nature of the functional consequences of iron- deficiency anaemia in children *J. Nutr.* 131: 669S-675S.
- Sabate J. (2001) *Vegetarian Nutrition*. CRC Press, Washington DC.
- Sakkijha, S.H. Kahoul, and Brits, R. (2011) Permissive underfeeding and intensive insulin therapy in critically ill patients: A randomized controlled trial. *American Journal of Clinical Nutrition* 93(3):569–577.
- Sebire, N.J., Jolly M., Harris, J.P., Wadsworth, J., Joffe, M., Beard, R.W., Regan, L., Robinson, S. (2012) Maternal obesity and pregnancy outcome: a study of 287,213 pregnancies in London. *International Journal Obesity Related Metabolism Disorders*. Aug; 25(8):1175-82.
- Seidman, I. (2006) *Interviewing as qualitative research: A guide for researchers in education and the social sciences*. New York, NY: Teachers College Press.
- Statistics Sierra Leone (2004) *Household Population Census of Sierra Leone*.
- Sylvia, B., Mary Dowd, S. (2002) *The Nursing Mother's Diet. The art of successful breastfeeding: A Mother's Guide*
- Symonds, Pope, Sharkey, Budge (2012) Adipose tissue and fetal programming. *Diabetologia*. 55:1597-1606.
- Taylor, P.D., Poston, L. (2007) Developmental Programming of Obesity in Mammals. *ExpPhysiology* 92(2):287-298.
- Thompson, J.M., Wall, C., Becroft, D.M., Robinson, E., Wild, C.J., Mitchell, E.A. (2010) Maternal dietary patterns in pregnancy and the association with small-for gestational-age infants. *British Journal of Nutrition*. 103(11):1665-73.
- Tounian, P. (2011) Programming towards childhood obesity. *Annals of Nutritional Metabolism*. 58, Suppl. 2, 30-41.
- Walsh, J.M., McGowan, C.A., Mahony, R., Foley, M.E., McAuliffe, F.M. (2012) Low glycaemic index diet in pregnancy to prevent macrosomia (ROLO study): randomised control trial. *British Medical Journal*. Aug 30; 345
- Zeisel, S.H. (2009) Is maternal diet supplementation beneficial? Optimal development of infant depends on mother's diet. *American Journal Clinical Nutrition*. Feb; 89(2):685S-7S.