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Relationships between a Prenatal Nutrition Education Intervention and Maternal Nutrition in Ethiopia

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Abstract

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Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

Public Policy and Administration

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Abstract

In Ethiopia, 17% of pregnant women ages 18-49 are malnourished and have low awareness of prenatal nutrition, which may relate to increasingly high rates of maternal and infant mortality. The purpose of this mixed methods research study was to determine the effects of a community-based prenatal nutrition education intervention program on maternal nutrition knowledge and attitudes in the Alaje district of Ethiopia. The theoretical framework was Sen's capability theory of poverty, in which opportunities can lead to well-being and promote economic development. Research questions focused on the relationships among 8 independent variables—age, income source, degree of program implementation, marital status, education, number of pregnancies, number of children, and occupation—with respect to maternal nutrition knowledge and attitudes. Health workers recruited 135 pregnant and non-pregnant women in each of 2 villages: Dejen (control village) and Takha (experimental village), totaling 270 participants. The community intervention program was an add-on to the Ethiopian government's nutrition program and provided information on portion sizes, the importance of eating an extra meal each day, and obtaining adequate rest during pregnancy. Data from customized pretest and posttest focus groups and surveys were collected. Focus groups were analyzed manually and surveys were analyzed using 1-way ANOVAs and descriptive statistical analyses. The key findings were that the women in Takha had significantly greater knowledge of the importance of prenatal health requirements. The implications for positive social change include recommendations for policy makers about proper dietary practices in order to improve pregnancy outcomes related to maternal malnutrition.

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Dedication

I dedicate this work to several individuals. This includes my dissertation chair, Dr. Kevin Fandl and Dr. Patricia Ripoll, my former professor, who is also on my dissertation committee. In Ethiopia, at Mekelle University, I wish to extend my sincere thanks and dedication to my mentor/advisor, Dr. Usha Kulkarni. Over the course of more than three years, until our first meeting in September 2013, Dr. Kulkarni had provided valuable support as a close friend and mentor. She has guided me with tremendous emotional and spiritual support throughout the course of my dissertation research.

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Chapter 1: Introduction to the Study

Introduction

Ethiopia is currently ranked overall as the sixth poorest nation in the world and faces multiple developmental challenges (World Bank [WB], 2012b). The problem of inadequate maternal nutrition, including prenatal nutrition throughout Ethiopia, is among the highest in the world at 17% among all mothers (Save the Children [StC], 2012). Poor prenatal and maternal nutrition can be related to serious pregnancy complications, including maternal mortality (WB, 2012a).

The fifth Millennium Development Goal (MDG) was created by the United Nations (UN) to address safe motherhood (WB, 2012a). While progress has been made to meet the fifth MDG, adequate nutrition during pregnancy is needed to ensure the optimal survival of the mother and infant in delivery (WB, 2012a). If an expectant woman is malnourished during pregnancy, she may give birth to an infant who is also undernourished (StC, 2012). For this reason, adequate nutrition throughout pregnancy is needed (Klein, 1995).

Ethiopia is one of the world's oldest civilizations (Gish, Thay, & Latif, 2007). The oldest human remains of a skeleton was found in the remote Afar desert of northern Ethiopia, dated at 3.2 million years old (Shreeve, 2009). Among the first dynasties to rule Ethiopia was the Axumite Empire, from the 1st century CE in ancient Ethiopia. When the rule of Axum declined in power during the Middle Ages, the Zagwe dynasty promoted cultural and artistic milestones (Gish et al., 2007). Throughout the 14th and 17th centuries,

Ethiopia and Liberia were the only two African nations that were able to successfully resist and fight off attempted colonization from France, Britain, and Portugal.

The 18th and the 19th centuries brought periods of decentralization and a civil war throughout Ethiopia (Encyclopedia of the Nations, 2012), which led to civil and religious strife. In 1889, Emperor Menelik II was crowned king and has been credited for uniting Ethiopia with distinct borders, in the creation of a modern nation. Emperor Selassie, the last emperor, ruled Ethiopia from 1930-1974 and accomplished a number of progressive reforms in women's rights, education, economic development, and Westernization of Ethiopian society (Gish et al., 2007). After Selassie was deposed in 1974, Ethiopia went through a dark period of turmoil and instability under a communist government and military rule until democratic elections were finally held in 1991 (Gish et al., 2007). Today, Ethiopia has successfully maintained its stability as a democratic nation with numerous ethnic groups and tribes (Gish et al., 2007).

Despite advancements under Emperor Selassie's rule, the numerous periods of turmoil throughout Ethiopian history have affected the health of women and girls. The people of Ethiopia went through difficult times of drought, famine, and civil war after Selassie's deposal (Carillet, Butler, Lukas, & Starnes, 2009). Today, despite the ability to maintain a relatively stable political climate, Ethiopia is still considered a developing nation. Ethiopia is now lead by Prime Minister Hailemariam Desalegn, who replaced long-time ruler, Meles Zenawi in 2012 (Ayicheh, 2012).

In the 21st century, over 80% of the Ethiopian population resides in rural areas (United Nations Population Fund [UNPF], 2013). The Ethiopian government has

maintained a lukewarm relationship with its neighbors, Kenya, Somalia, Sudan, and Eritrea (Carillet et al., 2009). A 2-year border war was fought with Eritrea, from 1998-2000.

Human rights abuses are also common throughout Ethiopia, and sporadic incidents of terrorism have also occurred (Human Rights Report, 2011). Internal displacement from the Ethiopian-Eritrean war has also created more problems for women and girls in the northeastern part of the country. As Ethiopia is a patriarchal society, where men and boys are favored over women and girls, the health of women and girls has been neglected over the decades (Carillet et al., 2009).

Ethiopia is a rapidly changing society and has become a hub for foreign investment and aid (Van de Wolfe, 2012). There is prominent economic growth; but, much work is still needed (Van de Wolfe, 2012). Rural women in Ethiopia still have to fight for recognition with regards to equality and better health. If the society continues to fight against discrimination and prejudice, the chances of reducing a serious problem such as poor maternal nutrition will be much higher (Carillet et al., 2009). In Ethiopian culture, women are considered to be subordinate to men (Pathfinder International, 2007). Since the start of the 21st century, there have been many initiatives made by non governmental organizations, private organizations, and government agencies to increase educational opportunities and medical care provided to women (Bertini, 2012). In terms of positive social change, the lives of Ethiopian rural women can be dramatically improved with the introduction of prenatal nutrition knowledge, which can fight serious complications of pregnancy (Bertini, 2012).

Background of the Problem

Poor maternal nutritional knowledge and attitudes pose risks to pregnant women in rural Ethiopia. As Ethiopian society is fairly conservative, a woman's honor and reputation can be deeply affected, especially if she is unwed and pregnant (Gender Inequality and Women's Empowerment [GIWE], 2008). Rape and sexual assault are also common causes of out-of-wedlock pregnancies. Marital rapes by husbands also occur. Many women do not seek medical or prenatal care due to the fear of shame, discrimination, and being ostracized from their villages (GIWE, 2008).

Complications can arise during pregnancy, especially when no medical attention is available; many women are forced to deliver their babies in unsanitary and isolated conditions, without proper care or medical equipment. The nutritional status of the pregnant woman or young girl can also be worse with no availability of prenatal care (GIWE, 2008). Adverse medical conditions during pregnancy can be reduced if pregnant women are given more opportunities to learn about prenatal nutrition.

The Ethiopian Constitution has emphasized gender equality, which theoretically guarantees equal rights on property, employment, and health care, including a safe pregnancy (Government of Ethiopia, 2012). However, the law is often flouted and completely disregarded (World Intellectual Property Organization, 2012). The intergenerational cycle of malnutrition, defined as poor dietary intake from disease, poverty and cultural factors, has also affected pregnant women and girls (United Nations International Children's Emergency Fund [UNICEF], 2013a). Due to malnutrition, the

health of a pregnant woman is greatly reduced and impacted from poor nutrition (Klein, 1995).

In this qualitatively weighted and sequential (QUAL→quan) mixed method true experiment (with matching control group) research study, I investigated the nature of the relationship between eight independent variables under two conditions. Pregnant and non pregnant women in the intervention village and the control village were both offered the basic national standard of prenatal education, while the intervention village sample was offered additional nutritional assistance including an extra meal a day and adequate rest. The two dependent variables were maternal nutrition knowledge, as measured by basic nutrients, portion sizes and eating one extra meal per day and maternal nutrition attitudes, as defined by economic empowerment and adequate rest. The eight independent variables, which were defined as age of the participants in years, who are pregnant and non pregnant, occupation, education (primary and secondary levels), source of income, marital status (single, widowed, married, separated, divorced), number of children (1 or more already born and not within gestation), number of pregnancies (1 or more and includes first time pregnancies), and the implementation of the prenatal nutrition education program, during a preexisting 5-month intervention consisting of teaching the concepts of portion sizes, adequate rest and one extra meal per day for pregnant and non pregnant women (ages 18-49) in the Alaje region of rural Ethiopia. An unborn child that develops 8 weeks after conception until birth is known as a fetus (Sizer & Whitney, 2008).

A pregnant woman, especially in rural areas, needs to understand the critical nature of proper prenatal nutrition. The pregnant woman must remember that she is not only eating for herself, but also for her unborn child (Klein, 1995). Pregnant women are expected to gain a significant amount of weight throughout the whole course of the pregnancy. A woman of normal weight prior to pregnancy is expected to gain about 25-35 pounds (Blake, 2012). If the pregnant woman is underweight, she should gain about 35-40 pounds throughout the pregnancy (Blake, 2012). Without significant weight gain, the pregnant woman and the unborn infant can suffer from problems such as iron-deficiency anemia (Klein, 1995).

Several complications of childbirth can be counteracted by eating wholesome, nutritious and appropriately cooked food (Rolfes, Pinna, & Whitney, 2009). A pregnant woman must also consume at least three servings of protein, seven servings of carbohydrates, and five or more servings of fruits and vegetables per day (Blake, 2012). Serving sizes are defined from the guidelines of each type of food from the MyPlate tool (United States Department of Agriculture [USDA], 2015). Fats and lipids should be taken in small quantities, as they are most often found in cooking oil, butter, protein, and dairy foods (Blake, 2012). The expectant mother should also drink several glasses of clean water per day (Blake, 2012). During the daytime, a pregnant woman should stop her work and rest every 1-2 hours to regain her energy (Klein, 1995).

A less than optimal weight gain of a pregnant woman can also have a lasting impact on future pregnancies (Kulkarni, 2012). Even if a malnourished pregnant woman survives childbirth, her children are likely to experience growth failure from infrequent

feeding and intake of poor quality foods (Kulkarni, 2012). When adolescent girls or adult women become pregnant, the nutritional neglect experienced can be exaggerated and prolonged (Kulkarni, 2012). The high rate of infections from malnutrition is not only related to the pregnant mother's immune system, but also to the gestational duration in weeks, due to the prevalence of premature babies, stillbirths or high rates of miscarriages (Kulkarni, 2012). A full term pregnancy is typically 38-40 weeks from the date of last menstrual cycle.

In rural areas, a woman or girl's health can become severely compromised towards basic development and reproductivity (Kulkarni, 2012). A pregnant woman either married or unmarried, in a rural area may find it very difficult to get proper prenatal care at a health facility (Ethiopia Demographic and Health Survey, 2011). Health facilities in Ethiopia usually consist of hospitals, health centers, or health posts in both rural and urban areas. Some of the common reasons for not seeking prenatal care are distance, lack of family support, or being in poor health altogether (World Health Organization [WHO], 2006). Shame is also a factor in not seeking prenatal care if the woman is pregnant by rape, incest, or out of wedlock (GIWE, 2008). From the widespread scope of literature available, the current existing empirical and theoretical gap in the literature, with this quantitatively weighted mixed methods study, is very broad on the problems of maternal nutritional status related to the lack of prenatal nutritional knowledge and poor attitudes within rural Ethiopia.

With a diverse cuisine and an abundance of spices, Ethiopian cuisine represents all the major food groups – meat, nuts, dairy, fruits, vegetables, and grains. A pregnant

woman in Ethiopia can acquire all the necessary nourishment her body and growing baby needs throughout pregnancy (Sheen, 2008). Traditional Ethiopian cuisine is versatile and contains the basic nutrients of protein, carbohydrates, vitamins, minerals, and fat (Sheen, 2008). Injera is the soft pancake made from the flour called teff. Stews or wot and vegetables are typically served on top of injera and eaten with fingers (Sheen, 2008). Injera can also be made from flour derived from other crops such as sorghum, wheat, and barley (Mulugeta, 2013). The teff flour is rich in nutrients, and contains an abundance of dietary fiber, protein and calcium (Sheen, 2008). Teff also contains modest amounts of iron, magnesium, phosphorous, zinc, and thiamin (Sheen, 2008). Wot is accompanied with a special sauce that contains berbere, a type of sauce that can be made from hot chili peppers, oil, tomatoes, onion, salt, spices, legumes. Berbere can also be made from animal products such as beef, chicken and fish with considerable amounts of iron and protein (Sheen, 2008). The Ethiopian Orthodox Church dictates that there are occasions during the year that worshippers should not take any type of meat products (The Spiritual Life, 2013). Meat or dairy products cannot be eaten on Wednesdays and Fridays except for the 50 days between Easter and Pentecost, the Fast of Holy Virgin Mary, the Fast of Nineveh, the Fast of the Apostles and the Fast of the Prophets (Ethiopian Heritage Society of North America, 2013).

On the dairy side, ayib (homemade cheese) and irgo (homemade yogurt) are side dishes frequently eaten with entrees (Sheen, 2008). Vegetable protein can be obtained from beans, peanuts, and lentils (Sheen, 2008). Vegetables such as spinach, bell peppers, tomatoes, onions, garlic, and eggplants are commonly cooked or served with injera and

contain several vitamins and minerals (Sheen, 2008). Starchy vegetables such as yams and potatoes are commonly eaten (Sheen, 2008). Some factors where Ethiopian pregnant women cannot acquire even the most basic food staples are poverty and food insecurity (Feed the Future [FtF], 2012).

Despite the diversity of cuisine, obtaining adequate nutrition is often difficult. Ethiopia is the sixth poorest nation on the planet (FtF, 2012). Approximately 38% of the total Ethiopian population is unemployed and 85% of the labor force depends primarily on agriculture as a livelihood for work and food (FtF, 2012). Around 12 million Ethiopians (13% of the population) are afflicted with food insecurity and chronic problems with malnutrition, which includes pregnant women (FtF, 2012).

Statement of the Problem

The research problem addressed in this study is the lack of adequate prenatal maternal nutrition knowledge and maternal nutrition attitudes, which have contributed towards pregnant women's frequent illness, maternal mortality, and poor birth outcomes (FtF, 2012). Within Ethiopia, while there has been progress in increasing maternal nutrition, 17% of Ethiopian women still suffer from poor nutrition during pregnancy. The government of Ethiopia has enacted the Growth and Transformation Program (Ethiopian Agricultural Transformation Agency, 2014), National Nutrition Program (Government of Ethiopia, 2013) and Health Development Army (All Africa, 2012) programs to achieve the fifth MDG. In promoting maternal nutrition, a nutrition education program can be designed as an intervention. In this study, a preexisting prenatal nutrition education program was used. Limited economic development opportunities, extreme poverty, and

food insecurity have also been blamed for the lack of education on prenatal nutrition (Sen, 1999).

With the gap in services for pregnant women and girls, it is vital not only to provide food and prenatal nutritional education, but also to invest in vocational skills to break the cycle of poverty. Once a pregnant woman is able to earn an independent living, she can have greater access to prenatal services, including prenatal nutrition education. In choosing the region of Tigray as a case study, focusing on both qualitative and then quantitative methodologies, the outcome of this research demonstrates the importance of prenatal nutrition education upon Ethiopian women's understandings on adequate nutrition during pregnancy (and nursing), for both the mother and the infant.

Nature of the Study

In order to reach out to the affected community of pregnant young women and girls in the rural Tigray region, I chose a true experimental research design. Both the control and the intervention villages were given the standard Ethiopian Governmental Program on prenatal nutrition education. I provided the pregnant and non pregnant women in the sample intervention village (n = 135) education on adequate rest, portion sizes, and the notion of an extra meal per day. The qualitative portion of this (QUAL→ quan) experimental research study deductively determined the nature of the relationship between a prenatal nutrition educational program and education (the major independent variables) and maternal nutritional knowledge and maternal nutrition attitudes (the two dependent variables) for pregnant and non pregnant women.

With this concept, the eight independent variables were the degree of implementation of the supplemental prenatal nutrition education program (for the intervention group only), age (18-49), education (illiterate, some primary education, completion of primary education, some secondary education, or completion of secondary education), household income, marital status (single, widowed, married, separated, or divorced), number of pregnancies (includes first time pregnancies, one or more), number of children (one or more already born and not within gestation), and occupation. All of these independent variables, including the degree of implementation of the prenatal nutrition program, were measured from the selection of participants in the control village (Dejen, $n = 135$) and the intervention village (Takha, $n = 135$). However, the two main independent variables, the degree of implementation of the prenatal nutrition education program and education, were assessed by comparing the percentages of knowledge and attitudes from the pretesting and posttesting phases.

Variables

The two dependent variables were maternal nutritional knowledge and maternal nutrition attitudes, as measured by a customized pretest and posttest survey questionnaire (34 questions) based upon the attitudes towards food, knowledge about prenatal nutrition and cultural practices. Creswell and Clark (2011) suggested that the qualitative and quantitative research questions must be honed towards the key variables needed for testing. Within the context of this weighted sequential (QUAL → quan) mixed method research study, I chose to measure maternal nutritional knowledge and maternal nutrition attitudes and emphasized more on the qualitative aspect. There were three research

questions, two qualitative and one quantitative question. For the quantitative question, a null and alternate hypothesis was also included.

Qualitative Research Questions

1. What are some of the key behaviors concerning maternal nutritional knowledge and maternal nutrition attitudes on food and cultural practices concerning prenatal nutrition education from the combined interventions of the government maternal nutrition program and the additional program in the rural Ethiopian intervention village of Takha in the Alaje district?
2. What are some of the key perceived factors that might impact the maternal nutrition knowledge and maternal nutrition attitudes of a pregnant woman in the rural Ethiopian villages of Takha and Dejen in the Alaje district?

The villages were randomly selected for intervention status. The samples were matched by demographics via age, pregnancy status and children as closely as possible. The confirmation of these selected villages underwent ethical clearance from the Regional Health Bureau in Tigray district. The ethical clearance from the Health Research Ethics Review Committee (HRERC) of the College of Health Sciences, Mekelle University (equivalent to the Institutional Research Board of Walden University) was obtained after the dissertation proposal was submitted to the Ethics Review Committee in January 2014 (HRERC#: 0309/2014). After the ethical clearance letter was given to Walden IRB, the Walden University approval number given was 06-03-14-0168078 in June 2014.

The qualitative portion of the sequential (QUAL → quan) mixed method traditional experimental (with a matching control group) research study focused on observations and five focus group questions with 28 women in both Takha and Dejen villages (n = 14 women in each focus group). The 28 women were recruited by the health workers in Takha and Dejen and were randomly selected by me according to age and if they were currently or already had been pregnant. Fifty-seven percent of the focus group participants were pregnant in the pretesting phase, but only 50% of the focus groups participants were pregnant in the posttesting phase. The focus groups and survey questionnaires were used as guidelines to obtain the participants' perceptions on prenatal nutrition and maternal nutrition status (Creswell & Clark, 2011). The majority of this research study was qualitative and consisted of observations and focus groups with the participants, while the quantitative section contained survey questionnaires combined with a cross-sectional exploratory study. I provide more details about the research methodology in Chapter 3.

Quantitative Research Question and Hypotheses

What is the nature of the relationship among the eight independent variables: the degree of implementation of supplemental prenatal nutrition education program (as measured in hours of engaged attendance and active participation), age (18-49 years), education (no education, primary education, secondary education, college education), source of income, marital status (single, married, widowed, separated or divorced), number of pregnancies (includes first time pregnancies, one or

more), number of children (one or more already born and not within gestation), and occupation?

The dependent variables were maternal nutrition knowledge, as defined by basic nutrients, portion sizes, and one extra meal per day and maternal nutrition attitudes, as defined by the woman's perception of adequate rest and economic empowerment.

$H_0$1*:* There is no statistically significant relationship among the two dependent variables and the eight independent variables in two Ethiopian villages in the rural Tigray region. The two selected villages were Dejen and Takha, based in the Alaje district of Ethiopia. Dejen (Village 1) served as the control group and Takha (Village 2) served as the intervention group.

H_A1: There is a statistically significant and positive relationship among the two dependent and eight independent variables.

The findings from the two qualitative research questions were used to inform the design of the quantitative research question. The quantitative data were collected through 34 pretest and posttest survey questions (each) to assess each of the dependent and independent variables, and used the five point Likert scale format (from 1 = *strongly agree* to 5 = *strongly disagree*).

Purpose of the Study

The purpose of this qualitatively weighted and sequential (QUAL→ quan) mixed method true experimental (with a matching sample control group) research study was to determine the nature of the relationship among the eight independent variables as detailed and described above.

Theoretical Framework: Economic Development

A low awareness on the importance prenatal nutrition is often related to the lack of economic opportunities. Rural Ethiopian women and girls in the Tigray region are often very poor and have limited income to support themselves, let alone their families and/or unborn children. In the exploration of theoretical concepts, the most applicable theory was the economic development theory, in which a pregnant woman who has low socioeconomic status is likely to be in poorer health (Sen, 1999). Poor health is also related to the inability to obtain prenatal care (Sen, 1999).

The works and approaches of eminent developmental economists, Szirmai (1997, 2005), Sen (1981, 1983, 1999), Sachs (1993, 2005), Collier (2007), Yunus (2007), Banerjee (2011), Easterly (2006), Polak (2008), Thirlwall (2006, 2011), and Meier (2005) were explored. From the perspective of development economics, human capital and the screening theories were addressed by Szirmai (1997). Sen's (1983) theory of poverty and Sachs's global economics theory (2005) were both used as a framework for study. Easterly (2011) and Collier upheld the principles of self-reliance for women and rural economic development. Yunus championed microcredit programs for rural poor women. Thirlwall (2006) and Meier found strong relationships between prenatal nutrition education, maternal nutrition status, and economic opportunity. Economic opportunity indicated that if a woman is employed, she can improve her nutrition status and have greater access to prenatal nutrition education through her income and independence. The relationship of the economic development theories to prenatal nutrition education was investigated throughout this research study.

Definition of Terms

Economic development: The topic that is related towards increasing the quality of life and welfare of a community or individual through various policies based on economic health. Human capital, safety, education/literacy, health, infrastructure, competition, environmental issues, and sustainability are among several branches where economic development theory can be applied (Sen, 1983).

Maternal nutritional attitudes: The current perceptions concerning preference or dislike concerning practices in nutrition during pregnancy or breastfeeding on maternal nutrition issues (Daba, Beyane, Fekadu, & Garoma, 2013). Maternal nutritional attitudes are defined by economic empowerment and adequate rest per day.

Maternal nutritional knowledge: The facts and information about nutrition that a pregnant or breastfeeding mother may know pertaining to her health and the health of her child (Daba et al., 2013). Maternal nutritional knowledge is defined by knowledge of the basic nutrients, portion sizes, and one extra meal per day.

Prenatal nutrition intervention: An educational program to explain the science and metabolism of food, nutrients and minerals that can affect the health of the mother and fetus during pregnancy (Samour & King, 2012). The supplemental intervention program consisted of Ethiopian government intervention and my own intervention concerning the promotion of portion sizes, adequate rest, and one extra meal per day.

Significance of Study

I explored the nature of the relationship among an enhanced educational prenatal nutrition program (the intervention), along with the eight independent variables and two

dependent variables, maternal nutrition knowledge and attitudes. In administering a prenatal nutrition education program, based upon on my experiences in teaching prenatal nutrition, I hypothesized that the promotion of better nutrition would enable rural women to empower themselves to prevent pregnancy complications. If the individual, community, and society recognize that poor nutritional knowledge and attitudes are a serious problem at all levels, it can be drastically reduced (Lassi, Haidar, & Bhutta, 2010). On the subject of positive social change, the knowledge of prenatal nutrition education can facilitate saving lives of Ethiopian village pregnant and non pregnant women, infants, and young children.

Assumptions

I made four major assumptions throughout the research study. In choosing participants for this proposed study, a large sample size of 270 pregnant and non pregnant females in rural Ethiopia was appropriate according to Mekelle University standards for PhD students. My second assumption was that extremely few strong prenatal nutrition education programs exist for pregnant women in the rural Tigray region. My third assumption was that I would encounter a language barrier, since I cannot speak the main language of the Tigray region, Tigrinya. My fourth and final assumption was cultural shocks and difficulty of adaptation in working as a doctoral student in Ethiopia, such as dealing with perceptions of a foreigner.

From the contacts at Mekelle University, there are many districts around Mekelle, which consists of several villages. The average female in Tigray region is likely to be poor and have little or no education. With the poor nutritional status quite high in the

Tigray region among women (UNDP, 2012), prenatal nutrition programs are often not considered a priority. The language barrier was overcome by using translators from Mekelle University who are bilingual in Tigrinya and English. The translators were graduating master's degree students. To mitigate the problems of cultural shocks, I journeyed to Ethiopia for the first time in September 2013 for engaging in preliminary research where I had the opportunity to interact with rural female villagers who are pregnant. This helped me to gain more understanding of Ethiopian culture as well.

Limitations

There were threats that were addressed with regards to reliability, external, and internal validity. With regards to external validity, the first two critical threats were the interaction between selection and treatment and the interaction of history and treatment (Creswell, 2009). In the case of the threats between selection and treatment, I would not be able to make generalizations on individuals who have different characteristics than the participants. With the threats between history and treatment, again, generalizations cannot be made for either past or future occurrences or situations (Creswell, 2009).

With the first problem on selection and treatment interaction, the two villages in the Tigray region could have been located relatively close, where villagers from both villages could communicate and interact, resulting in contamination of the data. To reduce the problems with external validity, there was a significant distance between the selected villages to prevent the participants from communicating with one another. The second problem between the history and treatment intervention can be addressed when

the research study has to be repeated at another time to generate more accurate results (Creswell, 2009).

With internal validity threats, there are six major problems for the traditional experimental research design: mortality, selection, testing, maturation, history, regression, and compensatory demoralization. Mortality can result when the participants drop out of the proposed research study for any reason due to illness, personal problem(s), lack of interest, or other reasons. With selection, each participant had different demographic characteristics, such as educational background or maturity characteristics, which could influence the results (Creswell, 2009). With regards to testing, the participants can remember the answers from the pretest questions; this can negatively impact the answers for the posttest questions and the overall outcome of the scores. With maturation, the participant can mature in age as time progresses and also negatively impacting the results (Creswell, 2009).

With history, the number of unexpected occurrences or events can cause negative influences on the outcome of the intervention, especially when time passes. These include, but may not be limited to, financial, health, social, or personal difficulties experienced by the participants (Creswell, 2009). Regression can occur when the extreme scores from surveys are selected to undergo the treatment program. The scores from the surveys could be too high or too low. Finally, with regards to compensatory demoralization, resentment can arise from the control village for not receiving the same treatment (Creswell, 2009).

In describing solutions for internal validity threats, a sizeable total population of 270 participants can help to allay problems of mortality (Creswell, 2009). Having a variety of different participants from the selected two villages can help to counteract selection as well. To remedy this situation, the posttest situation was completed 5 months after the intervention was started, and immediately after it ended. With approval from Mekelle University's IRB department in January 2014 (along with Walden University IRB's acknowledgment of Mekelle University's IRB agreement), the actual enhanced intervention took place from May-September 2014, a total of 5 months, the same duration as the government only plan (Creswell, 2009). From the beginning, the control and intervention participants were instructed not to talk to one another or non participants about the research study. With regards to maturation, any participant who had crossed over the age of 49 after 5 months was removed in the posttest phase and replaced with another participant between 18 - 49 years old (Creswell, 2009).

The final three internal validity threats, history, regression, and compensatory demoralization are also credible threats within the proposed research study. However, this was remedied by allowing the experimental village and the control village to have the government nutrition program implemented during the implementation phase. The experimental village was given a small additional component with the existing government intervention, where three aspects were included: adequate rest, portion sizes, and one extra additional meal per day. While the nutritional value of the extra meal was not recorded, pregnant and non pregnant women were taught to have one extra meal per day during the enhanced prenatal nutrition educational intervention.

The three major threats to reliability in a traditional experimental research design are error(s) from the researcher, environmental changes, and participant changes. Human error can occur on my part in terms of measurement from the instruments and data entry. Within the environment, unexpected changes may occur with the day, time, temperature, light or weather. This can create error within reliability. The last threat was based on the participants. Inattention, lack of focus, hunger, tiredness, or other types of mental stress could cause additional error. To compensate for all three of these changes, I was as accurate and consistent as possible on the measurements and kept the instruments updated. The same conditions for both the environment and participant were followed throughout the course of the research study. The participants were respected at all times and also treated with great courtesy to obtain accurate information by me and the rest of my research team.

Delimitations

The distance between two villages may have helped to remove the diffusion of treatment threat, since the knowledge of the prenatal nutrition education program could influence the control negatively during the project (Teddlie & Tashakkori, 2011). Takha and Dejen are 25 miles from one another; Dejen is located in a very mountainous and remote area that is accessible only by a four-wheel drive vehicle. Takha is about 20 minutes by car from the nearest town of Adishuhu. The delimitations to the research study included all 270 participants who were able to answer the qualitative and quantitative research questions. The intervention participants in Takha were involved with the treatment program, where they learned about prenatal nutrition both from an

adolescent and adult perspective. The treatment program was delivered in an informal manner that allowed all women and girls to share their experiences and discover ways to understand prenatal nutrition. I had believed that the treatment program would also build confidence in the participants. The participants were also given the opportunity to share their views about nutrition (Teddlie & Tashakkori, 2011).

Summary

Takha was the enhanced intervention group and Dejen was the control group, two villages selected for this research study in the rural Alaje district of the Tigray region. Ethiopia was an ideal place to study the lack of prenatal nutrition awareness among pregnant and non pregnant women villagers. The age range selected for the study was from 18 - 49 years old. In Chapter 2, I provide an extensive review of literature related to rates of maternal nutrition, while in Chapter 3, I present an explanation of the research methodology. In Chapter 4, I compute the analyses and results and in Chapter 5, I also provide the discussion and conclusion of this study.

Chapter 2: Literature Review

Introduction

The literature review is composed of selected articles that reflect the scope of research of the study concerning prenatal nutritional status. It is divided into sections about the lack of prenatal nutrition, maternal nutrition, economic development, and the importance of prenatal nutrition education during pregnancy. The literature review consists of references and resources that have generally supported prenatal nutrition in reducing complications during pregnancy. The databases used were ProQuest Central, ProQuest Health and Medical Complete, PubMed, SAGE Premier, and Dissertations & Theses. The literature review resources were selected according to relevance to the topic, particularly on studies in the developing world. The keywords used were *prenatal nutrition education*, *economic development*, *Ethiopia,* and *maternal nutrition*.

Despite the high rates of poor maternal nutritional status in Ethiopia, the findings from the literature review indicated that poor maternal nutritional status can be reduced with effective nutrition education and economic opportunities for employment in rural areas. Poverty is a persistent problem in Ethiopia. The most significant factors that affect poor pregnant women and girls in Ethiopia are cultural factors, natural disasters, and weak governance, despite a democratic government and push towards gender equality.

Previously Related Studies

There have been very few studies that have been conducted using the traditional experimental research design on prenatal nutrition education in studying attitudes and knowledge. I first came across three studies that had similarities with my research, but

were focused on evaluating existing interventions for maternal health from the developing country's government. The first study was from the province of Baluchistan in Pakistan. Ghaffar, et al. (2012) conducted a mixed-methods cross-sectional research design study. Ghaffar et al. used a population sample of 513 women from 18-40 years of age. The qualitative portion consisted of eight focus groups. The quantitative portion used a standard questionnaire combined with personal interviews. The independent variables were sociodemographics, knowledge, attitudes, and perceived problems. The dependent variable was the usage of a prenatal clinic in a Pakistan government facility during pregnancy (Ghaffar et al., 2012). The data were analyzed using bivariate analysis, multiple regression analysis and the χ^2-test. The results revealed that just 14.4% of the sample of 513 women had received prenatal care. Prenatal care knowledge of pregnant women was statistically significantly and positively related towards prenatal care facility usage ($p < 0.001$). No correlations (r) or regression coefficients (βs) were reported. There was a high level of distrust towards government facilities and very low knowledge of prenatal care. While nutrition was not specifically discussed within this study, it was otherwise implied that prenatal nutrition education knowledge was very limited (Ghaffar et al., 2012)

Mohannad, Rizvi, and Irfan (2012) conducted another quantitative study based in Pakistan. This study was concentrated on pregnant women's nutritional knowledge on iron supplements and used the traditional research experimental design with a sample of 400 pregnant women, chosen randomly over 2 months throughout the Pakistani capital, Islamabad. The independent variables were education, socioeconomic status, parity, and

gestational age. The dependent variable was the practice and knowledge levels of iron-rich foods and iron supplements. The data analysis employed the *ANOVA*, multiple regression and the χ^2-test. Mohannad et al. found a positive and statistically significant correlation *(*$p < 0.001$) between nutritional status, education and knowledge. Like the above study, neither the correlations (r) nor regression coefficients (βs) were reported. Iron-deficiency anemia was lower among pregnant women who were literate and had more education. Mohannad et al. suggested that behavioral, physiological and socioeconomic status factors should also be addressed, and more awareness programs are needed to combat iron-deficiency anemia.

The final study was based in Kenya and was a cross-sectional design with a focus on knowledge, behavior, and attitudes among pregnant women in Western Kenya. This included being tested for prenatal nutrition, Vitamin A, dietary diversity, and the consumption of Vitamin A foods (Perumal et al., 2013). A cross-sectional survey was used, and the χ^2-test and Student's t test were conducted on data collected from 979 pregnant women. The dependent variables were nutrition knowledge score, health and healthcare knowledge score, attitude score, and dietary diversity score. The only independent variable was whether the pregnant woman attended a prenatal clinic during the survey (a yes or no answer). The results were that 59% of pregnant women attended prenatal clinics, while the remaining pregnant women did not attend (Perumal et al., 2013). Other behaviors measured were sustainable agricultural practices, childcare, and healthier behaviors. The study resulted in a higher rate of knowledge and healthy behavior towards nutrition with pregnant women who visited health clinics and

empowered themselves with the information provided from the clinics. It was also implied that the pregnant women attending prenatal clinics had better pregnancy outcomes in consuming Vitamin A than those who did not (Perumal et al., 2013).

Maternal Nutritional Knowledge, Status, and Attitudes

There are many reasons why maternal nutritional status can be negatively impacted, such as poor prenatal nutrition and lack of knowledge pertaining to prenatal nutrition (Lartey, 2008). There is a strong and positive relationship between maternal nutritional status and health, social, and environmental factors (Lartey, 2008). Maternal nutritional status can be affected in Ethiopia due to numerous and complex reasons. Some of the primary examples that have been addressed are the scarcity of skilled birth attendants, the high prices of food, food insecurity, traditional beliefs, harmful traditional food practices, and the existence of mental disorders such as depression or severe anxiety in pregnant women (Saldanha et al., 2012). In discussing these correlates of poor maternal nutritional status, the goal was to relate how each of these factors is directly related to poor prenatal nutrition.

A skilled traditional birth attendant with knowledge of both traditional and modern obstetric practices can help to save a pregnant women's life, which includes the administration of prenatal nutrition education (Nelson et al., 2011). Skilled birth attendants also have experiences in traditional healing practices and are familiar with the local culture and customs towards pregnancy and childbirth (Prata et al, 2011). However, many women in rural Ethiopia cannot obtain access to a skilled traditional birth attendant,

let alone a hospital or clinic. As a result, the only other option is to seek the service of an unskilled birth attendant (Nuru, 2009).

Unskilled birth attendants in rural Ethiopia are likely to be impoverished and have little or no education (Nelson et al., 2011). Nuru (2009) stated that an unskilled birth attendant has a higher likelihood of delivering poor quality prenatal services. This includes the omission of prenatal nutrition education altogether once a woman or girl becomes pregnant (Nuru, 2009). When unskilled birth attendants cannot provide proper information or prenatal care, mothers are likely to experience poor prenatal nutrition. Skilled birth attendants are also often a rarity (Dhakal, Teijlingen, Raja, & Dhakal, 2011). Some of these complications from poor maternal nutrition can result in iron-deficiency anemia and maternal stunting (Saldanha et al., 2012).

The high prices of food can also lead to the inability to purchase nutritious food for the prevention of poor nutritional status. The global financial crisis has taken a severe toll on developing countries and has particularly caused difficulty in buying food for the poor and underprivileged (Brinkman, de Pee, Sanogo, Subran, & Bloem, 2010). Ethiopia has a history of famine and food insecurity; costly prices of obtaining, even the most basic staples, have led to increased dependency on foreign food aid (Von Braun & Olofinbiyi, 2007). Due to the problems of food shortage, under nutrition during pregnancy is likely to occur in young women and girls in the rural areas of Ethiopia as oppose to urban areas (Bitew & Telake, 2010). To compensate for the high prices of food and coping with food insecurity, agricultural productivity and better education can

provide more access to food and promote maternal nutritional status. The progress in achieving both of these goals has been slow (Bitew & Telake, 2010).

Traditional beliefs regarding nutrition have been blamed as one of the main causes of maternal and infant mortality in Ethiopia. Many women and girls are raised in tribal rural societies that have ancient customs and cultural attitudes on pregnancy (Yousef, Ayilew, & Seid, 2011). As Ethiopia is a traditionally a male-dominated society, a large proportion of major decisions on prenatal health care, which also include prenatal nutrition, are often made by the pregnant woman or girl's husband or male relatives (Yousef et al., 2011). Since females are considered subordinate in Ethiopian culture, they are not given as much food or education as males (Duncan & Hayden, 2008). Another example of poor nutrition in females is attributed towards food taboos among pregnant women in Ethiopia. Very few studies have been conducted on the prevalence of food restrictions and its relationship with pregnancy outcomes.

Demissie, Muroki, and Kogi-Macau (1998) undertook a cross-sectional study where they found that most common reasons for food taboos stemmed from the fear of a difficult delivery. Foods such as milk, cheese, and meat are the most frequently avoided by pregnant women, while bananas and linseed are also avoided to a lesser extent (Demissie et al., 1998). Other harmful traditional practices related to food taboos are the omission of green vegetables and any food item that contains a white color. Many pregnant women and girls believe that green vegetables such as green bell peppers can cause baldness of the baby after birth; white-colored foods are believed to be associated with obesity (Assefa, Wassie, Getahun, Berhaneselassie, & Melaku, 2005). In compliance

with food taboos, a pregnant woman not only experiences compromised nutrition, but also raises the chances of infection, micronutrient deficiencies, and varied illnesses (Assefa et al., 2005). In presenting the findings on food taboos in Ethiopia, while there are beneficial food beliefs that have been held for generations, there are also harmful beliefs, which can seriously impact the health of a population.

Another aspect of maternal nutritional status also relates towards girls or women developing a mental disorder during the course of pregnancy. One of the most common traditional health beliefs held throughout Ethiopia is the relationship of mental and physical health (JVS [JVS], 2012). According to Ethiopian cultural norms, a pregnant woman is considered to be vulnerable, both physically and mentally (JVS, 2012). The most common emotional problems that Ethiopian pregnant women experience are depression and anxiety. External factors such as poverty, abuse, neglect and domestic violence have exacerbated the feelings of loneliness, fear and vulnerability (Hanlon, Whitle, Wondimagegn, Alem, & Prince, 2010).

Eating behavior and health attitudes towards food greatly depends on the mental health of a pregnant woman. From a quantitative cohort study, violence towards the woman during and after pregnancy are common in the developing world and can affect overall maternal health (Nunes et al., 2010). Violence and depression are also correlated with drug and alcohol dependence or abuse, particularly with the husband and the male relatives of the family. Poor food intake can negatively impact the health of the mother and infant on both short-term and long-term levels (Nunes et al., 2010)

Economic Development

Ethiopia is a largely agricultural society and much of its people are in the agriculture industry. Dao (2008) conducted a multivariate analysis study and concluded that women in the developing world could help a nation reduce poverty and fight problems like maternal mortality. If both women and girls are employed and can engage in the labor force, there is positive correlation for improving the economic environment (Dao, 2008). Szirmai (2005) observed that African countries, including Ethiopia, traditionally place a very high level of self-sufficiency and self-reliance. A strong sense of ethnicity, pride, and cultural identity is also observed in many African societies. In displaying a substantial amount of loyalty and strength within a community, the social structure is built to maintain survival (Szirmai, 2005).

Pregnant women and girls who do not have access to prenatal nutrition education are often not given the chance to have a steady employment and can be illiterate. In relation to rural development, another theoretical approach that could be included is the transactionalist theory (Szirmai, 1997). Rural women and girls often have to deal with several obstacles such as starvation, poverty, illiteracy, political strife, and famine. Communities have coped by using survival strategies in the face of challenges and serious problems (Szirmai, 1997). Ethiopian schools are usually divided into elementary (Grades 1-8) and high school levels (Grades 9-12). While the typical academic curriculum consists of mathematics, English, sciences, social sciences, and physical education, prenatal nutrition is a subject that is not taught in the classroom (Fairbanks, 2012). Unless an Ethiopian student attends a medical college or is specializing in

biological sciences, prenatal nutrition is usually not taught at schools. Within this context, if a woman or girl has little or no formal schooling, a prenatal nutrition education program can be tailored that allows for hands-on demonstration in learning about nutrition (Fairbanks, 2012).

Prenatal Nutrition Education and Economic Opportunity

In sharing similar views with Szirmai (1997), Sachs (2005) concurred on the importance of economic opportunity for better nutrition among women. In the rural areas of Ethiopia, the most common occupation is agriculture. While there are many families who may have land, they are often poor, as the crops are not enough to sustain good nutrition (Sachs, 2005). To increase the household income of the family, Sachs's approach is to sell part of a homegrown crop and engage in trading practices with other communities. This practice would increase the supply of food and encourage bartering for more expensive foods, such as meat, milk, and eggs (Sachs, 2005). This would also lead towards better nutrition both for pregnant women and the family. While the household can become self-sufficient, advanced technology and better resource utilization from a developing nation's government can further increase income (Sachs, 2005).

Sachs (2005) further related the effects of cyclical unemployment on Ethiopia's economy, leading to profound negative effects. As Ethiopia is a developing nation, inflation and unemployment have affected Ethiopia's economy (Sachs & Larrain, 1993). Rural poverty and the lack of opportunities have forced many youth to seek work in urban areas. Nonetheless, the competition for jobs has increased the unemployment rate

in urban areas, but decreased unemployment in rural areas. Females, including adolescents and women, are more affected by unemployment in the rural areas than males (Broussara & Tekleselassieb, 2012). When resources are not used and productivity suffers, this can result in the loss of profits and opportunities for business (Sachs & Larrain, 1993). This leaves pregnant girls and women most vulnerable for unemployment and thus, they do not have enough food, leading to compromised maternal and infant nutritional status.

Collier (2007) emphasized the rural economic development for the poor. As Ethiopia is a nation that is heavily dependent on foreign aid, Collier believed that long-term constant reliance on aid does not promote economic opportunity or employment. Collier's approach on economic development in a developing nation advocated economic reforms by prioritizing economic development for ordinary people, including girls and women. The Ethiopian government should attempt on improving its neighborly relationships with Somalia, Eritrea, Sudan, and Kenya to increase trade and economic opportunities (Collier, 2007). To counter obstacles like corruption and oppression, jobs should be created by the local, state, and national governments throughout rural areas and officials should closely monitor progress on economic development. When this happens, pregnant and non pregnant women and girls alike can benefit from income generation and nutrition education (Collier, 2007).

Sashar (2010) presented an account of the theory of poverty originally created by Sen (1981). The theory of poverty can depict a situation that is common to a rural area of a developing country. Sen presented three major points concerning poverty, capability

deprivation; the lack of freedom; and the unavailability of essential services like income, human needs such as shelter, clothing, food, and economic opportunities (Sashar, 2010). While all of these points are relevant to pregnant women in Ethiopia, Sen further indicated that a combination of low income, unemployment, and capability deprivation can lead to problems such as malnutrition. The relationship between capability and income can also be negatively affected by gender discrimination against women and girls in a highly patriarchal society like Ethiopia. In having no hope or support, pregnant women or young girls are likely to suffer from problems not only from poor prenatal nutrition, but reduce self-esteem and motivation and increased depression (Sashar, 2010).

Sen's (1981) approach to the importance of prenatal nutrition was relayed by speaking further on the sense of entitlements. It is not just absence of food that causes starvation, but the inaccessibility of food that is illegally channeled or mishandled. A person is also deprived of ownership over food; laborers and peasants, who rely primarily on agriculture for survival, are denied direct entitlements (Sen, 1981). In citing the Ethiopian famine of 1972 - 1974, which was accompanied by the downfall of Ethiopia's last emperor, Selassie, the famine was exacerbated by internal conflict, ineffective government policies, and drought (Sen, 1981).

In moving towards economic opportunity, Sen (1999) continued to highlight the benefits of employment of women and girls. While Sen did not specifically mention pregnant women, it is insinuated that the economic status of a pregnant or non pregnant woman and her family can greatly improve when she is given employment. Many women, even in Ethiopia, are expected to work long hours within the home. However,

once male dominance is reduced or even eradicated within a family, a woman or girl, even if she is pregnant, can help to fight obstacles such as poor prenatal nutrition and illness through employment, and reduce fertility rates (Sen, 1999). With the freedom to obtain employment outside of the home, a pregnant woman is likely to have a greater chance of having a better pregnancy and obtain adequate food (Sen, 1999). Sen emphasized that greater freedom from employment can curb unnecessary pregnancies and bring unwanted children through employment.

According to Polak (2008), greater economic opportunity can reap enormous benefits on prenatal nutrition education. While Polak characterized himself as social entrepreneur, rather than development economics theorist, his views are also related to Sen's (1981). Polak made a distinct correlation between prenatal nutrition and economic development. Polak believed that the problems of poverty can be solved by using business models, products, and services to poor people, who earn less than a $1/day. For example, if the Ethiopian government reinvests in agriculture for pregnant or non pregnant girls and women and increases income for the rural poor, the quality of food and better nutrition can result (Polak, 2008). By providing economic opportunity, better health services, including prenatal nutrition education can be accessed and nutritional status can be highlighted (Polak, 2008). Polak pointed out that local, state, and national governments of a developing nation should be able to prioritize rural economy development and focus on quality and practical livelihood opportunities for poor people, particularly women and girls.

Very few studies have been conducted on microcredit programs and its effects on nutrition in Ethiopia. Doocya, Teferrab, Norell, and Burnhama (2004) presented findings on improved nutritional status of young women and girls who work with microfinance programs. With increased income, they had the ability to purchase more expensive foods such as meat, eggs, and milk. Overall, microcredit had successfully reduced food insecurity and food aid in Ethiopia (Doocya et al., 2004). The founder of microcredit, Yunus (2007), channeled his approach towards economic development by providing poor women the opportunity to become entrepreneurs and lift them out of poverty. While Yunus did not specifically mention pregnant women, rural poor women have the most potential to acquire numerous socioeconomic gains for themselves and their families. To capitalize on the benefits of microcredit programs for health and nutrition, two of the sixteen Grameen Bank principles are to grow and sell vegetables for income, and take care of the client's health (Yunus, 2007). This would imply that physical, mental, and prenatal health must be given priority. The introduction of more microcredit programs for pregnant young women and girls in Ethiopia can be given the opportunity to earn a living, as well as purchase or grow more food for better health (Yunus, 2007).

Some poor people, while they may agree that food is important for survival, do not always perceive it as mandatory. Banerjee and Duflo (2011) observed that villagers in very remote and rural areas may own a television, radio, cell phone, or DVD player. Instead of bins or crates to store extra food, a rural villager would rather find ways to alleviate his or her boredom by viewing television programs or listening to music. Better health and giving nutritious food to pregnant women is not considered a priority.

Economic opportunities for pregnant women would improve nutritional status; however, the earnings may go towards purchasing other household items rather than food (Banerjee & Duflo, 2011). With the digital age, tasting the pleasures of life has taken precedence over the health of pregnant women. As a result, pregnant women in rural villagers continue to suffer from undernutrition resulting in health complications (Banerjee & Duflo, 2011). When prenatal nutrition education is introduced, rural villagers can be educated to allot income for a pregnant woman's needs; when income is available, it must be spent wisely and sensibly on authentic and nutritious food for survival, especially for vulnerable family members.

Maternal Nutrition Status and Economic Opportunity

Easterly's (2011) opinions and approaches can be categorized with those of both Polak (2008) and Sen (1981); an increase in internal and external rural trade and promoting positive perceptions of Africa to the West can give rise to economic opportunity and curb problems in maternal nutritional status. Aid money can often be misused and abused by corrupt officials and authorities, and often fails to help the poorest people; Ethiopia is no exception (Furtado & Smith, 2007). Easterly (2006) criticized foreign aid, as it does not solve problems such as maternal mortality nor improve economic prospects. Easterly also has castigated the International Monetary Fund (IMF) and WB for not giving poor nations and communities opportunities to help themselves. For example, Easterly believed that a community should wisely use local resources for providing economic opportunities to women of childbearing age. Training local young women who have finished secondary school on basic midwifery concepts and pregnancy

problems is a type of economic opportunity that can be extremely helpful to pregnant women in rural areas. This program can be supported by both government funds and foreign aid alike (Easterly, 2006). Economic opportunities should also include measures of self-reliance for the local poor, where success and failures of programs must be vigilantly scrutinized (Easterly, 2006).

After combing through the theoretical concepts of prominent development economists, well-known organizations such as the WB, WHO, and UNDPA have also contributed significantly towards the study of maternal nutritional status, prenatal nutrition and economic development in Ethiopia. The WB has indicated that over a quarter of Ethiopian women suffer from a low body mass index (BMI) at a range below 18.5 from inadequate nutrition. Nearly one-third of this population is between the ages of 15 - 19 years old (WB, 2012a). A major barrier for prenatal nutrition education is that the literacy rate for women ages 15 and above is only 23% (WB, 2011). A 72% ratio of females to males in secondary school enrollment has also been recorded (WB, 2011).

A study on Ethiopia from African Development Bank (ADB) has given some possible solutions towards maternal nutritional status and greater prenatal nutrition. The government of Ethiopia is committed to promoting gender equality in Ethiopia, which included better nutrition for women (ADB, 2011). The ADB identified the greatest strengths of Ethiopia as human resources, natural resources potential, and market size. Its geographical location can promote trade and create more economic opportunities, particularly for women, giving them more access to nutritious food. The natural resources can offer employment in the fields of agriculture, fish production, and hydroelectric

power generation. With these sources of income, it is inferred that prenatal nutrition can be expanded among pregnant women (ADB, 2011).

The WB has presented some interesting studies on economic development and women. There are still strong traditional views indicating that pregnant women should not be involved in farming or agricultural labor, despite statistics showing the contrary (WB, 2010). While decentralization of economic development has encouraged women's empowerment, agricultural extension activities throughout Ethiopia must be made in greater strides towards women, even if they are pregnant. When the labor market is open to pregnant women, they can obtain prenatal care and acquire nutritious food with increased income. As a result, maternal nutritional status can be increased (WB, 2010). However, inequality and gender discrimination is still quite common. Women and girls are frequently overshadowed by their husbands, fathers or other male relatives. The situation is even more problematic for pregnant women or girls, since both social and economic rights for these groups are often disregarded altogether (WB, 2010).

As way to combat this problem, three solutions are offered. The empowerment of Ethiopian women can be greatly elevated by including the input of women and girls on development projects (WB, 2012b). Not only can income generation activities be supported, but also they can help to pinpoint the greatest needs that cater to Ethiopian young women and girls, such as maternal health during pregnancy (WB, 2012b). Finally, gender awareness programs should be implemented and followed thoroughly to achieve the maximum outcomes. This would include better protocols for safe motherhood for pregnant women, and focus on maternal nutrition (WB, 2012b). Throughout Ethiopia, the

issue of climate change has also affected economic empowerment activities in agriculture. For example, investments in rural livelihood activities that do not depend on environmental changes have been introduced. Others aspects include improved water supply, range improvement, microscale irrigation, and strategies to enhance preparedness for future natural disasters and emergencies (WB, 2012b).

The UNDP has reported that Ethiopia has among the lowest rates of prenatal care, which includes nutrition throughout Africa. Only 59.4% of women and girls have reported that they have had at least one visit at a health center or visited a health professional (UNDP, 2012). The progress of improved prenatal care appears to be slower in some regions throughout Ethiopia. In order to facilitate progress, program prioritization, particularly on prenatal nutrition, should be conducted throughout each region. While the Tigray region does not have the lowest rates of prenatal care coverage in Ethiopia, it has experienced some lagging, including nutrition (UNDP, 2012). Due to this, the Ethiopian government must strengthen maternal nutrition programs to prevent common nutritional deficiencies in girls and women.

A program on survival and health was created for Ethiopia by UNICEF (2011) containing components on developmental and humanitarian levels for 2012 - 2015. While UNICEF's extensive work targets children, it has recognized the role of maternal nutrition during pregnancy. UNICEF has called for the construction of 3,200 health centers throughout Ethiopia by 2015, where services are provided for girls and women (UNICEF, 2011). These health centers are to provide high quality and critical care services in prenatal nutrition education. Education for girls and women would also

include prenatal nutrition services in rural and agricultural areas, focusing on gender sensitivity issues (UNICEF, 2011).

A report on agricultural programming has actively encouraged economic empowerment of agricultural programs for women and girls throughout the developing world, including pregnant women (Food and Agricultural Organization [FAO], 2012). In addition to investing in better technology for reducing labor and time spans, promoting access for child care after delivery can ease the burden of responsibility of women who already have other children (FAO, 2012). The husband and other relatives can be engaged for taking care of the children while the pregnant woman or girl is away at work. Physical labor should be monitored strictly so the health of the woman or girl does not become compromised (FAO, 2012). Even if a woman is earning substantial income, there must be adequate gender-oriented protection measures for nutrition support. These include ration cards, micronutrient sachets, and food vouchers (FAO, 2012).

UNFPA had made a recent report on the trends of weight gain by Ethiopian women. The Tigray region has seen an increase in the number of Ethiopian women who have low BMI. At 34.1%, the region of Tigray has the third highest percentage of women and girls with low BMI (UNFP, 2012). Low BMI has been affiliated with little or no education, poverty, illiteracy, poor nutritional intake associated with anemia, and the lack of a toilet in a household (UNFP, 2012). While significant progress has been made for women seeking prenatal care, only 30.9% in the Tigray region were reported to have sought the help of health center or health professional (UNFP, 2012).

Maternal Nutritional Status, Economic Opportunity, and Prenatal Nutrition

Szirmai (2005) connected the topics of health, education, and economic development. Szirmai's approach towards economic opportunity combined both human capital and screening theories. While the human capital theory focuses on educational qualifications concentrating on theoretical concepts, the screening theory is defined by demonstration and application (Szirmai, 1997). Szirmai implied that education, linked with theoretical and practical experience, can greatly improve the maternal nutritional status. Girls and women should be given opportunities to understand how prenatal nutrition education can be learned and applied (Szirmai, 2005). Maternal nutritional status is negatively affected by illness and malnutrition during pregnancy, which can lead to diminished levels of productivity within the household and in the working environment. Among these are the reduced labor input, decreased labor intensity, and low/unproductive activities (Szirmai, 2005).

With the lack of adequate nutrition, a woman would not be able to contribute financially to her family and may become unemployed. In many rural areas throughout Ethiopia, households must rely on their own labor for income. When illness from poor nutrition strikes, this can be catastrophic for an already struggling family trying to cope with inadequate finances (Szirmai, 2005). In learning prenatal nutrition education, literacy for pregnant women would be highly beneficial, where girls and women alike could deliberate and ponder innovative solutions for better nutritional health. Literacy can also open more doors to new ideas and better technologies (Szirmai, 2005). In including

education with economic development and health, this will give rise to financial capability, professional skills, and changes towards positive attitudes (Szirmai, 2005).

Thirlwall (2011) documented how economic opportunity can influence the fertility rates of women and girls and promote better maternal nutritional status. In a similar stand with Easterly (2006) and Sen (1981), Thirlwall (2006) stated that economic opportunity and education can improve the current socioeconomic conditions of a poor woman. The cycle of poverty, high fertility, and the poor health of pregnant women can be successfully broken with newfound independence and available income from employment and education. This could be done if a woman and her family have greater ownership of their land and engage in trade to increase food production and food security (Thirlwall, 2006).

While Thirlwall (2006) did not specifically refer to prenatal nutrition education, he has inferred that quality education can greatly improve health and survival of a pregnant woman particularly towards increasing the supply of skilled labor from a household. According to the data that Thirlwall presented on sub-Saharan Africa, including Ethiopia, it can be surmised that prenatal nutrition education and economic opportunity would create great progress for women and girls.

Human development is linked towards women's education and good nutrition. Meier (2005) indicated that women are chiefly responsible for the health and family size, including pregnant women. With better education and the opportunity for employment, the gender gap would narrow (Meier, 2005). Meier believed that income generation should be given a greater priority over household work where many women play a large

role. According to Meier, there are three major recommendations of agricultural development that can have a positive and lasting impact on pregnant and non pregnant women and girls: the investment in health and nutrition, rapid technical change for rural farmers to increase incomes, and rural organizational structures for the provision of valuable services.

Importance of Prenatal Nutrition

When nutrition interventions are introduced on maternal nutrition, they can fall into two different categories, nutrition specific intervention programs and nutrition sensitive intervention programs (Middleton et al., 2012). While nutrition specific interventions concentrate on issues such as supplementation, fortification and behavior change communications, nutrition sensitive programs venture further towards causes of poor nutrition, such as food insecurity, poverty and gender discrimination. Each study may vary; but, if long-term adequate maternal nutrition is to be achieved, it is desirable to include both nutrition specific and nutrition sensitive intervention programs (Middleton et al., 2012). For the implementation of the program to achieve the maximum amount of positive throughout a region, particularly in a developing nation like Ethiopia, the physical, cultural, social, and economic factors have to be completely addressed from the beginning. Maternal nutrition programs should try to include some aspect of prenatal nutrition education and empowerment for it to become completely effective (Middleton et al., 2012).

In another example, an evaluation study was conducted on what interventions might be the best for improving maternal nutrition. Bhutta et al. (2008) conducted a

cohort study spanning 36 countries, including Ethiopia, on what interventions are the most effective. Iron, folate other micronutrient supplements combined with energy and protein intake have reduced complications during pregnancy. However, they are only short-term solutions in tackling the overall problem of inadequate maternal nutrition (Bhutta et al., 2008). Stunting is particularly a serious problem that can interfere with the development of a fetus and affect the nutritional health of the mother during pregnancy. Prenatal nutrition education must be included along with the assessment of economic status and women's empowerment have to be included as part of the intervention (Bhutta et al., 2008).

Poor diet leads to several negative outcomes during pregnancy, including that of maternal mortality. If a diet is low in protein, vitamins B_6, folate, and fiber, critical periods for fetal development can be particularly affected (Samour & King, 2012). A pregnant woman needs nutritious food during the course of gestation and should not eat just any available food. If the nutrition content and the quality of the food are inferior, it will not contribute positively to the growth of the fetus nor will it benefit the mother during the postpartum period (Klein, 1995).

In the developing world, including Ethiopia, nutritious food can be difficult to obtain due to poverty. Low-income women are more likely to have poor dietary habits and nutritional status, which leads to reduced pregnancy outcomes. Other negative contributing factors are poverty and lack of education (Haggarty et al., 2009). Little or no education and sporadic employment may yield poor quality food (Kamau-Mbuthia & Elmadfa, 2007). A strong significance is that low-income pregnant women with lack of

economic opportunity are likely to suffer from poor prenatal nutrition status. The nutritional health of the mother can be compromised (Kamau-Mbuthia & Elmadfa, 2007).

The health of the mother and child during pregnancy rests largely on prenatal nutrition (Shapira, 2008). Long-lasting consequences cannot only impact the mother's health, but also the surviving child can suffer from preventable ailments that may last throughout adulthood (Shapira, 2008). In a cross-sectional study profiling 400 women and girls in four villages within the Southern Tigray region, Haileselassie, Mulugeta, and Girma (2013) found that health and prenatal nutrition education are needed for lactating mothers after delivery. According to the results, 31% were underweight, 25% had chronic energy deficiency and 2% suffered from stunting (Haileselassie et al., 2013). In focusing on prenatal nutrition education, some of the challenges to encounter are poor intake of food, inadequate gestational weight gain, and reduced caloric density of food (Shapira, 2008). Among other common factors of nutritional inadequacy during pregnancy are maternal age, gestational age, and irrelevant educational background. Frequently, when mothers are in their adolescent years, the nutritional content of their diet is much lower than older mothers. Young women and girls who live in rural areas may have had some education, but prenatal nutrition knowledge is largely absent (Sukchan et al., 2010).

Supplementation has helped to counteract nutrition conditions, such as micronutrient deficiencies. However, primary dependency on supplementation to compensate for poor nutrition can lead to undesirable results (Kapil, 2009). Regardless of the dosage of supplementation, other essential nutrients such as carbohydrates or protein can be disregarded. There are almost always multiple factors resulting in an unhealthy

pregnancy, not just micronutrient deficiencies (Kapil, 2009). In avoiding or partaking in certain foods or taking supplements, single or multiple nutrients can be affected either negatively or positively. From the results of a non interventional simple random sampling study, a sense of caution on supplements should be taught to women and girls who become pregnant. Overindulgence and toxicity of supplements can take place if the supplement dosages are unregulated (Mashayekhi, Dilmaghanizadeh, Fardiazar, Moghadam, & Ghandforoush-Sattari, 2009).

Prenatal Nutrition Education

In identifying some of the main nutrients to be taught for prenatal nutrition education, there are four minerals and three vitamins that should be incorporated into a typical program. The main nutrients are iron, calcium, iodine, zinc, Vitamin A, folate, and Vitamin D. All of these nutrients play a vital role in the prevention of maternal mortality and are best obtained from a balanced diet. The deficiency in one nutrient can influence the production of another nutrient.

Iron is a critical and key nutrient during pregnancy (Klein 1995). Iron-deficiency anemia has been commonly recorded in pregnant women spanning several developing countries, including Ethiopia. Low consumption of iron during pregnancy often been associated with moderate to severe anemia, and can increase the chances of complications during pregnancy (Kozuki, Lee, & Katz, 2011). Maternal nutritional status can often consists of low iron levels; consequently, a pregnant woman in Ethiopia is likely to experience slowed growth of the fetus and heavy bleeding after delivery. The consumption of iron-rich foods such as chicken, meat, and eggs could also be difficult to

find in a rural environment, as they can be expensive for the average poor family to afford (Latham, 1997). For this reason, alternate sources of iron such as spinach, beans, and lentils, need to be sought. Multiple strategies have to be created to address both nutritional and non nutritional concerns (Haidar, 2010).

Zinc is not as well known in prenatal nutrition education programs, but has slowly gained recognition. Zinc is still highly regarded for its properties pertaining to reproductive development (Pathak, Kapil, Dwivedi, & Singh, 2008). Protein-energy malnutrition resulting in maternal mortality is also associated with scarcity of zinc in the diet. The chances of increasing risk of maternal mortality are prevalent with zinc deficiency in the diet (Pathak et al., 2008). The supplementation of zinc can be introduced during the gestation period and can increase the chances of having a healthier baby (Caulfield et al., 2011). Within Ethiopia, zinc deficiency among expectant women and girls is not uncommon. The staple grains that are prevalent in Ethiopian cuisine rely on teff and enset, both of which contain a large amount of phytates that subsequently inhibit zinc absorption. Simultaneously, protein-energy malnutrition can also be a consequence of reduced zinc intake (Abebe et al., 2007). Educational interventions must be taken to teach pregnant women the right types of foods that can compensate for reduced zinc consumption (Caulfield et al., 2011).

Vitamin A deficiency is a common problem throughout the developing world, and can be a risk factor. Faisel and Pittof (2000) pointed out that Vitamin A could improve anemia and boost the immune system during pregnancy. In teaching about Vitamin A in a prenatal nutrition program in relation to the Ethiopian diet, pregnant young women and

girls can partake in foods such as eggs or spinach, instead of taking supplements (Demissie, Ali, Mekonnen, Haider, & Umeta, 2009). While supplementation has remained a common solution to low Vitamin A deficiency, a pregnant woman may still be at risk for poor maternal nutritional status if she completely depends on supplements. In featuring the relationship with Vitamin A and iron for educational purposes, Vitamin A is best obtained by being consumed in eating foods such as eggs and spinach (Kirkwood et al., 2010). An Ethiopian pregnant woman can benefit far more from eating Vitamin A foods on a regular basis rather than solely depending on supplementation (Kirkwood et al., 2010).

Folate or folic acid is a common nutrient that is emphasized in conventional prenatal nutrition education. It is usually associated with neurological development during pregnancy and can help to prevent mental retardation of the fetus (Fehr, Fehr, & Protudje, 2011). However, folate also works closely with iron for promoting oxygen capacity during pregnancy. The amount of folate and iron from the diet can determine the status of a pregnant women's health. Complications can result from poor folate consumption, including preterm delivery, fetal death, anemia, reduced maternal nutrition status, and even maternal mortality (Ogundipe et al., 2012). While supplementation combining both iron and folate is encouraged, the low folate consumption of Ethiopian women is directly related towards diet. As folate is found in a wide range of plant and animal foods, low socioeconomic status and less affluence reduce food diversity and lowers folate consumption (Haidar, Melaku, & Pobocik, 2010).

Calcium and Vitamin D help to strengthen the bones during fetal development and also assist in the prevention of hypertension disorders during pregnancy, notably preeclampsia and eclampsia (Osungbade & Ige, 2011). As calcium and Vitamin D collaborate closely with each other, an inadequate supply of both nutrients can lead to pelvic bone deformities, making the process of delivery both dangerous and difficult (Batha, 2009). About 5% of Ethiopian pregnant women suffer from preeclampsia and eclampsia (Teklu & Gayam, 2006). While the number of preeclampsia and eclampsia patients may be low in Ethiopia, calcium and Vitamin D are nevertheless needed for a healthier pregnancy (Osungbade & Ige, 2011). Calcium is found predominantly in dairy foods, and a small part of Ethiopian cuisine does use dairy products such as milk and cheese (Sheen, 2008).

The final major nutrient, iodine, is a prominent part of prenatal nutrition education, as it is chiefly assists in the prevention of mental retardation of the fetus during pregnancy. Iodine deficiency has been documented in Ethiopia, where the traditional diet does not contribute to an adequate consumption of iodine (Dugassa & Nagassa, 2012). Without significant iodine consumption, a pregnant woman or girl can suffer from serious complications such as stillbirth or miscarriage (Dugassa & Nagassa, 2012). From an epidemiological study conducted throughout Ethiopia, approximately 36% of women and girls who were pregnant and nursing mothers have suffered from goiters. However, it is estimated that this percentage maybe at a much higher range, from 50-95%, depending on the region (Yibrie et al., 2007).

Another cross-sectional study was conducted in the Tigray region of Ethiopia, where the high prevalence of goiter at 80% was reported in women (Kidane & Woldegebriel, 2006). An effective intervention should be aimed at pregnant women that can include price reduction of iodized salt on the market and increased availability to reduce goiter and thyroid-related conditions (Kidane & Woldegebriel, 2006).

In addition to obtaining proper amounts of nutrients, a steady and healthy weight gain should be maintained throughout pregnancy to support the baby prior to delivery. The gained weight is needed for the development and growth of the fetus (Tsigga, Filis, Hatzopoulou, Kotzamanidis, & Grammatikopoulou, 2010). Mutthaya (2009) reemphasized the point that maternal weight gain can prevent low birth weight and other complications, including the risk of maternal mortality. Maternal weight gain can be negatively affected with an increase amount of physical labor and chores, a common expectation of women throughout Africa (Muttaya, 2009). However, it was also emphasized that it is not just food intake and physical exertion status that affects maternal weight gain; cultural beliefs, education, environment, and socioeconomic status of the pregnant woman and her family also matters (Muttaya, 2009).

In further elaborating on cultural beliefs on food and health in Ethiopia, beneficial health beliefs must be addressed in order to create a culturally appropriate prenatal nutrition education model (Hode, 1997). Some of these helpful cultural beliefs in Ethiopia can actually promote the health of a pregnant woman. In emphasizing healthy and beneficial cultural beliefs along with prenatal nutrition education, the health of a woman and girl can be greatly valued (Klein, 1995). Among these beliefs is to allow for a

pregnant woman to continue being active in doing housework and exercise until giving birth (Duncan & Hayden, 2008).

Exercise during pregnancy will contribute towards easier labor for better delivery. Eating warm foods during pregnancy and postpartum periods is believed to promote healing of the woman's body after birth (Duncan & Hayden, 2008). Childbirth is celebrated in the presence of women only and there is much support and encouragement from the community.

Maternal nutrition knowledge and maternal nutrition attitudes have also been studied in other nations pertaining to prenatal nutrition education, but not in Ethiopia. There have been very few studies that have been done which target prenatal nutrition education. Some of these nations are Malawi, Sierra Leone, and Bangladesh. In Malawi and Sierra Leone, the knowledge and attitudes of pregnant women was measured on the prevention of iron-deficiency anemia. Kalimbira, Mtimuni, and Chilma (2009) used a quantitative cross-sectional research design and featured a sample size of 629 randomly selected women in the central, southern and northern regions of Malawi. Questionnaires were administered as the methodology for the pretesting phase. The dependent variables were maternal knowledge and attitudes and the independent variables were anemia and iron supplementation. The χ^2 test was used and the critical value that was used was $p > 0.05$. The results indicated that while a large percentage (97.1%) knew about anemia, 43.6% of women avoided iron supplements because of nausea during pregnancy, increasing the chances of acquiring anemia. Clinics, nongovernmental organizations

(NGOs) and government agencies still need to increase compliance for taking iron supplements to decrease anemia (Kalimbira et al., 2009).

Within Sierra Leone, the findings were less acceptable. Out of 171 women who were randomly selected in a mixed-methods study consisting of surveys and interviews, 40% had provided incorrect answers on a 10-question survey questionnaire on anemia (Fredanna, M'Cormack, & Drolet, 2012). Like in Malawi, the χ^2-test was also used with a $p > 0.05$. While early intervention and financial status elevated iron levels, those participants who suffered from pica and received wrong information had a greater incidence of anemia. The conclusion of this study had indicated that social marketing strategies need to be administered and implemented on anemia in the future (Fredanna et al., 2012).

The nation of Bangladesh, which has a higher population than Ethiopia, also has problems pertaining towards poor knowledge and attitudes towards prenatal nutrition education and overall maternity care (Taha, Shahri, & Sebai, 1996). Taha et al. surveyed and interviewed 76 mothers and 12 traditional birth attendants throughout three villages in rural Bangladesh. According to the data, 92.1% of all mothers had never been in contact with a health worker and were ignorant of basic knowledge of prenatal nutrition education (Taha et al., 1996). Nearly 77.6% of traditional birth attendants had limited knowledge and training of maternity care, including prenatal nutrition knowledge. Many mothers and traditional birth attendants had misconceptions and false beliefs towards food (Taha et al., 1996). In rural areas of Ethiopia, while the government has made

progress, prenatal nutrition education still does not have a major emphasis within the government program.

Nutritious food such as genfo, a type of porridge, is commonly eaten before and after delivery (Government of Western Australia, 2008). Genfo is a traditional dish that contains essential amino acids, fiber, small quantities of iron and folate, and fat from clarified butter (Duncan & Hayden, 2008). Along with genfo, a drink called atmit, is presented and consumed after birth. Atmit is believed to increase the woman's ability to breastfeed her child and is heavily encouraged for lactation. It can contain clarified butter or fermented milk (Urga, Keshava, & Narasimha, 1997). Atmit is usually made with flaxseed, oats, and honey; furthermore, constipation during pregnancy can be relieved (Duncan & Hayden, 2008). Fermented teff is frequently used for the purpose of making atmit, where a substantial amount of iron and zinc can be absorbed if it is consumed frequently (Urga et al., 1997).

Summary

From the evidence that has been gathered throughout this literature review, there has been support and emphasis towards the benefits of prenatal nutrition education for both pregnant and non pregnant females in rural Ethiopia. A pregnant woman or girl can benefit from education and employment opportunities, as there will be a greater access towards a reduction of poverty. Among the prominent development economic theorists, the three major elements of the study that were covered were prenatal nutrition education, economic opportunity, and maternal nutrition. Education, combined with practical and theoretical experience can improve prenatal nutrition and economic development.

Trading practices between communities can reduce self-reliance and poverty. Foreign aid dependence should be reduced. The microfinance movement has positively affected the lives of rural women and resulted in better prenatal nutrition education and maternal mortality. Higher employment of women can ameliorate overall standards of living to reduce poverty. Food must be prioritized at the highest level for better health of women instead of non-essential items.

A sense of community, combined with collective action, can result in the health of pregnant women and young girls in rural Ethiopia becoming a greater priority. The extent of malnourishment can vary in each woman or young girl, depending on the age, prior medical history, or socioeconomic background. As with all communities, pregnant women and young girls in rural Ethiopia have adopted lifestyles and attitudes toward eating. Prenatal nutrition education must be incorporated and applied towards the lives of pregnant women and young girls from helpful traditional and cultural beliefs. Successful eating strategies should match the pregnant woman or young girl's lifestyle from both a short-term and long-term basis. In Chapter 3, I provide an explanation and justification of the research methods that were used to gather data.

Chapter 3: Research Method

Introduction

This chapter is an explanation of the methodology used in this weighted and sequential (QUAL → quan) mixed method true experimental (with a matching control group) research study. The research design and approach is described, along with the setting and sample of the study. Instruments, variables, and measures are also defined.

Research Design and Approach

The methodology for this research study was exploratory and correlational. The qualitative portion and quantitative portions were conducted sequentially, with a much stronger emphasis on the qualitative analysis. After I had traveled to Ethiopia for the first time in September 2013 and met with senior and prominent faculty members at Mekelle University, it was agreed that the true experimental research design was the most appropriate design for the implementation of a prenatal nutrition educational program. The participants were chosen via a randomized controlled trial and the randomized sampling method was used. The type of true experimental research design that was chosen for this study consisted of the pretest/posttest design and targeted two villages.

The qualitative portion included observations and focus groups of pregnant and non pregnant women with children in each of the two villages. Non pregnant women with children were also included, as a sample of only pregnant women was very small. The traditional experimental research design was also be used to meet the ethical protocols for IRB research at both Mekelle University and Walden University.

Setting and Sampling

Setting

In the course of this research study in Ethiopia, there were two villages selected in the Tigray region in the district of Alaje. Currently, Alaje has a predominantly agricultural sector and is the site of one of the historic battles during Ethiopia's short occupation by Italy (Vandevort, 2009). Alaje is located in the Southern Tigray region and is approximately a 2 hour drive from Mekelle. Takha and Dejen were the two villages selected, and they were randomly assigned to be the control or intervention group. Takha is closer to the town of Adishuhu, the gateway to the Alaje district. Dejen is located further into the mountains. The distance between both villages is approximately 25 miles. The main language that the women speak in both villages is Tigrinya, one of main languages spoken throughout Ethiopia. However, a map of the villages displaying Takha and Dejen was unavailable.

Study Sampling

The randomized sampling method was used for this study. This was a probability-based sampling method that helped to reduce bias throughout the course of the study. The randomized sampling method was also used to separate the findings from the qualitative and quantitative components. Once this was completed, the findings were corroborated and confirmed.

It was agreed by both my Walden dissertation committee and the faculty of Mekelle University that a sample of 200 - 300 women and girls between the ages of 18 - 49 years was needed for the research study. The sample that was selected was 270; this

sample was based on the statistical and correlational methodology concerning the relationship with multiple variables. To identify participants, serial numbers and blocks were used for the identification of the participants' homes for pretest/posttest survey questions and focus groups. The latest available population data for the Takha and Dejen originated from the Alaje District Health office based in Adishuhu (Alaje District Health, 2014). To date, there has not been any prenatal nutrition educational study conducted within the villages of Takha and Dejen. For this reason, in the calculation below, a 90% confidence interval level was justified to calculate the sample size. The following formula was used:

$$N \text{ (sample)} = p\,(1 - p) \div (\text{margin of error}/z\text{-score or critical value})^2$$

Using the 90% confidence interval, the z-score = 1.645 and the margin of error was 0.05. The p value that was chosen was 0.5. In calculating the formula, the sample size (n) was determined to be 270 pregnant and non pregnant women (with children) from the ages of 18 - 49 in Takha and Dejen. After speaking to the contacts at Mekelle University and Walden University dissertation committee members, it was confirmed unanimously that 270 pregnant and non pregnant women was an acceptable sample size for this study.

The formula for determining the sample size of this research study was typed below (Six Sigma, 2013). The intervention village (Takha) and the control village (Dejen) each both had a sample of 135 pregnant and non pregnant women from the ages of 18 - 49 years old. According to the formula below, while the total sum did not come

exactly to 270 participants, it was determined that an even number like 270 should be used for quantification purposes throughout the study.

$$270 \approx 268.96 = (0.5 * 0.5) \div (0.05/1.645)^2$$

Study Instruments and Measures

The qualitative portion was the major focus throughout this study. The qualitative data collection, which consisted of focus groups and observations, was administered to the 28 participants from both the intervention and control villages. The five research assistants had facilitated the process of surveying the participants during the pretesting and posttesting periods. The focus groups were both conducted by two Ethiopian research supervisors, faculty members at Mekelle University with expertise in health education, health communication and nutrition in Tigrinya. This provided more scope for cultural understandings on maternal nutrition issues. The focus groups were also supplemented with more information prior to the treatment and gave the participants an idea of what to expect throughout the study.

Observations were documented and recorded on the background of each participant along with the control and experimental focus groups. There were five focus group questions altogether. The questions were open-ended, simple, specific, and straightforward. As many of the women were illiterate or have little education, it was mandatory that each participant understands the questions completely and be given enough time to state their answers. The research faculty had assisted the participants for clarification. There were 28 women selected from the control and experimental villages, 14 women in each village. Two focus groups were conducted each in the control and

experimental villages. Each focus group consisted of seven women. This same format was done in both the pretesting and posttesting periods.

The five questions for the focus groups are in Appendix B and are listed below. The observation checklist has been written in Appendix C. The consent forms for in research are in Appendix D. The explanations for both the survey questions and focus group questions are in Appendix E.

1. Tell me about your local cultural traditions and what you should you eat while you are pregnant.
2. How are you supporting your family financially? Are you getting enough food?
3. What are the major types of food you eat? Has this changed when you became pregnant? Why or why not?
4. What medical services have you sought when you are or were pregnant? Were any of the services on prenatal nutrition?
5. What are some factors that have influenced you to buy nutritious food while pregnant? What foods do you consider to be nutritious and why?

A notebook and audio recorders were used for data collection and analysis. Audio focus groups were conducted instead of video focus groups for ethical reasons. Observation notes were made for each participant before and during the focus group. The observations were recorded in a clear fashion and did not contain unnecessary jargon, questionable opinions, or extreme views. The focus group questions were also tested for cultural sensitivity and simplicity and translated into Tigrinya beforehand. As there was

possibility that a participant could drop out of the focus group for any reason, the researcher made sure that another participant was available for the completion of the entire process (Janesick, 2011). Each focus group lasted between 30-45 minutes.

In qualitative research, bias and trustworthiness are issues that usually arise from subjective rather than objective points of view. As the dissertation study took place in rural Ethiopia, I had already recognized that the environment was radically different from my home environment in the United States. In addition to experiencing culture shock, I needed to make significant adjustments to an unfamiliar society, particularly in terms of the language barrier, food, customs, and the nonsystematic pace of the society. While there are cultural similarities between my East Indian background and Ethiopian culture, I practiced cultural sensitivity and flexibility in order to reduce bias at a significant level. The ability to increase trustworthiness with the participants came with my eagerness towards learning (Janesick, 2011).

The reduction of bias and the promotion of trustworthiness can also be accomplished during the focus group process. Throughout focus groups, it was essential that the questions were to be posed in a neutral and transparent manner towards the participants. Positive verbal and nonverbal cues included displaying favorable body language on the part of the focus group monitor. Each person of the focus group met the requirements of my target population for this study. However, if there was another person besides the ideal participant within the focus group, that individual was requested to leave. During the pretesting phase, a few of the women had brought their children along,

either breastfeeding or non breastfeeding; no other adults were allowed in the room during the focus group.

All participants were made as comfortable as possible and given plenty of time to answer their questions in a thorough and honest way. The focus groups took place in the classroom of the village health posts in Takha and Dejen. Both the control and experimental villages' focus groups were scheduled according to the participants' convenience. Efforts were made not to interfere with their daily activities or invade their privacy at any time. When the responses were provided, the credibility and genuineness were verified using respondent validation or member checking techniques. As the focus groups were conducted using the protocols named above, the chances of bias and prejudice on most levels was greatly reduced (Teddlie & Tashakkori, 2011).

Observations were made starting from the description of the surrounding environment, the physical setting and appearance of the participant. The observations were conducted coincidentally with the focus groups. Some of the observation aspects that were recorded were the purpose, time, activity, and the rationale for that observation to be made. The reason that observations were conducted was that they provided more insight about the participants' lives and their living situation.

The intervention treatment for this study was a combined prenatal nutrition education program from the Ethiopian government and my own intervention program (the control group only received the government education program). The subjects covered in this supplemental program were the basic concepts of nutrition, food groups, and important vitamins and minerals from the Ethiopian Government National Nutrition

Program (Government of Ethiopia, 2012). The treatment was a combination of the government intervention and my intervention (described below). The chosen modules from this program were Module 2 and Module 3.2 from the Ethiopian Government National Nutrition Program on pregnancy. From Module 2, the functions of macronutrients (carbohydrates, fats, water, and protein) and micronutrients (Vitamin A, Vitamin D, folic acid, iron, calcium, zinc and iodine) were discussed. The concept of balanced diet and the Food Pyramid diagram was also included from Module 2. Within Module 3.2, the importance of gaining weight, eating properly, iron deficiency anemia is discussed for pregnant women (Government of Ethiopia, 2012).

My intervention further included the importance of portion sizes, adequate rest and one additional meal per day for pregnant women along with the government nutrition program. Both the control and experimental villages received the government prenatal nutrition education program; the experimental village received the additional intervention. After the data collection was completed in 5 days, the intervention continued over the course of 4 months from May 2014 to September 2014. When the pretest and intervention phases were completed, I returned to Ethiopia in October 2014 for my final trip after 5 months and observed the effects of the intervention using the same survey and focus group questions for the posttest questionnaire.

With regards to the quantitative portion, the survey questionnaires by the research assistants were completed within 3 days in the experimental village, Takha during the pretesting and posttesting periods. There were 34 pretest and posttest questions for each survey questionnaire. These 34 questions are listed in Appendix A. The questionnaires

were administered before and after the intervention, once consent was obtained from the participants and with the permission of Mekelle University authorities.

The survey questionnaires were conducted with the assistance of five research assistants, master's students at Mekelle University. The five research assistants spent 3 days surveying the participants in Dejen, the control village. However, the same research assistants were not used for both the pretesting and posttesting periods. All of the research assistants were bilingual in English and Tigrinya. The two villages in the rural Tigray region described above served as the intervention (which will receive the additional treatment) and the control groups. With regards to the pretest and posttest period, the questionnaires were administered orally, since several participants were illiterate or had minimal education. Mail-in surveys cannot be used, since they are unreliable and inconsistent in rural areas of developing nations. Prior to the start of data collection, the survey questions were corrected and customized for to be cultural appropriateness and acceptability according to local customs and expectations.

A comparison between the experimental factor and control villages were made according to the effect of the treatment program. The first 25 survey questions for the pretest and posttest questionnaires used a 5-point Likert scale (1= *strongly agree* to 5 = *strongly disagree*) and the final nine additional questions gave some additional information on the participants. The questions were also accompanied by explanations on how the questions related towards data collection (Appendix A). As recommended by Mekelle University faculty, all of the 34 survey questions were needed for obtaining adequate information. The questions were translated into Tigrinya and administered using

the help of the research assistants, where I had served as the principal investigator and supervisor. I also provided the survey questions below.

The survey questions were divided into five parts according to the major themes – one meal per day, adequate rest, portion sizes, basic nutrients and economic empowerment. Once the data collection was completed and ready for analysis, the steps taken for translation and back translation undertook the assistance of interpreters provided from Mekelle University. I had contacted an Ethiopian travel agency in Washington, DC that had translation services for Tigrinya. When the data were completed, it was made available towards the stakeholders in Ethiopia and presented in English. At Mekelle University, all assignments and projects for all classes must be written in English. I created the survey questions for the participants to be simple and straightforward as much as possible.

Non Likert Scale Questions

1. What is your age?_____ (18 - 49 years)
2. What is your marital status? Married Single Widowed Separated Divorced
3. What is your educational level?

   No Education Primary Education

   Secondary Education College Education
4. What is your source of income?
5. Are you pregnant?

   Yes

   No

6. How many living children, who have been born and are alive, do you have?
7. How many pregnancies have you had?
8. What is your occupation?
9. Did you get information on prenatal nutrition education? Yes No

Likert Scale Questions - One Meal Per Day

10. It is important to have healthy and good quality food during pregnancy.
11. A pregnant woman should eat first at mealtimes.
12. It is acceptable for pregnant women to skip meals if they do not feel hungry.
13. It is possible for a pregnant woman to eat any type of food she wants.
14. I think it is acceptable to eat three or more meals per day during pregnancy.

Portion Sizes

15. I believe that it is valuable for pregnant women to learn about food portion sizes.
16. A pregnant woman should eat potatoes, injera, bread, etc. five times per day.
17. A pregnant woman should eat foods containing cooking oil and butter on a frequent basis.
18. A pregnant woman should consume fruits and vegetables on a daily basis.

19. A pregnant woman should eat milk/cheese, meat/eggs, and legumes three times a day.

Adequate Rest

20. A woman can become ill during pregnancy if she has not rested much.
21. A pregnant woman should have 1 - 2 hours of rest every day.
22. A pregnant woman should have at least 8 hours of sleep per night.
23. A pregnant woman should perform hard work throughout the day.
24. A pregnant woman who rests and sleeps in the daytime is lazy and unproductive.

Basic Nutrients

25. A pregnant woman should eat a variety of different types of foods
26. If a pregnant woman consumes *siwa* or locally produced alcohol, there will not be any problems for her health.
27. Pregnant women should not gain weight, since it can cause problems in the delivery process.
28. Pregnant women should obtain iron/folic acid and Vitamin A supplements from the health center.
29. Pregnant women should drink plenty of water every day.

Economic Empowerment

30. A pregnant women should support herself and her family by growing food.

31. I feel that the price of food at the village market or shop is not always affordable.
32. Preparing food based on locally available ingredients for pregnant women is better for health.
33. Pregnant women should work outside of her home and earn a living, rather than depending on her husband or family members.
34. Pregnant women should get support from their husband and family members when they are employed.

The additional sources of quantitative and qualitative data were part of secondary data. The quantitative data collected were taken from the Ethiopian Demographic Health Survey (2012) and the qualitative data from a dissertation with similar research (Piasecki, 2013). The existing survey and interview data taken from these documents focused on prenatal nutrition and maternal health. Because Ethiopia is a developing nation, Internet services are not as fully developed where all public records are digitized. For this reason, I had obtained other additional data in hard copy format later during the study from resources such as Ethiopian women's organizations, community organizations in the Tigray region, and the Ethiopian national government's statistics on maternal health (Janesick, 2011).

Study Variables and Measures

In addressing the relationship between the eight independent variables and the two dependent variables, the goal of the explanatory study was to establish the necessary connections of all of the variables. Frankfort-Nachmias and Nachmias (2008) pointed out

that the variables of a study are to be selected with regards to their relevance in terms of explaining the research question and the overall context of the study. The two dependent variables were maternal nutritional knowledge and maternal nutrition attitudes, while the two primary independent variables were the degree of implementation of the prenatal nutrition education program and education.

The other six quantitative independent variables were age, education, occupation, marital status, number of pregnancies, number of children and source of income of the participants. Maternal nutrition knowledge and maternal nutrition attitudes, the dependent variables, influenced prenatal nutrition education, age, and the occupation of each participant in question (Frankfort-Nachmias & Nachimas, 2008). Prenatal nutrition education was an understanding of the importance of prenatal nutrition and its effects on pregnancy before delivery. Age referred to women (18 - 49) years old. Occupation was the current job the participant holds. The source of income indicated where the financial support originates within participant's home. Marital status was defined as single, widowed, married, separated, or divorced. The number of pregnancies was defined on having at least one pregnancy. The number of children was defined as having at least one child or an unborn child. Education was defined as no education, primary education, secondary education or college education. I had selected the above independent variables, as they correspond to the context of my study, for example, living in poverty with inadequate income, little prospects for economic empowerment, and the common age range where inadequate nutritional knowledge occurred from researching prenatal nutrition education.

Procedure for Data Collection

According to the IRB guidelines from both Mekelle University and Walden University, for questionnaires and focus groups, permission was obtained from each participant and from Mekelle University as well. The adolescent girls and women, all between the ages of 18 - 49 years old, were informed about the nature of the study. Consent was retrieved from each participant before proceeding further. The dynamics and protocols of the study were carefully explained to each participant by the research assistants and the two Mekelle University faculty members. The faculty members had spoken to the community leaders of both villages and the Alaje District Health Office to obtain permission prior to working in Takha and Dejen.

With the support from Mekelle University, I did not have any difficulty in obtaining ethical clearance and permission. The participants were later identified and recruited for the research study. The rights of the participants were fully disclosed, where it was made clear that the participants' daily activities or privacy was not to be disturbed on any level. A written contract in Tigrinya was included on top of the survey questionnaire for verification; for those who were illiterate, a thumbprint was used for signing.

Since the sample size was 270 participants, Mekelle University had offered to provide five data collectors during the pretesting and posttesting phases; these data collectors were Master's students at Mekelle University, bilingual in both Tigrinya and English, to assist with the data collection. Prior to this, arrangements were made for translating the questionnaires from English to Tigrinya. With the help of the research

assistants, I had also assisted with the implementation as well. During the pretesting period, there were some errors and incomplete data and 12 survey questionnaires had to be redone in the control village, Dejen. Six survey questionnaires were also redone in the experimental village, Takha for the same reason during the pretesting period. The data collection during the pretesting and posttesting phases had each taken approximately a week to complete, both qualitative and quantitative data focus.

Qualitative Analysis

On the subject of reliability in the qualitative portion of this study, I had verified the facts and information from the focus groups by using two audio recorders when the focus groups were in session during the pretesting and posttesting phases. The recordings were later translated from Tigrinya to English, where the facts were further confirmed. The observations were also recorded during the focus groups session of each of the participants as well (Golafshani, 2003).

The validity depends on the type of qualitative research design that has been chosen (Golafshani, 2003). However, I did not choose any particular qualitative design such as case study, ethnography, phenomenon, or grounded theory for my dissertation study. Instead, I only chose to use elements common to qualitative research - focus groups and observations. For this reason, validity was not considered for the qualitative portion of this research study.

Sequential Quantitative Analysis

SPSS was used for data analysis in the quantitative portion of the study. There were two tests that were undertaken. As this is a comparative study, the descriptive

crosstabs statistical tests were used for the control and intervention villages. The *ANOVA* test was used afterwards for comparing at least three or more variables for statistical significance.

Upon finalizing the plans with the dissertation committee and obtaining IRB approval, I had traveled to Ethiopia for the second time in May - June 2014 to complete the pretesting phase. I made my final trip to Ethiopia in October 2014 for the posttesting period. The data were collected during the field visits to the village. Once this was done, the model building strategies, data generation and recording, and accurate description analysis of the data were narrated. The quantitative data were tracked in a research logbook, while the qualitative data were documented in my reflective journal.

For the purpose of justifying validity of the quantitative assessment process, the validity of the survey questionnaires were measured by the selected Mekelle University faculty members prior to the pretesting data collection and reliability assessment. Ten survey questionnaires were distributed during the normal business hours in Mekelle University. There were many constructive comments that were given and this helped to successfully shape the survey questions. Validity was also measured by evaluating each question from the survey questionnaire on five major criteria. These include the relevant content, cultural sensitivity, simplicity in meaning and comprehension, and adhering to the intentions of the questionnaire. It was made clear to the participants that there were no hidden meanings, agendas, or other intentions on my part when the survey questions are asked. The information presented by the research questions aligned towards the goals and purpose of the entire study (Teddlie & Tashakkori, 2011).

The reliability of the survey questionnaires was tested prior to the pretesting data collection using 12 survey questionnaires among adult Ethiopian village women (18 and over) in Adishuhu. The women villagers were encountered by the research assistants on a crowded Friday, the weekly market days for selling local goods. The research assistants asked 12 random women and tested the survey questions accordingly in Tigrinya. From the feedback received, the questions were well-received and very much appreciated by the women. While one of the most important tests for reliability is the test-retest method within the quantitative study, it was not possible to repeat the entire study due to the time and budget constraints (Teddlie & Tashakkori, 2011).

From the overall study, I had used ordinal levels of measurement. The ordinal levels of measurement were based on rank, particularly on educational level. This was on a scale of 1-4, where 1 = *no education*, 2 = *primary education*, 3 = *secondary education*, 4 = *college education* (Teddlie & Tashakkori, 2011).

Role of Researcher in Data Collection

As the author of this study, I am a trained nutrition specialist, consultant, and health/nutrition professor with experience working in international development and NGOs. Having also trained as a dietitian, I had gained strong familiarity with the prenatal nutrition education. During the visits to the villages, Takha and Dejen, I was accompanied by Mekelle University research assistants and faculty members and was responsible for the explanations of both pretest and posttest questionnaires and focus groups. I had distributed the consent form to the participants, where each and every participant will be given a clear explanation of the study's intention.

The qualitative data were collected from the focus groups and observations and recorded under my supervision. The quantitative data were collected from the pretest and posttest questionnaires and recorded by the Master's students also under my supervision. My major responsibility was to ensure that all data were genuinely accurate and properly maintained. Data were promptly recorded on the computer after the collection and back-up copies are made. Efforts were made to secure the collected data from the field sites at all times. The original data recorded were locked and secure in a safe place; only I have access to the original data. The original data will later be destroyed after 5 years from the date of data collection.

Data Analysis

Qualitative Data Analysis

For the qualitative data analysis portion, I chose to manually summarize the focus groups content to establish themes, patterns or relationships, as well as classifying, coding, and linking information on various topics. Some of the collected information was derived from the questions above, which included foods for pregnancy, educational background, and cultural traditions. As the research team was not familiar with computerized qualitative analysis programs such as NVivo 10, I chose to find appropriate information for simplifying transcriptions of the audio focus group data from both Takha and Dejen manually.

To maintain the evidence of quality standards, primarily in qualitative research, I verified the data and assisted towards the prevention of bias. With regards to the ordinal level of measurement, I intended to shift the direction in measurement of the women's

maternal nutrition attitudes and nutrition knowledge (Janesick, 2011). The method for data analysis I chose was the analyzing coding strategy. This strategy analyzed three main questions:

1. What was this content really about?
2. Why was the content interesting?
3. How did the content relate to the two qualitative research questions?

Quantitative Data Analysis

The independent and dependent variables were tested accordingly using the SPSS computer software program. There were only two SPSS tests undertaken: the descriptive crosstabs statistical tests and the one-way *ANOVA* (Green & Salkind, 2011). The descriptive crosstabs statistical test compares the control and intervention groups using the dependent variables of maternal nutrition knowledge and maternal nutrition attitudes, with the sociodemographic variables (Green & Salkind, 2011). The one-way *ANOVA* test was used by testing the dependent variable, maternal nutritional knowledge only, as string variables (maternal nutrition attitudes) cannot be measured. This test enabled me to determine the significance on the effect of the prenatal nutrition education program, education, marital status, number of pregnancies, number of children, age, income, and occupation (Green & Salkind, 2011).

Ethical Considerations

I addressed that all participants have a voluntary option to be a part of this study. As nutritional status and dietary concerns happened to be serious issues where emotions such as guilt, anger, or sadness could have arose, I needed to be sensitive and considerate

as possible towards the participants' feelings and emotional status. I also had to instruct the research assistants to engage in sensitivity as well. Participants were informed that they have the right to remove themselves from the study at any time without facing negative consequences. Strict confidentiality was guaranteed as part of the study as well. The consent form was also given and carefully explained with regards to both risks and benefits. I also took the time to maintain an atmosphere of confidentiality and trust throughout the study, as I felt that it was necessary to establish a climate of trust and respect during the survey questionnaire.

Summary

The major goal of this study was to observe how maternal nutritional knowledge and maternal nutrition attitudes in women and girls from 18-49 years of age in Ethiopia was correlated with the implementation of a prenatal nutrition program, education, marital status, number of pregnancies, number of children, age, source of income, and occupation. Because maternal nutritional knowledge and attitudes is an intricate problem that can be influenced by ambiguous factors, the mixed method design was chosen to extract indispensable information for better understanding with an emphasis on qualitative analysis. With the traditional experimental research design, I was able to test if prenatal nutrition education and education positively correlated with maternal nutrition knowledge and maternal nutrition attitudes. In reviewing the literature review from Chapter 2, there was a lack of visible information on the traditional research experimental design prenatal nutrition education's effects on maternal nutrition knowledge, behavior and attitudes. I believed that my mixed-methods study on prenatal nutrition education can

truly make a deep difference between life and death. I had also anticipated that new knowledge generated from this study can be geared towards health professionals throughout rural Ethiopia.

Chapter 4: Results

Introduction

At the beginning of the research study, pretesting survey questionnaires, focus groups and observations were conducted in both the control and experimental villages of Dejen and Takha. The questions from both the survey questionnaires and the focus groups were created to measure the maternal nutrition knowledge and attitudes among 270 participants along with the independent variables, the degree of implementation of prenatal nutrition education program, maternal age (18-49 years), education (primary/secondary completion, some primary/secondary completion, illiterate), source of income, marital status (single, married, widowed, separated or divorced), number of pregnancies (includes first time pregnancies, one or more), number of living children (one or more already born and not within gestation) and type of occupation.

The research study started with the pretest phase, progressed to the intervention phase which lasted 5 months, and then concluded with the posttest phase immediately after the five month intervention. The intervention that was introduced within this study was a prenatal nutrition education program that included the concepts of portion sizes, adequate rest, and one extra meal per day during pregnancy in Takha. The intervention took place over 5 months from late May 2014 through late September 2014. Two visits were made twice a month by me in June 2014 to Takha. After my departure from Ethiopia in late June 2014, the research team members made one visit in July 2014, two visits in August 2014 and two visits in September 2014. The research team members were in consistent contact by cell phone with the two health extension workers who were

implementing the intervention. Throughout the implementation process, positive feedback was consistently reported by the two health extension workers in Takha.

After the intervention period was completed in September 2014, the posttest survey questionnaires in both Dejen and Takha, combined with the focus groups and observations were conducted in October 2014. In Chapter 4, I present the results of the intervention and compared the pretest and the posttest data that were collected from the control and experimental villages of Dejen and Takha. The testing procedures and research questions were presented below along with a total of ten tables from both the qualitative and quantitative analysis.

Testing Procedures

The intervention was designed to incorporate the basic nutrition concepts (macronutrients and micronutrients) from the government of Ethiopia's National Nutrition Program, as well as my intervention program (portion sizes, one extra meal per day and adequate rest) within Takha. Throughout the course of the intervention, starting from late May 2014 till late September 2014, the two health extension workers continuously conducted intervention sessions at village gatherings taking place every week on Saturdays, Sundays and Tuesdays. These days were selected due to the availability of the village women and classes could be attended without interruptions.

With the support of the Alaje District public health director and the Takha health center head, the two health extension workers continuously held nutrition classes consisting of the researcher's intervention program. A minimum of 16 sessions were held per month. The classes incorporated the usage of the two visual aids provided by me and

consisted of portion sizes demonstrations using local foods. As Takha is divided into three smaller villages, Adigoomba, Shiket, and Qualenqual, three sessions of nutrition classes were held in each sub village, making the total amount of sessions of nine each week.

Qualitative Results

The qualitative results focused on the subjective aspects from the pretesting and posttesting phases of the focus groups and observations. A summary was created from the participants' answers of the five focus group questions in both Dejen and Takha. The summary provides the details of these answers and gives the reader an opportunity to make a comparison between the control and experimental villages. It appeared that Dejen participants had somewhat better knowledge on prenatal nutrition education than the Takha participants prior to the prenatal nutrition intervention program.

Table 1 shows the posttesting responses of the four focus groups that took place in both Dejen and Takha. The intervention that was administered within Takha appeared to yield the maximum positive effect when it came to Question 1, Questions 4, and Question 5, as there appeared to be more knowledge on the type of nutritious foods eaten and prenatal nutrition education.

The intervention had promoted prenatal nutrition education knowledge in Takha. As both Table 1 and Table 2 contain vast amounts of data, the results have been summarized.

Table 1

Pretesting Summary of Focus Group Questions from Control and Intervention Villages, Dejen and Takha

Question	Control Village – Dejen	Intervention Village - Takha
Tell me about your local cultural traditions and what you should you eat while you are pregnant.	14 female participants – 2 focus groups with 7 women each	14 female participants – 2 focus groups with 7 women each
Local and cultural foods	Roasted potatoes, cabbage, wheat injera, kicha and lentils	Flatbread, lentils, teff, legumes, chickpeas, kollo, milk and milk products, bananas, oranges, cabbages, porridges made from different cereals, occasionally meat
Food Taboos	No white-colored foods such as whey (watery part of churned milk or butter), local alcohol, but no strong food taboos known	Hot green peppers, *senafiche* (bitter-tasting pungent sauce eaten with raw meat), garlic, local alcohol should not be eaten during pregnancy
Perception of nutritious foods	Sorghum, wheat, red teff, soups, meat, milk, cabbage, tomato, potato, pumpkin, bread, chickpea sauce and egg	Honey, egg, chicken meat, meat (other animals) and the vegetables (cabbage, onion and lettuce, lentils, teff, flatbread, milk and milk products, bananas, oranges, porridges
How are you supporting your family financially? Are you getting enough food?		
Economic Support	Except for R4, only one respondent, all participants are housewives and completely dependent on husbands for income; R4 sells eggs at market to buy market foods and items	Only R5 and R6 from the first intervention focus group sell grains and alcohol for income; the rest are all housewives and dependent on their husbands
Attitudes towards pregnant women	Pregnant women are respected and not required to work hard or carry heavy items	Expectations are for women to run the household but should not work too hard or carry heavy items
What are the major types of food you eat? Has this changed when you became pregnant? Why or why not?		
Major Types of Food	Injera, flatbread, kollo (roasted barley), chickpea, lentils, broad bean, legumes, boiled milk; if income is available, fruits such as banana and orange	Injera, flatbread, kollo (roasted barley), chickpea, lentils, broad bean, legumes, boiled milk, fruits such as banana and orange
Changes in Food Habits	Poor appetite and changes in tastes towards food during pregnancy	Poor appetite, meat products are more expensive than carbohydrates, fruits and vegetables; food habits changes due to supply and demand of accessible foods
What medical services have you sought when you are or were pregnant? Were any of the services on prenatal nutrition?		
Medical Services	Supplementation, pregnancy status, prenatal nutrition education	Monthly prenatal follow- up, urine and HIV/AIDS tests, pregnancy examination, supplementation, family planning, good hygiene practices

(table continues)

Question	Control Village – Dejen	Intervention Village - Takha
Prenatal Nutrition Education Information	Limited information and general lack of awareness: a) Small, frequent meals b) Variety of foods encouraged c) Soft foods – soups and porridges	General information provided, but not specific or detailed: a) Clean food consumption encouraged b) Eating injera with hot chickpea sauce, not cold sauces c) Some foods provided by health clinic from government program such as cooking oils and lentil d) Variety of foods encouraged
Perceptions of nutritious food	Participants already know that eating well produces a healthy child and promotes good nutrition; honey, cabbage, carrots, tomatoes, bananas, potatoes, eggs, oranges, injera are nutritious; items such as meat, milk and milk products	Meat, milk and milk products, carrots, tomatoes, honey, bananas, potatoes, cabbage, eggs, oranges, porridge, bread, honey, green-leafy vegetables, injera
Barriers to certain foods	Expensive items such as meat, milk and milk products are difficult to afford; market is very far from the village; having children less than a year; self-care discouraged, poverty	Lack of knowledge to select nutritious foods; butcher shop not available, so meat is difficult to obtain; market day is fixed in nearby town; lack of income, poverty

Table 2

Posttesting Summary of Focus Group Questions from Control and Intervention Villages, Dejen and Takha

Question	Control Village – Dejen	Intervention Village - Takha
Tell me about your local cultural traditions and what you should you eat while you are pregnant.	14 female participants – 2 focus groups with 7 women each	14 female participants – 2 focus groups with 7 women each
Local and cultural foods	Injera with lentils, porridge, eggs, sorghum, meat, tomatoes, potatoes, honey and milk are consumed. Injera made of teff is also popular.	Wheat injera, porridge, potatoes, legumes and lentils such as dekoko and wefcho, milk, butter, macaroni, barley, peas, broadbean, cabbage, carrots, lettuce and potatoes
Food Taboos	Areqi (local alcohol), green peppers and senafiche should not be consumed, but no real food taboos are available.	Coca-Cola and local alcohol such as 'areqi' and 'siwa', and roasted chickpeas should not be eaten; general food taboos are not common
Perception of nutritious foods	Meat and milk are considered to be the nutritious foods by participants.	Meat appears to be the type of food that all respondents agree that is healthy.
How are you supporting your family financially? Are you getting enough food?		
Economic Support	Women do household activities such as cooking, cleaning, and laundry. R6 states she sells animals, grains, and local alcohol for income generation. R10 sells cattle, goat and chickens. R14 sells tomatoes and potatoes.	Household activities are common and most women do not work. The activities are cooking, cleaning, keeping animals, doing the laundry and Only R4 said she sells chicken and sheep when available.
Attitudes towards pregnant women	No walking long distances or lifting heavy objects.	Pregnant women should not walk long distances or lift heavy objects; some work hard and others do not do much work
What are the major types of food you eat? Has this changed when you became pregnant? Why or why not?		
Major Types of Food	The same types of food are consumed, such as lentils, coffee, bread, injera, beans, and vegetables like tomatoes and cabbage.	The major types of food consumed are lentils (shero), coffee, bread, injera, beans, chickpeas, flat bread, porridge, macaroni, and vegetables like cabbage, and carrots. Fruits like banana and oranges are consumed.
Changes in Food Habits	Some pregnant women dislike eating lentils (shero). The economy and poverty has made it difficult for many pregnant women to obtain desired foods.	Respondents have stated that eating once a day per day can take place during pregnancy, but it was agreed that women should eat 2-3 times per day. Changing food habits can be due to hating the foods available, health problems or poverty. However, the women want to have a healthy baby after delivery and want to make sure the child grows well.

(table continues)

Question	Control Village – Dejen	Intervention Village - Takha
What medical services have you sought when you are or were pregnant? Were any of the services on prenatal nutrition?		
Medical Services	Education given for HIV, immunization, iron, pregnancy status, and basic nutrition education and infant feeding.	Family planning, immunization, screening for malnutrition, delivery and postnatal services are administered. Some foods like corn soya blend and oil were previously given, but not anymore.
Prenatal Nutrition Education Information	Very basic nutrition education is administered as given by the National Nutrition Program of Ethiopia.	The same foods should not be eaten throughout the day; whatever healthy food that is available should be eaten. Iron education is sometimes discussed. However, the information is not specific, as the types and contents of foods are not discussed.
What are some factors that have influenced you to buy nutritious food while pregnant? What foods do you consider to be nutritious?		
Perceptions of nutritious food	Foods like meat, milk, injera, tomatoes, bananas, and oranges are nutritious. Vegetables of all kinds are good for health.	Different vegetables, meat, lentils, legumes, milk, injera, honey, and porridge are considered nutritious foods.
Barriers to certain foods	Poverty and the lack of money are the main problems for the respondents. The respondents have also cited the remote location of Dejen and lack of knowledge and awareness of nutritious foods. There is no butcher shop in Dejen for obtaining meat products.	Lack of accessibility to food, high prices of fruits and vegetables, poor nutrition, lack of awareness, long distances to the nearest marketplace town, and poor prioritization are the largest barriers.

Observations

There were two focus groups in the pretesting phase that were conducted in the control village, Dejen, and two focus groups conducted in the experimental village, Takha. To promote one-on-one interaction, each focus group consisted of seven participants. Of the 14 women that had participated in the control village (Dejen) focus groups, only four participants (29%) had some education. However, in the experimental village (Takha), six participants (43%) of the 14 women in the two focus groups had some education. Within each focus group in both Takha and Dejen, only one to two women were outspoken and willingly volunteered information during the pretesting and posttesting phases.

From observing the participants in the pretesting phase, the highest percentage of respondents answered Question 1 at 89.2% in both the control and experimental villages, while the lowest percentage answered Question 2 at 57.1%. The women appeared to be very aware of their cultural traditions and the necessary foods, but only a total of four respondents out of 28 participants stated that they are economically independent. Table 3 illustrates the observations that were made from the pretesting group. To summarize Table 3, most of participants had knowledge on cultural traditions and foods in both the control and intervention villages.

The last qualitative table illustrated is the posttesting group observations in Table 4. Table 4 also has a similar layout and format from Table 3. While the same participants were not targeted, 14 women from Dejen and 14 women from Takha were also selected for the focus groups. In both tables, the highest percentage of women in the posttesting

group answered Question 5 at 67.9%, whereas the lowest percentage of women in the post-testing phase answered Question #3 at 39.2%. To summarize Table 4, the intervention program had promoted better knowledge of prenatal nutrition on factors and nutritious foods in both the control and intervention villages.

Table 3

Pretesting Phase of Number of Respondents in Control and Intervention Villages who Answered the Focus Group Questions

Focus Group Question	Control		Intervention		Total	%
	FG#1	FG#2	FG #1	FG #2		
Q#1 – Cultural traditions and foods	6/7	6/7	6/7	7/7	25/28	89.2
Q#2 – Economic Empowerment	4/7	6/7	3/7	3/7	16/28	57.1
Q#3 – Major types of food, Changes in Food Habits	4/7	6/7	3/7	6/7	19/28	67.9
Q#4 – Medical Services & Prenatal Nut. Ed.	2/7	7/7	5/7	4/7	18/28	64.2
Q#5 – Factors & Nutritious Foods	4/7	5/7	4/7	5/7	18/28	64.2

Table 4

Posttesting Phase of Number of Respondents in Control and Intervention Villages who Answered the Focus Group Questions

Focus Group Question	Control		Intervention		Total	**%**
	FG#1	FG#2	FG #1	FG #2		
Q#1 – Cultural traditions and foods	6/7	3/7	3/7	4/7	16/28	57.1
Q#2 – Economic Empowerment	4/7	3/7	2/7	4/7	13/28	46.4
Q#3 – Major types of food, Changes in Food Habits	1/7	2/7	2/7	6/7	11/28	39.2
Q#4 – Medical Services & Prenatal Nut. Ed.	4/7	4/7	3/7	5/7	16/28	57.1
Q#5 – Factors & Nutritious Foods	5/7	3/7	4/7	7/7	19/28	67.9

Quantitative Results

The quantitative aspect of this study played a minor role and had limited significance, notably on portion sizes information from the intervention program. Within the pretesting and posttesting periods for the quantitative part of this study, the survey questions were divided into categories to compare the control and the experimental villages. These categories were the sociodemographic variables, maternal nutrition knowledge, and maternal nutrition attitudes. There were eight quantitative tables that were displayed, where four tables displayed the pretesting results and the other four tables displayed posttesting results. The data for sociodemographic variables, maternal nutrition knowledge scores, maternal nutrition attitude scores, and the one-way *ANOVA* results were displayed to give the reader an overview of the quantitative standpoint of this study.

Pretesting Results

The pretesting sociodemographic characteristics had determined the baseline data of the participants in both Dejen and Takha. These included the marital status, source of income, education, pregnancy status, number of pregnancies, occupation, and the whether the participant had obtained prenatal nutrition education beforehand. The four categories of maternal nutrition knowledge were one extra meal per day, adequate rest, portion sizes, and basic nutrients. Among the survey questions reflecting attitudes, the opinions of the participants were taken into consideration, including on the topic of economic empowerment within the survey questionnaire.

Table 5 presents the information on sociodemographic variables. The response was within the group of participants from 18-49 years from 270 respondents. Approximately 84% of the participants were married and approximately 72% were uneducated. The mean age of participants was 30.58, with a standard deviation of 7.7. 94.8% of the participants earned their income from agriculture and 79.2% were farmers. 79.6% of the participants have had information on prenatal nutrition education before. Ten percent of the participants were pregnant, 47.4% of participants had one to three pregnancies, and 51.9% had one to three children.

Table 6 presents the participants from the control and experimental villages on the knowledge categories of one extra meal per day, adequate rest and portion sizes. The scores from 0.0-4.0 indicate how much the participants scored for each intervention category: extra meal knowledge, adequate rest knowledge and portion size knowledge. For the extra meal knowledge, 73% of the participants had 3.0 out of 4.0 of the correct answers, whereas only 8.1% had all four questions correct. Within the adequate rest knowledge questions, while there were 79.3% of all the participants scored 3.0 out of 4.0, 0.0% had all four answers correct. However, within the portion sizes knowledge category, the participants had 65.2% scored 4.0 out of 4.0, the highest percentage.

Due to the large amount of information, the data results are presented in Table 5 and Table 6. No statistically significant findings were found between the intervention and control groups in either Table 5 or Table 6.

Table 5

Baseline Pretesting Sociodemographic Characteristics of Respondents on Control and Intervention Villages Tigray Region, Northern Ethiopia; N= 270

Variable	Control		Intervention		Total	
	Freq.	(%)	Freq.	(%)	Freq.	(%)
Marital Status						
Married	117	51.1	112	48.9	229	84.8
Single	3	1.1	2	0.7	5	1.8
Widowed, Separated or Divorced	15	5.6	21	7.9	36	13.5
Education						
None	85	31.5	109	40.4	194	71.9
Primary (1-8)	33	12.2	20	7.4	53	19.6
Secondary (9-12)	14	5.2	5	1.9	19	7.0
College	3	1.1	1	0.4	4	1.5
Source of Income						
Agriculture	125	46.3	131	48.5	256	94.8
Merchant Business	2	0.7	1	0.4	3	1.1
Government Salary	4	1.5	1	0.4	5	1.9
Agriculture, Merchant	3	1.1	0	0	3	1.1
Other	1	0.4	2	0.7	3	1.1
Pregnancy Status						
Yes	12	4.4	15	5.6	27	10.0
No	123	45.6	120	44.4	243	90.0
No. of Pregnancies						
Prime-gravida (1-3)	67	24.7	61	22.6	128	47.3
Multi-gravida (4-5)	34	12.5	42	15.6	76	28.1
Grad-multiple (6 or more)	34	12.6	32	11.8	66	24.4
No. of Children						
None (0)	0	0	2	0.7	2	0.7
Prime-para (1-3)	73	26.4	67	24.8	140	51.2
Multi-para (4-5)	44	16.3	44	16.3	88	32.6
Grad multiple (6 or more)	18	6.6	22	8.2	40	14.8
Occupation						
Unemployed	16	5.9	2	0.7	18	6.6
Housewife	25	9.3	1	0.4	26	9.7
Government Employee	4	1.5	0	0	4	1.5
Farmer	84	31.1	130	48.1	214	79.2
Other	6	2.2	2	0.7	8	2.9
Info on prenatal nutrition education obtained?						
Yes	114	42.2	101	37.4	215	79.6
No	21	7.8	34	12.6	55	20.4

Table 6

Baseline Pretesting of Maternal Nutrition Knowledge Scores on Control and Intervention Villages Tigray Region, Northern Ethiopia

Variable	Control Freq.	(%)	Intervention Freq.	(%)	Total Freq.	(%)
Extra Meal Knowledge						
0.0	0	0	1	0.4	1	0.4
1.0	4	1.5	0	0	4	1.5
2.0	25	9.3	21	7.8	46	17.1
3.0	93	34.4	104	38.5	197	73.0
4.0	13	4.8	9	3.3	22	8.1
Adequate Rest Knowledge						
0.0	1	0.4	0	0	1	0.4
1.0	5	1.9	5	1.9	10	3.7
2.0	21	7.8	24	8.9	45	16.7
3.0	108	40.0	106	39.3	214	79.3
Portion Sizes Knowledge						
0.0	0	0	0	0	0	0
1.0	2	0.7	4	1.5	6	2.2
2.0	12	4.4	10	3.7	22	8.1
3.0	35	13.0	31	11.5	66	24.4
4.0	86	31.9	90	33.3	176	65.2

The three maternal nutrition attitude categories presented in Table 7 that corresponded with the intervention were pregnant women working hard, learning about portion sizes, and the perceived laziness from sleeping and resting. For pregnant women working hard, 62.2% strongly agreed as the highest percentage. In learning about portion sizes, 64.4% strongly agreed this was necessary. With regards to the perceived laziness from sleeping and resting in the daytime, 68.5% disagreed or strongly disagreed and felt that pregnant women should be given the option to rest or sleep. No statistically significant findings were found between the intervention and control groups in Table 7.

Table 7

Baseline Pretesting Maternal Nutrition Attitudes of Respondents on Control and Intervention Villages Tigray Region, Northern Ethiopia

Variable	Control		Intervention		Total	
	Freq.	%	Freq.	%	Freq.	%
Portion sizes						
Supportive	129	47.8	130	48.1	259	95.9
Unsupportive	6	2.2	5	1.9	11	4.1
Resting, Sleeping						
Supportive	39	14.4	42	35.6	135	50.0
Unsupportive	96	15.6	93	34.4	135	50.0
Hard work						
Supportive	14	5.2	8	3.0	22	8.1
Unsupportive	121	44.8	127	47.0	248	91.9

Table 8 demonstrates the one-way *ANOVA* test, where the dependent variable, maternal nutrition knowledge was tested. The one-way *ANOVA* test does not allow for testing string variables, so the maternal nutrition attitudes were not measured. Instead, the one-way *ANOVA* test only indicated the significance and measurements of the portion size knowledge, adequate rest knowledge, and extra meal knowledge that were tested from the prenatal nutrition educational intervention program. No statistically significant findings were observed in either the intervention or control groups.

Table 8

Pretesting One-way ANOVA for Comparison of the Dependent Variables, Maternal Nutrition Knowledge and Maternal Nutrition Attitudes

Variable	Types	Sum of Squares	*df*	Mean Square	*F*	Sig.
Portion size knowledge	Between Groups	.015	1	.015	.027	.870
	Within Groups	147.304	268	.550		
	Total	147.319	269			
Adequate rest knowledge	Between Groups	.000	1	.000	.000	1.000
	Within Groups	76.874	268	.287		
	Total	76.874	269			
Extra meal knowledge	Between Groups	.093	1	.093	281	.597
	Within Groups	88.370	268	.330		
	Total	88.473	269			

Posttesting Results

Table 9 illustrates both the control and intervention sociodemographic variables from the posttesting results from both the villages of Dejen and Takha. This information

was collected in October 2014 after the intervention program was implemented. As this is a community intervention study, the same participants from the pretesting phase were not recruited for the survey questionnaires. Of the participants, 85.9% were married and 77.0% were uneducated. The mean age in years was 32.1. 20% of the participants were pregnant, 40.4% of participants had one to three pregnancies; but, only 15.2% of participants had one to three children compared to 29.6% having 4-5 children. 96.7% of the participants earned their income from agriculture and 71.9% of the participants were farmers. Of the participants, 91.8% of participants also stated they had access to prenatal nutrition education.

As with Table 6, Table 10 illustrates the scores of the knowledge components concerning extra meals, adequate rest and portion sizes for the participants in Dejen and Takha during the posttesting phase. For the extra meal knowledge, 67.8% scored 3.0 out of 4.0 and only 3.0% scored 4.0 out of 4.0. On the adequate rest knowledge, 78.1% scored 3.0 out of 3.0, the highest percentage. With regards to the portion size knowledge, 83.7% scored 3.0 out of 4.0 and only 3.0% scored all the questions correct at 4.0 out of 4.0. No statistically significant findings were observed in either the intervention or control groups for Table 9 and Table 10.

Table 9

Posttesting Sociodemographic Characteristics of Respondents on Control and Intervention Villages Tigray Region, Northern Ethiopia; N= 270

Variable	Control		Intervention		Total	
	Freq.	(%)	Freq.	(%)	Freq.	(%)
Marital Status						
Married	117	43.3	115	42.6	232	85.9
Single	1	0.7	3	2.2	4	1.5
Widowed, Separated or Divorced	17	6.3	17	6.2	34	12.5
Education						
None	103	38.1	105	38.9	208	77.0
Primary (1-8)	19	7.0	27	10.0	46	17.0
Secondary (9-12)	10	3.7	3	1.1	13	4.8
College	3	1.1	0	0.0	3	1.1
Source of Income						
Agriculture	130	48.1	131	48.5	261	96.7
Merchant Business	0	0.0	0	0.0	0	0.0
Government Salary	4	1.5	2	0.7	6	2.2
Agriculture, Merchant	0	0.0	0	0.0	0	0.0
Other	1	0.4	2	0.7	3	1.1
Pregnancy Status						
Yes	31	11.5	23	8.5	54	20.0
No	104	38.5	112	41.5	216	80.0
No. of Pregnancies						
Prim-gravida (1-3)	52	19.2	57	21.2	109	40.4
Multi-gravida (4-5)	41	15.2	35	12.9	76	28.1
Grand-multi- gravida (6 or more)	42	15.6	43	16.0	85	31.6
No. of Children						
None (0)	4	1.5	6	4.4	10	3.7
Prime-para (1-3)	23	8.5	18	6.7	41	15.2
Multi-para (4-5)	45	16.7	35	12.9	80	29.6
Grad multiple (6 or more)	27	10.1	35	13.0	62	23.1
Occupation						
Unemployed	4	1.5	14	5.2	18	6.7
Housewife	25	9.3	27	10.0	52	19.3
Government Employee	3	1.1	0	0.0	3	1.1
Farmer	102	37.8	92	34.1	194	71.9
Other	1	0.4	2	0.8	3	1.2
Info on prenatal nutrition education obtained?						
Yes	120	44.4	128	47.4	248	91.8
No	15	5.6	7	2.6	22	8.2

Table 10

Posttesting Maternal Nutrition Knowledge Scores of Respondents on Control and Intervention Villages Tigray Region, Northern Ethiopia

Variable	Control Freq.	(%)	Intervention Freq.	(%)	Total Freq.	(%)
Extra Meal Knowledge						
0.0	0	0.0	1	0.4	1	0.4
1.0	2	0.7	10	3.7	12	4.4
2.0	44	16.3	22	8.1	66	24.4
3.0	86	31.9	97	35.9	183	67.8
4.0	3	1.1	5	1.9	8	3.0
Adequate Rest Knowledge						
0.0	7	2.6	2	0.7	9	3.3
1.0	1	0.4	10	3.7	11	4.1
2.0	16	5.9	23	8.5	39	14.4
3.0	111	41.1	100	37.7	211	78.1
Portion Sizes Knowledge						
0.0	0	0.0	2	0.7	2	0.7
1.0	2	0.7	9	3.3	11	4.1
2.0	12	4.4	11	4.1	23	8.5
3.0	115	42.6	111	41.1	226	83.7
4.0	6	2.2	2	0.7	8	3.0

Table 11 indicates the posttesting phase of maternal nutrition attitudes with its relationship to the intervention themes of portion sizes, adequate rest and hard work. The results indicated that 93.3% of all participants supported learning about portion sizes. 88.5% of the participants disagreed that pregnant women are lazy when sleeping and resting during the daytime. Finally, 55.9% of the participants expressed unsupportive opinions that pregnant women should work hard throughout the day. There were no statistically significant results that were shown in the control or the intervention groups.

Table 11

Posttesting Scores of Maternal Nutrition Attitudes of Respondents on Control and Intervention Villages Tigray Region, Northern Ethiopia

Variable	Control		Intervention		Total	
	Freq.	%	Freq.	%	Freq.	%
Portion sizes						
Supportive	128	47.4	124	45.9	252	93.3
Unsupportive	7	2.6	11	4.1	18	6.7
Sleeping, resting						
Supportive	15	5.6	16	5.9	31	11.5
Unsupportive	120	44.4	119	44.1	239	88.5
Hard work						
Supportive	71	26.3	48	17.8	119	44.1
Unsupportive	64	23.7	87	32.2	151	55.9

The final quantitative table, Table 12, compares the first dependent variable, maternal nutrition knowledge, with the control and experimental villages. While there were no significant differences in the pretesting one-way *ANOVA* table, the only significant difference shown is the portion sizes knowledge at 0.013. This indicates that the intervention had its effect in the experimental village of Takha, as the concept of portion sizes was largely regarded as a new and unknown lesson. Adequate rest and the importance of eating one extra meal per day seemed to be understood by most of the participants, as these concepts appeared to be easier for comprehension compared to portion sizes. The knowledge of portion sizes was the most statistically significant in the intervention and control groups.

Table 12

Posttesting One-way ANOVA for Comparison of Dependent Variables, Maternal Nutrition Knowledge, Maternal Nutrition Attitudes

Variable	Types	Sum of Squares	*df*	Mean Square	*F*	Sig.
Portion size knowledge	Between Groups	1.959	1	1.959	6.237	.013*
	Within Groups	84.193	268	.314		
	Total	86.152	269			
Adequate rest knowledge	Between Groups	.370	1	.370	.736	.392
	Within Groups	134.948	268	.504		
	Total	135.319	269			
Extra meal knowledge	Between Groups	.093	1	.093	.238	.626
	Within Groups	104.148	268	.389		
	Total	104.241	269			

*The portion size knowledge was the only statistically significant finding.

Evidence of Trustworthiness

Throughout the course of the study, the research assistants and research supervisors throughout the pretesting and posttesting phases were very clear to the participants that their consent was voluntary for the entire study. The consent form was presented in Tigrinya to all of the participants. Very few women refused to participate and indicated they were not interested. However, through the translation, the research assistants and research supervisors reported in both the pretesting and posttesting phases that they encountered little resistance and no problems with the survey questionnaires and focus groups. According to the research assistants, the participants were quite eager to speak to them and encountered little hesitation.

On the notion of the qualitative research, my research team and I continued to expand the community intervention in Takha. Along with the health extension workers in Dejen and Takha, I chose to randomly recruit women from 18-49 years of age to prevent bias. The answer to the first of the three qualitative questions was that the content focused on the maternal nutrition attitudes and knowledge related to cultural traditions, economic empowerment, and major types of foods, medical services, and factors of nutritious foods. For the second question, the content is interesting because it gives valuable and critical perceptions and opinions of how the participants feel about cultural attitudes of foods, economic empowerment. The final question was that the content was related towards the women's willingness to learn about nutrition; factors that hampered better nutrition were the lack of awareness and knowledge, poverty and cultural expectations of working hard throughout the day. Some of the key perceived factors were oriented

towards not eating at least 3 times per day, complete dependence on the husband or other family member for income, and limited variety and availability of foods in the village and market.

The issues of dependability and conformability were addressed with the two research supervisors, both who had translated the focus groups from Tigrinya to English. It was important to ensure that both non pregnant women and pregnant women were selected according to the required criteria. The research supervisors had already made arrangements with the health extension workers and the head of the health centers ahead of time prior to data collection. To assist with the coding, the focus groups were first translated with the help of the research supervisors. Afterwards, I summarized the themes within the charts above. I found that it was much easier to summarize and code by hand rather than use any computerized qualitative research analysis program.

Summary

In Chapter 4, I highlighted and explained the findings from the research study on both qualitative methods, with a smaller emphasis on the quantitative methods. The major aspects of the study showed how the focus group questions were categorized, according to maternal nutrition attitudes and nutrition knowledge. The focus group responses and observations also related to the overall theme and intervention of the study. Statistical analysis, using the SPSS program, was performed for the quantitative analysis, while the focus groups and observations analysis were primarily conducted manually.

Chapter 5: Discussion, Conclusions, and Recommendations

Introduction and Overview

Throughout this dissertation study, my purpose was to explore and understand how the implementation of a supplemental prenatal nutrition education program (concurrently with an Ethiopian sponsored one, treatment or control villages), including eight other independent variables was related to the two dependent variables, maternal nutrition knowledge and maternal nutrition attitudes in two rural villages. This was a comparative and qualitatively weighted mixed-methods study using the traditional experimental research design, where Dejen (n = 135, equally split between pregnant and non pregnant women) served as the control village and Takha (n = 135, also equally split between pregnant and non pregnant women) served as the intervention village. Prior to this, there was no scientifically based existing research related the economic development theory to maternal nutrition knowledge and maternal nutrition attitudes within the rural Tigray region of Ethiopia.

Within scholarly literature, this study was designed to fill a gap concerning maternal nutritional health in rural Ethiopia. Both samples of women were pretested prior to the five month intervention program, then posttested immediately afterwards. The results of the qualitative study were used to design the quantitative survey questionnaires.

The findings of this research study are based both on the qualitative and quantitative scale on a comparative level. The study also included a set of factors that have correlated the prenatal nutrition educational program along with age, pregnancy status, number of children, source of income, education level, occupation and marital

status with maternal nutrition knowledge, and maternal nutrition attitudes. These factors include basic nutrients and economic empowerment, combined with the three components of the intervention, portion sizes, adequate rest and eating one extra meal per day. The results of this study support existing literature review in collaboration with the economic development theory.

Interpretation of Findings

The total sample size of the study was 270 women. The control village, Dejen had 135 women and the intervention village, Takha also had 135 women. The sample women from both groups ranged in age from 18 to 49 years old. The primary occupation of the women was agriculture, with a smaller percentage of unemployed workers, housewives, laborers, or government workers. As there is one quantitative research question, one set of null and alternative hypotheses and two qualitative research questions, this section is divided accordingly to address all of the research questions.

Qualitative Research Questions

There were two qualitative research questions that were presented. The first qualitative research question was: What are some of the key behaviors concerning maternal nutritional knowledge and maternal nutrition attitudes on food and cultural practices concerning prenatal nutrition education from the combined interventions of the government maternal nutrition program and the additional program in the rural Ethiopian intervention village of Takha in the Alaje district? To answer this question during the pretesting phase, the key behaviors were the acceptance of a variety of foods for consumption and the avoidance of local alcohol, garlic, senafiche, and hot green peppers

during pregnancy. Foods that were frequently eaten included animal products, fruits, vegetables and injera. No strong food taboos existed for pregnant women. However, during the posttesting phase after the intervention was administered, the key behaviors were the acceptance of meat for consumption, instead of a variety of foods. Pregnant women also avoided local alcohol, and roasted chickpeas. Strong food taboos were also unavailable.

After the intervention was conducted, the focus group participants' behaviors indicated that the pregnant women should eat an extra meal per day for better health in the posttesting phase. On the subject of portion sizes, the women had responded that eating the correct amounts of foods at mealtimes will produce healthy children. As for adequate rest, the focus group participants stated that pregnant women should not do heavy work and rest when needed. From this analysis of the posttesting focus group, the intervention had positive effects on the participants' maternal nutrition attitudes and maternal nutrition knowledge.

The second qualitative question was: What are some of the key perceived factors that might impact the maternal nutrition knowledge and maternal nutrition attitudes of a pregnant woman in the rural Ethiopian villages of Takha and Dejen in the Alaje district? During the pretesting and posttesting phases, some of the key factors that have impacted both maternal nutrition knowledge and maternal nutrition attitudes are poverty, little or no education, the lack of economic empowerment and independence due to cultural beliefs, food insecurity, high prices of food (particularly animal products like milk and meat), and the lack of prioritization towards health. While the focus group participants in

Takha displayed much gratitude with the intervention and wanted to improve their nutritional status, the factors mentioned above have heavily influenced maternal nutrition knowledge and maternal nutrition attitudes.

In further incorporating and answering both the qualitative research questions, the two tables that presented the observations from the pretesting and posttesting phases were also compared. It appeared that the pretesting focus groups in both Dejen and Takha were far more interactive than the posttesting groups, since more participants had answered all of the focus group questions. This is very likely to be related towards the level of education among the participants in the pretesting phase. After the implementation of the intervention in Takha; however, more women in posttesting phase, particularly in the last two focus groups, had given satisfactory answers on the perceptions of nutritious foods. This indicated that intervention could have positively impacted the opinions of the focus group participants. Overall, the participants in the posttesting focus groups in Takha had provided positive feedback and commented that the prenatal nutrition education lessons were helpful and beneficial.

Quantitative Research Question

During the pretesting phase, in both Takha and Dejen, the majority of the participants were married (84.8%). In comparison during the posttesting phase, 85.9% of all participants were married. More women in the posttesting phase were illiterate or had no education at 77%, compared to 71.9 % in the pretesting phase. The marital status and education percentages were not statistically significant. However, 79.6% of the participants had received some prenatal nutrition education during the pretesting phase,

and this number was much higher during the posttesting phase at 91.8%. The implications indicated that the intervention promoted prenatal nutrition education awareness. The intervention in Takha, which was consistently implemented, could have also accounted for the higher percentage of prenatal nutrition education information, despite a higher illiteracy rate.

Identical participants were not surveyed in either Takha or Dejen, as many participants frequently move from one village to another for economic and personal reasons. In Takha only, 47.4% of the participants received some form of prenatal nutrition education, which included the intervention. This occurrence may be due to the frequent migration, lack of interest, or inability to attend the prenatal nutrition classes; the result could indicate why it has only a slightly higher percentage than Dejen at 44.4%.

Maternal nutrition knowledge tested on the concepts of extra meal, adequate knowledge and portion sizes were measured in both Takha and Dejen. Prior to the intervention in Takha, during the pretesting phase, 38.5 % participants in Takha scored 3.0 out of 4.0 in the extra meal knowledge, 39.3% of participants scored 3.0 out of 3.0 in adequate rest knowledge, and 33.3% scored 4.0 out of 4.0 in the portion size knowledge. In comparison, after the intervention was administered in the posttesting phase, 35.9% of participants scored 3.0 out of 4.0 in extra meal knowledge, 37.7% scored 3.0 out of 3.0 in adequate rest knowledge and 41.1% scored 3.0 out of 4.0, while only 0.7% scored 4.0 out of 4.0. The knowledge on adequate rest, extra meal, and portion sizes are critical for understanding prenatal nutrition basic concepts. However, while the percentages of the participants of the posttesting phase were slightly lower than the pretesting phase, this

indicated that the intervention did not have a strong effect in the intervention village of Takha as expected.

In answering the quantitative research question, the nature of the implementation of the prenatal nutrition program on maternal nutrition knowledge had a small effect because of two major factors that cannot be controlled, migration and illiteracy of the participants. Moreover, on a possibly smaller scale, the higher percentage of uneducated participants can also be blamed for the possible lack of interest in attending a prenatal nutrition education class altogether, leading to the unavailability of the participants. It should also be made clear that the intervention program had only affected the education and degree of implementation of the prenatal nutrition program variables, not the other six variables.

With regards to maternal nutrition attitudes, it appeared that the intervention had a positive effect primarily that on discouraging hard work throughout the day and encouraging adequate rest. In Takha, 17.8% of participants in the pretesting phase gave supportive views on pregnant women working hard; but, only 3.0% of the participants in the posttesting phase supported this view. In the pretesting phase, while 35.6% of the participants in Takha supported the view that a pregnant woman is lazy and unproductive when sleeping or resting in the day, this was reduced to 5.9% in the posttesting phase. The participants understood that pregnant women should not do heavy-handed tasks and should rest and/or sleep from time to time. For learning portion sizes, however, both the pretesting and posttesting phases in Takha gave strong supportive views; the

posttesting phase had a slight decrease at 2.2% on supportive views. The slight decrease can be attributed once again to a higher percentage of uneducated and illiterate participants in the posttesting phase in Takha.

On the one-way *ANOVA* comparisons of the dependent variables concerning knowledge (portion sizes, adequate rest, and extra meal), the posttesting phase indicated that the portion size knowledge was the most significant in Takha, whereas the adequate rest and extra meal knowledge were not significant at all. None of the values in the pretesting phase came as significant. However, the nature of the relationship of the prenatal nutrition education program indeed had a positive effect, but only on the knowledge of portion sizes in Takha. The reason behind this limited significance implied that adequate rest and eating one extra meal per day were not completely novel concepts to the participants and may have been introduced in the government nutrition program, but with much less emphasis. On the other hand, the portion sizes concept was completely new and unknown to the participants and perhaps much more appreciated by the participants, since it is not covered by the National Nutrition Program administered by the Government of Ethiopia.

Hypothesis

According to the results, the alternate hypothesis was correct, although a positive effect from the intervention program was not universally observed. For the maternal nutrition knowledge, the concept of portion sizes was most positively affected. With regards to the maternal nutrition attitudes, the support for adequate rest and discouragement of hard work were most affected positively.

With regards to the null and alternative hypothesis, the data supported the alternate hypothesis. As the data proved that the portion sizes knowledge was significant in the posttesting phase, the null hypothesis was rejected. On the notion of the adequate rest and extra meal knowledge from the pretesting to the posttesting phases, the significance of adequate rest had dropped closer to a significant number from 1.00 in the pretesting phase to 0.392 in the posttesting phase. The significance rate for extra meal knowledge had slightly increased from 0.597 in the pretesting phase to 0.626 in the posttesting phase after the intervention. Maternal nutrition knowledge and maternal nutrition attitudes had a positive and statistically significant relationship with the implementation of the prenatal nutrition intervention program and education, in favor of the alternate hypothesis.

Limitations

In exploring the limitations of this study, the first limitation was to find and choose the most desirable villages in the Alaje district that were comparable in size, population, and demographics. I was not able finalize the chosen villages for my study prior to my arrival in Ethiopia. I first chose two villages called Seret and Ahmedwuha on an arbitrary basis. However, it was found that Seret was located in a very remote area where very few foreigners had gone and was difficult to travel due to the unpaved dirt roads. The rented vehicle could not be used for traveling on rough roads under arduous conditions. Ahmedwuha was located on the border of the Tigray and Amhara state, where the main language is Akan. No one on the research team spoke Akan and possible translation difficulties were predicted. For all of these reasons, these two villages were

dropped. After consulting with the Alaje district head officer and the research team, Dejen and Takha were both chosen instead.

In addition to population, demographics, and size, the two villages chosen for the comparative study had to be at least 25-30 kilometers apart to prevent internal validity bias, primarily on testing and the diffusion of treatment. Despite the fact that Dejen and Takha were included in the study, Dejen had a smaller population of villagers comparable to Takha. Because of the geographical location, the villages located near Takha could not be used in the study because of their close proximity to the nearest town, Adishuhu. After much research, there were no other villages that were found at a significant distance from Takha other than Dejen. Dejen was the only acceptable option that was determined by the research team.

The second limitation was that the same participants could not be used either in the pretesting or posttesting phases. If the same participants were surveyed and selected for focus groups, the results may have been different, although there is no guarantee the participants would have been available for the study. Many of villagers in both Dejen and Takha do not have permanent residences and frequently move elsewhere for a variety of reasons. Migration is done throughout the year. Moreover, keeping the participants' identities anonymous was strongly recommended, since this is the most appropriate way to protect the participants from possible ethical problems and violations. Most of the participants were unable to afford the cost of a cell phone, as phone services can be very expensive for the average Ethiopian villager. Telephone communication, particularly in Dejen, was very difficult because of the poor network availability, due to its remote

location. Takha and Dejen also frequently suffer from electrical and power outages, leading to intermittent network disturbance. From all these factors, the study was determined to be more of a community intervention rather than an individual intervention.

The third limitation was my inability to speak the local language, Tigrinya. To further elaborate, while research assistants were hired by the researcher to conduct the survey questionnaires for language communication and the prevention of bias from participants seeing a foreign researcher, the research assistants, all current or former master's students at Mekelle University, were not all experienced in data collection. There were mistakes that were made in the survey questionnaires that had to be corrected in both the pretesting and posttesting phases. A handful of survey questionnaires had to be redone until satisfaction was achieved.

Tigrinya and English do not have any common language origins and are different linguistically, so information may have been lost during the translation from both the survey questionnaires and focus groups. As the research supervisors had explained during the study, it can be challenging to find the equivalent of a word, statement or idea in Tigrinya and directly translate it into English or vice versa. If this was the case, the context of the matter had to be explained specifically and clearly when direct translation was not possible.

The fourth and final limitation is bias with regards to gender. With the exception of only one data collector in the posttesting phase and myself, the research supervisors and the rest of the data collectors were all male. Possible bias from answering the survey

questions and/or the focus group questions could have occurred for cultural reasons, as Ethiopian women are not taught to mingle freely with Ethiopian men. Some of the village participants in the study may have felt intimidated, shy or uncomfortable in speaking to data collectors and research supervisors about subjects related to prenatal nutrition. The research supervisors had also stated that some of the participants appeared introverted and had to be encouraged and prodded gently to speak when asked the focus group questions. This was also reported by a few of the male data collectors during the pretesting and posttesting phases to a very small extent.

Future Recommendations

Prenatal nutrition is a subject that requires many years of studying and practical experience. In order to develop a solid comprehension and understanding, especially for low-income and low-literacy populations, prenatal nutrition programs need to cover some of the basic aspects of nutrition. While the National Nutrition Program from the Government of Ethiopia does have some nutrition information, this was not fully administered within the health clinics of either Dejen or Takha. According to the National Nutrition Program booklet distributed in Tigrinya, very little information is present on prenatal nutrition education. Few participants have completed secondary school or are college-educated in both Dejen and Takha; most participants were illiterate or had very little education. This presents a critical need for a simple program on prenatal nutrition education.

I recommend future intervention studies for implementing prenatal nutrition education throughout rural villages in Ethiopia. While the intervention on portion sizes,

adequate rest, and having extra meals per day was a fine start, more components need to be included within the intervention over a longer period of time. Along with portion sizes, adequate rest, and eating extra meals, some of these components should include detailed functions of macronutrients and micronutrients, the major food groups, the food pyramid, food safety, proper hygiene, common pregnancy problems and remedies (such as nausea, vomiting, constipation and diarrhea), and the understanding the clinical assessment of prenatal tests. The importance of iron, folic acid, and Vitamin A should also be stressed. If the intervention is to be expanded with all of these components, the time period should be at least 8-12 months or longer. Within the National Nutrition Program, the booklet available at health centers should include all of the above sections for teaching prenatal nutrition in Tigrinya and other local languages.

The second recommendation, as addressed in the sections on limitations for this research study, is increase the sample size of the villages. The sample size of 270 women is fair and accurate, but should be increased to 500-1000 women for the maximum effect. Instead of making this study a community intervention, the same women can participate both in the pretesting and posttesting phases of the study. There is no guarantee that all of the results would be significant, but the accuracy of the implementation could be much greater and possibly yield more desirable results. Because of finances, current circumstances, and the amount of time involved, using a larger sample would have not been possible at the present time.

The third recommendation for this study could have included more female data collectors and focus group coordinators for the possibility of preventing bias, because of

cultural reasons and the conservative nature of Ethiopian society. From the observations I have made, several participants appeared to be more comfortable in speaking freely with other women, rather than men. While there is no guarantee that the results will be better, hiring more female data collectors and focus group coordinators could possibly promote favorable results for similar future studies. At Mekelle University, there were no female research supervisors or professionally experienced female data collectors available at the present time for this research study.

The final recommendation should include the importance of economic empowerment and changing traditional attitudes within the prenatal nutrition educational intervention program. It is not enough to only speak about prenatal nutrition education, but also to address the critical factors that are prevalent in both Dejen and Takha, such as poverty, food insecurity, and high prices of food. Based from the evidence presented in Chapter 2 from the literature review, economic development and empowerment can provide greater access to prenatal nutrition education. Economic empowerment combined with prenatal nutrition, where pregnant women can earn a living, can be added to the intervention. Encouraging the women to become entrepreneurs, such as selling vegetables and/or fruits, cooked food, crafts, etc. would be very beneficial for household income and better health on a long-term basis. From the evidence presented by the pretesting and posttesting data, very few women earned an independent living and most were dependent on their husbands or families for financial security, income and food. If Ethiopian village women can become more educated and economically independent, they would be able to sustain themselves with better health.

Implications for Social Change

The potential for social change will be felt at the community level and at the organizational level. Because this research study is a community intervention, the health extension workers spent 3 days per week implementing the intervention in Takha through the sub-villages of Qualenqual, Adigoomba and Shiket. Armed with new information and knowledge, both pregnant and non pregnant women alike would have been able to greatly benefit from prenatal nutrition education. Village women would have the opportunities to use local foods and make approximate measures on how much to eat when cooking and serving food for themselves and their families. The participants in these health education classes can also spread their newfound knowledge with other women who have not been exposed to the intervention and empower them as well.

While the intervention of prenatal nutrition education program is not a new idea, this research study has still made a positive difference. As Ethiopia has among the highest rates of maternal mortality in the world, introducing self-help measures and prenatal nutrition education along with other behavior change communication strategies could yield positive outcomes on both short-term and long-term basis. The findings and recommendations that have been presented can be definitely used by researchers and practitioners alike who are interested in prenatal nutrition education. The research design of this study is also familiar to an experienced researcher, and this study can be repeated to generate results in a similar environment either in the Tigray region or another region throughout Ethiopia. As Ethiopia has a very rich and ancient culture, traditional attitudes

towards foods can also help to create more detailed survey questionnaires, focus group questions and an advanced intervention program.

Reflection of the Researcher

I felt that my experience as a researcher in completing my PhD dissertation in Ethiopia has been one of the best in my lifetime. In having a very keen interest in international development and global health, I had wanted to make a difference within a culture and country that was entirely different from my cultural background and origin. For my study, I had made a total of three trips to Ethiopia. The first trip consisted of meeting my mentor, Dr. Usha Kulkarni, part of the research team, as well as the nutrition and health faculty of Mekelle University. I had presented my study to the health and nutrition faculty at Mekelle University in September 2013 and received critical and valuable feedback. The second trip allowed me to spend a total of 2 months in Ethiopia gathering the pretesting data and conducting the pretesting data analysis from May-June 2014. The final trip in October 2014 consisted of spending 2 weeks to collect the posttesting data and analysis. In all of these three trips, I was successfully able to cultivate strong and lasting relationships with my research team and the departmental faculty at Mekelle University.

I had established an international NGO in 2011 called American Hindu World Service and is currently doing work in HIV/AIDS, nutrition and Ebola virus awareness and programs in the slums of Lagos, Nigeria, and promoting education to poor schoolchildren in Rawalpindi, Pakistan. In the future, I would hope to use my contacts and experiences in Ethiopia to promote nutritional awareness among women on future

projects, after the completion of my PhD program by presenting the findings to government agencies, prominent NGOs and community organizations within both Ethiopia and the United States.

Relationship With Public Policy and Administration

With regards to the link with public policy and administration, nutrition plays a critical role in food policy and should not be ignored. This is especially important for the developing world. Advocacy on awareness in nutrition has been increasingly seen in many non governmental and private organizations, such as International Food and Research Policy Institute (IFPRI), StC, UNICEF, and USAID. These organizations have encouraged governments of developing nations, including Ethiopia, in promoting better prenatal nutrition. If the national government can adopt policies on prenatal nutrition, the state and local governments can help to implement those policies and keep prenatal nutrition a priority.

Some of the interventions that can be included with regards to prenatal nutrition can be maternal nutrition dietary considerations, vitamin/mineral supplementation during pregnancy, and the fortification of staple foods. However, the five major challenges that governments of developing countries frequently face are cross-sectoral coordination, low quality human resources, limited advocacy and social pressure, lack of financial resources, and poor nutrition awareness (Ecker & Nene, 2012). While Ethiopia has taken major steps to address poor prenatal health and the lack of nutrition education among pregnant women in addressing these challenges, this study has indicated that there is a very long road ahead.

Conclusion

This study has yielded critical evidence on prenatal nutrition education. Although the findings can be corroborated or refuted by other researchers in similar future research studies, the evidence has displayed how a community intervention on prenatal nutrition education can make a difference in the lives of poor and disadvantaged women. The improvement and accessibility of prenatal nutrition education is not just only the responsibility of the community, but also health care centers, NGOs, women's rights groups, local government, state government, and the national government of Ethiopia. Finally, the pregnant woman herself has an obligation to have a healthy pregnancy with the support of her family. If this proactive attitude is being taken seriously into consideration by all the parties involved, a pregnant woman in rural Ethiopia will have a better chance of living a healthier and happier life for herself and her children.

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Appendix A: Survey Questions

Socioeconomic Demographic Questions:

1) What is your age? _____(15-49 years)

2) What is your marital status?
1. Married
2. Single
3. Widowed
4. Separated
5. Divorced

3) What is your educational level?
1. Illiterate
2. Some primary education
3. Completed Primary Education
4. Some Secondary Education
5. Completed Secondary Education

4) What is your occupation?

5) What is your source of income?

6) Are you pregnant? Yes No

7) How many pregnancies have you had? _____

8) How many living children, who have been born and are alive, do you have? _____

9) Did you get information on prenatal nutrition education?

1. Yes
2. No

Theme: One extra meal per day

10) A pregnant woman should eat healthy and good quality food.

□ Strongly Agree □ Agree □ Neutral □ Disagree □ Strongly Disagree

11) A pregnant woman should eat first at mealtimes.

□ Strongly Agree □ Agree □ Neutral □ Disagree □ Strongly Disagree

12) It is acceptable for pregnant women to skip meals if they do not feel hungry.

□ Strongly Agree □ Agree □ Neutral □ Disagree □ Strongly Disagree

13) It is possible for a pregnant woman to eat any type of food she wants.

□ Strongly Agree □ Agree □ Neutral □ Disagree □ Strongly Disagree

14) I think it is acceptable to eat three or more meals per day during pregnancy.

□ Strongly Agree □ Agree □ Neutral □ Disagree □ Strongly Disagree

Theme: Portion Sizes

15) I believe it is valuable for pregnant women to learn about food portion sizes.

□ Strongly Agree □ Agree □ Neutral □ Disagree □ Strongly Disagree

16) A pregnant woman should eat potatoes, injera, bread, etc. five times per day.

□ Strongly Agree □ Agree □ Neutral □ Disagree □ Strongly Disagree

17) A pregnant woman should eat foods containing cooking oil and butter on a frequent basis.

□ Strongly Agree □ Agree □ Neutral □ Disagree □ Strongly Disagree

18) A pregnant woman should consume fruits and vegetables on a daily basis.

□ Strongly Agree □ Agree □ Neutral □ Disagree □ Strongly Disagree

19) A pregnant woman should eat milk/cheese, meat/eggs, and legumes three times a day.

□ Strongly Agree □ Agree □ Neutral □ Disagree □ Strongly Disagree

Theme: Adequate Rest

20) A woman can become ill during pregnancy if she has not rested much.

□ Strongly Agree □ Agree □ Neutral □ Disagree □ Strongly Disagree

21) A pregnant woman should have 1-2 hours of rest every day.

□ Strongly Agree □ Agree □ Neutral □ Disagree □ Strongly Disagree

22) A pregnant woman should have at least 8 hours of sleep per night.

□ Strongly Agree □ Agree □ Neutral □ Disagree □ Strongly Disagree

23) A pregnant woman should perform hard work throughout the day.

□ Strongly Agree □ Agree □ Neutral □ Disagree □ Strongly Disagree

24) A pregnant woman who rests and sleeps in the daytime is lazy and unproductive.

□ Strongly Agree □ Agree □ Neutral □ Disagree □ Strongly Disagree

Theme: Basic Nutrients

25) A pregnant woman should eat a variety of different types of foods.

□ Strongly Agree □ Agree □ Neutral □ Disagree □ Strongly Disagree

26) If a pregnant woman consumes *siwa* or locally produced alcohol, there will not be any problems for her health.

□ Strongly Agree □ Agree □ Neutral □ Disagree □ Strongly Disagree

27) Pregnant women should not gain weight, since it can cause problems in the delivery process.

□ Strongly Agree □ Agree □ Neutral □ Disagree □ Strongly Disagree

28) Pregnant women should obtain iron/folic acid and Vitamin A supplements from the health center.

□ Strongly Agree □ Agree □ Neutral □ Disagree □ Strongly Disagree

29) Pregnant women should drink plenty of water every day.

□ Strongly Agree □ Agree □ Neutral □ Disagree □ Strongly Disagree

Theme: Economic Empowerment

30) A pregnant women should support herself and her family by growing food.

□ Strongly Agree □ Agree □ Neutral □ Disagree □ Strongly Disagree

31) The price of food at the village market or shop is expensive.

□ Strongly Agree □ Agree □ Neutral □ Disagree □ Strongly Disagree

32) Preparing food based on locally available ingredients for pregnant women is better for health.

□ Strongly Agree □ Agree □ Neutral □ Disagree □ Strongly Disagree

33) Pregnant women should work outside of her home and earn a living, rather than depending on her husband or family members.

□ Strongly Agree □ Agree □ Neutral □ Disagree □ Strongly Disagree

34) Pregnant women should get support from their husband and family members when they are employed.

□ Strongly Agree □ Agree □ Neutral □ Disagree □ Strongly Disagree

Appendix B: Qualitative Focus Group Questions

1) Tell me about your local cultural traditions and what you should you eat while you are pregnant.

2) How are you supporting your family financially?

3) What are the major types of food you eat? Has this changed when you became pregnant? Why or why not?

4) What medical services have you sought when you are or were pregnant? Were any of these services on prenatal nutrition?

5) What food do you consider to be nutritious for pregnant women? What are some factors that have influenced you not to buy nutritious food while pregnant?

Appendix C: Observation Checklist

1) Appearance of Participant and Dwelling of Participant

First level: □ Clothing □ Age □ Physical Appearance

Second level: □ Profession

2) Verbal behaviors and interactions of Participant

First level:

□ Who speaks to whom and for how long □ Who initiates the interaction

□ Tone of voice

Second Level: □ Dynamics of interaction

3) Physical interactions of Participant

First level: □ What people do □ Who does what □ Who interacts with whom

Second Level: □ Emotional communication and body language of participants

□ Emotions related to levels of interaction regarding social status, class, or profession

4) Personal Space and Human Traffic

First Level: □ How close people stand to one another □ People who arrive, stay or leave

Second Level: □ Individual preferences of personal space

□ Where people enter and exit □ How long people will stay □ Number of people

□ Whether they are alone or accompanied

5) People who stand out

First Level: □ Identification of people who receive much attention

Second Level: □ Characteristics of the individuals □ What differentiates between others

□ Whether people consult them or they approach other people □ Strangers or friends

Appendix D: Consent Forms

CONSENT FORM - ADULTS

You are invited to take part in a research study of the effect of prenatal nutrition program on maternal nutrition status in Dejen and Takha, Alaje district, Tigray region, Ethiopia. The researcher is inviting young women and girls from the ages of 18-49 who is or was pregnant to be in the study. This form is part of a process called "informed consent" to allow you to understand this study before deciding whether to take part.

This study is being conducted by a researcher named Divya L. Selvakumar, who is a doctoral student at Walden University at the School of Public Policy and Administration. She is currently collaborating with Mekelle University in Northern Ethiopia for her research. Divya is also a nutrition specialist, consultant and professor based in Laurel, Maryland, USA.

Background Information:
The purpose of this study is to compare whether an increase in prenatal nutrition knowledge reduced maternal mortality for young women and girls in two rural villages of the Tigray region of Ethiopia.

Procedures:

If you agree to be in this study, you will be asked to:

- Answer all survey questions (pretest and posttest questions)
- Answer all focus group questions, if selected
- Attend prenatal nutrition education seminar
- Duration: survey should take 5-10 minutes, focus group: 30 minutes and prenatal nutrition education program: 30 minutes-1 hour

Voluntary Nature of the Study:
This study is voluntary. Everyone will respect your decision of whether or not you choose to be in the study. No one at Mekelle University will treat you differently if you decide not to be in the study. If you decide to join the study now, you can still change your mind later. You may stop at any time.

Risks and Benefits of Being in the Study:
Being in this type of study involves some risk of the minor discomforts that can be encountered in daily life, such as becoming upset or sensitive. Being in this study would not pose risk to your safety or wellbeing.

The greatest benefits are obtaining knowledge on prenatal nutrition education and a greater sense of appreciation for food and nutritional health during pregnancy. The participants will be able to empower themselves from the knowledge acquired.

Payment:
There will be no payment offered.

Privacy:
Any information you provide will be kept confidential. The researcher will not use your personal information for any purposes outside of this research project. Also, the researcher will not include your name or anything else that could identify you in the study reports. Data will be kept secure by password combination on the computer and by storing it in a secure file cabinet with lock and key. Data will be kept for a period of at least 5 years, as required by the university.

Contacts and Questions:
You may ask any questions you have now. Or if you have questions later, you may contact the researcher via e-mail at divya.selvakumar@waldenu.edu

If you want to talk privately about your rights as a participant, you can call Dr. Afework Mulugeta. He is the Mekelle University representative who can discuss this with you. Mekelle University's approval number for this study is **ERC0309/2014** and it expires on **January 16, 2015.**

The researcher will give you an extra copy of this form to keep.

Statement of Consent:

I have read the above information and I feel I understand the study well enough to make a decision about my involvement. By signing below, I consent and understand that I am agreeing to the terms described above.

Printed Name of Participant _____

Date of Content _____

Participant's Signature _____

Researcher's Signature _____

COOPERATION OF RESEARCH ASSISTANT FORM

(Date)

Dear Research Assistant,

As we discussed earlier, our plan for your involvement in my study involves the following tasks:

- Conducting 34 survey questions using the Likert Scale (strongly agree, agree, neutral, disagree and strongly disagree) in person

If you agree to be part of this research project, my university requires that all research assistants maintain complete confidentiality of ALL the participants involved in this study.

During the course of your involvement in this study, you will have access to information that is confidential and should not be disclosed. By agreeing to serve as a research assistant, you are agreeing to the following confidentiality standards:

1. The data yielded by participants must be kept confidential during the data collection process, which means that no one is permitted to see or overhear a participant's data, including other participants and family/friends of the participant.
2. Participant identities are confidential. You will not disclose to anyone who participated and who didn't.
3. You will not disclose or discuss any confidential information with others, including your friends or family.
4. You will not in any way divulge, copy, release, sell, loan, alter or destroy any confidential information except as properly authorized by the researcher in this document.
5. You will not discuss confidential information where others can overhear the conversation (such disclosures are inappropriate even if the participant's name is not used).
6. You will not make any unauthorized transmissions, inquiries, modification or purging of confidential information.
7. You will store research data in a secure manner, under lock and key (or password protection, in the case of electronic files).
8. You will keep data in a manner that protects the privacy of participants and ensures that individual participants are not identifiable by outside parties.
9. You agree that any obligations under this agreement will continue after completion of the research assistant tasks.

Mekelle University also requires that you uphold the following ethical principles for research outlined:

1. Informed consent must be obtained from all research participants. This means that they must be fully informed about the study before being asked to make a decision about participation.
2. People may not be pressured into research participation. For example, it is not appropriate for people to be recruited while they are waiting for a health provider appointment (afterward would be less coercive). Further, no one who is an authority figure or service provider may be involved in participant recruitment because it would be difficult for a person to say no.
3. Potential harms to participants must be minimized. Any time that you suspect a person's participation might result in psychological, physical, social, or professional harm, you should terminate their participation in the study in a non-stigmatizing manner.

As the principal investigator in this research project, my responsibilities include the following:

1. I must train you in the ethical principles of informed consent, voluntary research participation, research confidentiality, and protection of human subjects prior to your interaction with research participants.
2. I must report any unexpected or adverse events that occur during data collection to Mekelle University's ethics committee (Institutional Review Board) within 1 week.
3. I must coordinate a system that will allow you to report any unexpected or adverse events to me within 24 hours, if I am not physically present with you during participant recruitment or data collection.
4. I must request Mekelle University committee's (IRB's) approval before making any modification to the research procedures or forms (this means that you may not implement modifications until I have confirmation of approval).
5. I must maintain complete and accurate records of all research activities (including consent forms and collected data).
6. I am liable for your actions as a research assistant. I must address any grievances or claims that are formally filed against you within the justice system or any other organization's system.

I will coordinate the exact dates and times of data collection with you at a later time. If your circumstances change, please contact me via email divya.selvakumar@waldenu.edu so we can amend this agreement.

I am requesting your signature to document that we have mutually agreed upon our roles and responsibilities within this study.

The terms of compensation for your research assistant role will be laid out in a separate document. Please note that our mutual adherence to the terms in this document is independent from any financial arrangement we make.

Sincerely,
Divya L. Selvakumar, Researcher

Printed Name of Research Assistant _____

Date _____

Research Assistant's Written Signature _____

Research Written Signature _____

Appendix E: Explanations of Survey and Focus Group Questions

Theme: One Meal Per Day

1) A pregnant woman should eat healthy and good quality food during pregnancy.

Explanation: To have a pregnancy with optimal outcome, it is necessary to eat adequate amounts of carbohydrates, protein, fats, vitamins and minerals. Traditional Ethiopian food does provide all of these nutrients. If the food is clean and of good quality, a pregnant woman should be able to have a healthy pregnancy throughout the next nine months until delivery. The intervention focuses on eating healthy meals.

2) A pregnant woman should eat first at mealtimes.

Explanation: Ethiopian society traditionally gives preference to boys and men over girls and women. Gender discrimination can affect the health of women and girls. For example, boys will be given larger portions, while girls are made to eat leftovers or smaller portions. When a woman becomes pregnant, she should be given as much as food as possible and not be among the last in her family to eat. In other words, she should be treated equally like the rest of her family members.

3) It is acceptable for pregnant women to skip meals if they do not feel hungry

Explanation: Many pregnant rural women and young girls may have the opportunity to eat adequate food throughout their pregnancies. However, due to cultural beliefs, pregnant women may also feel they do not have to eat at certain times and should eat only when hungry. The prenatal nutrition education program will teach basic concepts of nutrients such as carbohydrates, fats, proteins, vitamins and minerals; all nutrients are critical for preventing complications during pregnancy.

4) It is possible for a pregnant woman to eat any type of food she wants.

Explanation: Certain foods that are high in fat, sugars or salt should be avoided. However, food insecurity is a very serious problem in many parts of the developing world, including Ethiopia. As there are many reasons why food security might happen such as low income, famine, natural disaster, etc., the nutrition status of the mother can be affected when adequate food is not available. For this reason, pregnant women may have to eat whatever food is available to prevent starvation, even if the nutritional quality might be below average.

5) I think it is acceptable to eat three or more meals per day during my pregnancy.

Explanation: To gain weight adequately and to maintain the health of the mother and unborn child, it is recommended that a pregnant woman should eat as often as necessary.

While the meals do not have to be large portions, spreading the meals throughout the day can be beneficial for the pregnant woman to obtain vital nutrients. As part of my intervention, the lesson of portion sizes will be taught to the participants.

Theme: Portion Sizes

6) I believe that it is valuable for pregnant women to learn about food portion sizes.

Explanation: Pregnant young women and girls are often given more access towards prenatal nutrition education if they are able to pay for prenatal health checkups. Prenatal nutrition education falls under the preventive branch of medicine. If the income is not enough to cover a physician's visit, the treatment aspect would be focused upon, with little or no prenatal nutrition education given after the treatment is administered. The intervention will give free access to esteemed information.

7) A pregnant woman should eat potatoes, injera, bread, etc. five times per day.

Explanation: If the woman or girl is self-employed and has a small plot of land or farm, she can raise animals for the purpose of feeding her family or selling them at the market. This would indicate that the woman is economically empowered and independent. Depending on demand, a woman or girl's nutritional status can be assessed according to how much protein she gets during her pregnancy.

8) A pregnant woman should eat foods containing cooking oil and butter on a frequent basis.

Explanation: There are many reasons why a pregnant woman eats smaller portions at meals. This can be due to food insecurity, gender discrimination, illness, or cultural beliefs. However, the amount of food that is given or available for a pregnant woman to consume determines her weight gain throughout the pregnancy. A pregnant woman should eat adequately for her weight and height at meal times.

9) A pregnant woman should consume fruits and vegetables on a daily basis.

Explanation: Fruits and vegetables contain several important nutrients that are highly beneficial for both the health of the mother and unborn child. These include, but are not limited to Vitamin A, iron, fiber, and folate. Daily intake of fruits and vegetables combined with protein and carbohydrates are mandatory for sustaining optimal maternal nutritional health.

10) A pregnant woman should eat milk/cheese, meat/eggs, and legumes three times a day.

Explanation: Ethiopian food has a wide variety of cuisines that are both vegetarian and non-vegetarian. The tradition of abstaining from any meat, fish or egg products goes back to ancient times through the rituals of the Ethiopian Orthodox Church. Vegetarians can still get adequate protein by consuming lentils, beans, milk and cheese. All of these protein products are very much part of Ethiopian cuisine and are commonly consumed throughout the Tigray region as well.

Theme: Adequate Rest

11) A woman can become ill during pregnancy if she has not rested much.

Explanation: A pregnant woman may have experienced constant pain or is unable to take care of herself because of an unknown medical condition or illness. She can also experience problems from stress or excess physical labor. She needs to be given enough time to relax, while other family members can take over the more labor-intensive chores and responsibilities. Illness can lead to a variety of problems such iron-deficiency anemia and frequent infections. When a woman is not healthy throughout her pregnancy and is constantly ill, the health of the child after delivery can be drastically affected from poor nutrition. Moreover, a woman or girl can be at risk for bleeding heavily during delivery and after childbirth.

12) A pregnant woman should have 1-2 hours of rest every day.

Explanation: Resting for at least a couple hours a day gives many benefits. For example, some of these benefits include more energy, reduction of stress, lower blood pressure, and reduction of the heart rate to normal levels. Without adequate rest, the pregnant woman is likely to experience more illness and stress that can be detrimental to the development of her unborn child, both on short-term and long-term levels.

13) A pregnant woman should have at least 8 hours of sleep per night.

Explanation: On the average, it is recommended that a pregnant woman should try to get at least 7-8 hours of sleep per night. Less than this can cause lethargy and fatigue. Sleep is also beneficial for her health and the unborn child.

14) A pregnant woman should perform hard work throughout the day.

Explanation: Despite being pregnant, a woman in Ethiopian society may still have to clean, cook, and look after her family. She may still be obligated to work in the fields or tend to the family farm. Other family members need to take this into consideration. Therefore, adequate rest is needed and tasks that require hard work and intense labor should be delegated to other appropriate family members.

15) A pregnant woman who rests and sleeps in the daytime is lazy and unproductive.

Explanation: Insomnia or the lack of adequate rest can cause even greater health problems such as suppressing the immune system, chronic fatigue, and mental depression for a pregnant woman. However, because Ethiopian women are often expected to work during pregnancy, they may have to deal with accusations or criticisms of being lazy, if they choose to rest or sleep in the daytime. Sleep can help to prevent medical complications in pregnancy such as premature birth and vascular disease.

Theme: Basic Nutrients

16) A pregnant woman should eat a variety of different types of foods.

Explanation: Consuming a variety of different foods throughout pregnancy is ideal for obtaining all the adequate nutrients. While traditional Ethiopian village cuisine does contain many different types of foods, some foods may be more difficult to obtain due to low income, food insecurity or living in remote areas.

17) If a pregnant woman consumes *siwa* or locally produced alcohol, there will not be any problems for her health.

Explanation: It is not recommended for a pregnant woman to consume any type of alcoholic beverage at any time due to possible negative effects on the development of the fetus and mental/physical problems of the child after delivery. While alcohol is not acceptable in Muslim communities, it is accepted within Christian communities throughout Ethiopia. For this reason, while *siwa* can be sold as a source of income for the family, a pregnant woman should be cautious and stay away from *siwa* at all times.

18) Pregnant women should not gain weight, since it can cause problems in the delivery process.

Explanation: Weight gain is essential for the development of the unborn child. Poor nutrient intake can lead to premature birth, heavy bleeding and complications during labor and childbirth. Even if the woman carries her child to full term and delivers, the baby can still suffer from health consequences such as a decreased immune system, neurological problems, or physical disabilities.

19) Pregnant women should obtain iron/folic acid and Vitamin A supplements from the health center.

Explanation: Nutritional supplements are recommended if a pregnant woman's iron/folic acid and Vitamin A levels are at low levels. However, eating foods containing iron/folic acid and Vitamin A is the best option, instead of depending on supplements. Periods of

drought, famine, or food security can cause difficulties in obtaining adequate foods with Vitamin A, folic acid or iron. In such cases, supplementation is the solution.

20) Pregnant women should drink plenty of water every day.

Explanation: Water is the best source of hydration and prevents many complications such as dehydration and fluid imbalance throughout pregnancy. Clean drinking water should be consumed throughout the day, at least 7-8 cups with meals and while working, walking, or between meals.

Theme: Economic Empowerment

21) A pregnant women should support herself and her family by growing food.

Explanation: While many rural women and young girls can grow their own foods, this may not be possible if the land is owned by another person. The production of food can be an advantage for employment, economic benefits and better prenatal nutritional status. The knowledge derived from treatment program can help participants choose healthy and nutritious foods at the local markets or shops.

22) The price of food at the village market or shop is expensive.

Explanation: Corruption, mismanagement and fraud are also problems that many villagers have to face, due to the unscrupulous middlemen. Obtaining income and making any profits could be problematic and can interfere in buying food, thereby affecting the livelihood of the woman or girl. This can also lead to lower availability of nutritious food or poor quality food, negatively affecting prenatal nutrition.

23) Preparing food based on locally available ingredients for pregnant women is better for health.

Explanation: Local produce and staples can contain valuable nutrients, but should be freshly available and of good quality. If nearby shops or markets do not have quality foods, a woman or girl would have to seek nutritious food elsewhere. In encouraging sustainability and economic empowerment, women and girls should have the opportunity to cook their food and feed themselves using local food throughout their pregnancies. When food is made through imported ingredients, the prices can become very expensive.

24) Pregnant women should work outside of her home and earn a living, rather than depending on her husband or family members.

Explanation: As indicated in the literature review, economic empowerment and independence can overwhelmingly increase access to prenatal nutrition education and quality food. When a woman or girl is completely reliant on a family member to provide

for her, this can be a disadvantage if that family member is ill, abusive, neglected or works far from the home. Multiple incomes and sharing financial responsibilities can not only increase confidence, but can allow a family to live comfortably even during difficult periods such as famine or drought.

25) Pregnant women should get support from their husband and family members when they are employed.

Explanation: Economic empowerment can be beneficial to women, as it will give them a sense of confidence and independence in earning a living. Depending on the type of profession, a pregnant woman can still support herself and her family from her earnings and wages. However, the traditional view of Ethiopian women may be very much in existence in conservative households, where the woman is expected play the role of a housewife.

The following questions below reflect the independent variables, which influence maternal nutrition knowledge.

26) What is your age? _____ (18-49 years)

27) What is your marital status? Married Single Widowed Divorced Separated

28) What is your educational level? Illiterate Some primary education Completed Primary Education Some Secondary Education Completed Secondary Education

29) What is your household income?

30) Are you pregnant? Yes No

31) How many living children, who have been born and are alive, do you have?

32) How many pregnancies have you had?

33) What is your occupation?

34) Did you get information on prenatal nutrition education? Yes No

Focus Group Questions

1) Tell me about your local cultural traditions and what you can eat while you are pregnant.

Explanation: As described in the literature review from the prenatal nutrition section, there are cultural traditions in Ethiopian that may be obsolete or harmful for pregnant women concerning the intake of some nutritious foods. Some of the cultural traditions can be traced from the answers, and may determine if the prenatal educational nutrition program treatment might be related to a change in the pregnant participant's views on nutritional foods. While the harmful cultural traditions would be addressed, the beneficial cultural traditions will be given more attention within the prenatal nutrition education program.

2) How are you supporting your family financially?

Explanation: If a pregnant woman is or was employed when pregnant, the type of job could explain the current economic status of the person, e.g. laborer, farmer, shopkeeper, etc. The results may also indicate if the occupational salary is steady, periodic, or very occasional. Judging from what foods are being bought, I can stress the high priority of food during prenatal nutrition. The income that is generated can relate to the types and amount of food for the pregnant women.

3) What are the major types of food you eat? Has this changed when you became pregnant? Why or why not?

Explanation: This question indicates the main types of food that the participants eat often or on a daily basis. The diet patterns can change during pregnancy, but this can vary from the variety of foods available. Some women and girls may experience common problems such as nausea, vomiting, diarrhea, constipation or heartburn; these problems can alter the diet significantly.

4) What medical services have you sought when you are or were pregnant? Were any of these services on prenatal nutrition?

Explanation: The availability of economic opportunities can open doors towards seeking health services, including prenatal nutrition. When a pregnant woman heads to the health clinic, she could be referred to a nutrition professional for counseling or otherwise have her knowledge of nutrition could be ignored.

5) What food do you consider to be nutritious for pregnant women? What are some factors that have influenced you not to buy nutritious food while pregnant?

Explanation: Obtaining nutritious food could be difficult for many reasons. For example, poverty, high prices, lack of knowledge, cultural traditions, remote areas, illness and the lack of transportation to the market or shop are several reasons why nutritious food may not be purchased.

Appendix F: IRB Certificate (NIH Training Program)

Certificate of Completion

The National Institutes of Health (NIH) Office of Extramural Research certifies that **Divya Selvakumar** successfully completed the NIH Web-based training course "Protecting Human Research Participants".

Date of completion: 12/03/2013

Certification Number: 1338712