Distribution Agreement

In presenting this thesis or dissertation as a partial fulfillment of the requirements for an advanced degree from Emory University, I hereby grant to Emory University and its agents the non-exclusive license to archive, make accessible, and display my thesis or dissertation in whole or in part in all forms of media, now or hereafter known, including display on the world wide web. I understand that I may select some access restrictions as part of the online submission of this thesis or dissertation. I retain all ownership rights to the copyright of the thesis or dissertation. I also retain the right to use in future works (such as articles or books) all or part of this thesis or dissertation.

Signature:

_____ _____

Approval Sheet

Maternal diets in rural Tanzania: An exploration of culture, lived experiences, and social shifts affecting women's intake during pregnancy and lactation

By

Lyndsey Dickson
MPH

Hubert Department of Global Health

_____

[Chair's signature]
Amy Webb Girard
Committee Chair

Abstract Cover Page

Maternal diets in rural Tanzania: An exploration of culture, lived experiences, and social shifts affecting women's intake during pregnancy and lactation

By

Lyndsey Dickson

Bachelor of Science, Chemistry
Towson University
2015

Thesis Committee Chair: Amy Webb Girard, Ph.D.

An abstract of
A thesis submitted to the Faculty of the
Rollins School of Public Health of Emory University
in partial fulfillment of the requirements for the degree of
Master of Public Health
in the Hubert Department of Global Health
2020

Abstract

Maternal diets in rural Tanzania: An exploration of culture, lived experiences, and social shifts affecting women's intake during pregnancy and lactation

By Lyndsey Dickson

Introduction: Each year approximately 15.5% of infants are born with low birthweight, defined as underweight for gestational age, a common cause being maternal undernutrition. Maternal diets are crucial for the health of pregnant and lactating women and their children, yet women under-consume for reasons including food insecurity, insufficient knowledge of adequate nutrient consumption, and cultural beliefs and practices that restrict intake. Poor nutrition during a child's first 1000 days, conception through two years of life, is associated with impaired cognitive ability and can lead to stunting. This paper examines cultural beliefs and practices related to PLW's diets and influences of shifting norms on maternal intake in rural Tanzania.

Methods: Qualitative data were collected from thirty villages in two districts of Eastern Tanzania with varying levels of pastoralism and sedentarization. Data were collected in one of two local languages, Kiswahili or Maasai. Collection methods included household in-depth interviews, focus group discussions and key informant interviews. Verbatim transcripts were analyzed in MAXQDA 2020 via coding, constant comparison, conceptualization, categorization, theme development and thick descriptions.

Results: The effects of societal shifts in relation to maternal diets were explored. Changes were largely due to increased education and interethnic exchange, facilitated by changes in livelihoods, modernization, and globalization. Despite shifts in some norms, others remain unchanging. While public health efforts to improve maternal diets is praised and widely accepted, implementation has been hindered by persistence of cultural habits such as food allocation practices at mealtime, gender norms and PLW-related food taboos. Pastoral communities were less influenced than sedentary communities, yet participants from all villages discussed normalization of previously tabooed foods, saw changes in food availability, increased mutual decision-making among partners, ate more balanced meals, and prioritized children's diets.

Discussion: Cultural and societal influencers play a major role in maternal diet. Despite recent advances in livelihoods, education and intercultural exchange, tradition persists, and women face challenges to implementing new knowledge. This study has implications for nutrition education programs to improve maternal and child nutrition through improved diet. Findings provide insight for development of culturally appropriate nutrition interventions and program improvement programs in rural Tanzania.

Cover Page

Maternal diets in rural Tanzania: An exploration of culture, lived experiences, and social shifts affecting women's intake during pregnancy and lactation

By

Lyndsey Dickson

Bachelor of Science, Chemistry
Towson University
2015

Thesis Committee Chair: Amy Webb Girard, Ph.D.

A thesis submitted to the Faculty of the
Rollins School of Public Health of Emory University
in partial fulfillment of the requirements for the degree of
Master of Public Health
in the Hubert Department of Global Health
2020

Acknowledgements

I would like to thank my dad, mom, and brother (Rob, Kristen, and Luke Dickson) for always helping to propel me forward in whatever I do, for believing in me, and for proofreading each section of this thesis. I especially want to thank my mom, who enthusiastically fell in love with the topic, expressed complements about my hard work, and dove in to provide final edits each step of the way. Overwhelming gratitude goes out to Jonathan Preg, who has journeyed with me throughout this writing and analysis process as my boyfriend, fiancé and now husband. I am thankful for his support through tough times, exhaustion, tears, and for making late-night pancakes. I want to also acknowledge Carrie Ripkey, who set me on the right track as I began this journey and showed me where to find the data I needed. Importantly, a big thanks goes out to my Thesis Chair and Advisor, Dr. Amy Webb Girard, for her guidance, encouragement, wisdom, putting up with my frequent emails, and meeting with me via Zoom during the COVID-19 pandemic. Another wonderful source of support throughout this process was Cile Hutchinson, who offered many prayers and much optimism throughout this crazy phase of life in which I completed this project. I also could not have done it without Julia Sobolik from the writing center, who provided advice from training and personal experience. Last but not least, a huge appreciation goes out to Emory University's Rollins School of Public Health, especially to the Hubert Department of Global Health, for providing me a high-quality, comprehensive education through caring experts in my field with diverse perspectives and willingness to impart invaluable insight and collaborations with students.

Table of Contents

Chapter 1: Introduction

Introduction & Significance

Women's diets are an important factor in the overall health of communities worldwide. When pregnant and lactating women (PLW) consume insufficient energy or essential nutrients, global health is poorly impacted (Kohler, 2019; Shannon, 2008). Inadequate nutrition during pregnancy and lactation is crucial for maternal health, as well as the growth and development of children. Insufficient iron can lead to anemia, contributing to hemorrhage during labor and delivery. Calcium deficiency is linked to pregnancy-induced hypertension, or pre-eclampsia, which affects 2-5% of pregnant women and is a top cause of maternal mortality, leading to the death of 76,000 women and 500,000 children annually (FIGO, 2019).

Poor nutrition in a child's first 1000 days from conception is associated with impaired cognitive ability, less educational achievement, and diminished work performance, and leads to stunting (UNICEF, 2019b). The first half of this 1000 days is a crucial window for growth and development and infants' nutrients should come entirely from their mothers. Maternal undernutrition is a critical contributor to low birthweight (LBW), defined as underweight for gestational age, affecting 15.5% of all infants (WHO, 2018). LBW correlates with an increased risk of fetal mental development issues, irreversible cognitive and physical damage, stunted growth, and intergenerational effects affecting the human capital of entire countries (Kohler, 2019; Martorell, 2012; UNICEF, 2019a).

This thesis considers global communities across scale, narrows to low- and middle-income countries (LMICS), and further focuses in on various contexts of rural

Eastern Tanzania. It includes a review of published literature around intentionally eating down of specific nutrients and caloric energy, as well as food taboos during pregnancy and lactation. Cultural beliefs and practices were explored to determine what drives women's diets in these regions and provide insight into ways of effectively improving maternal intake and stigma around food consumption among PLW in this context. Understanding and implementation of proper diets for PLW could drastically improve maternal and child health (MCH) and quality of life worldwide.

Problem Statement

Cultural beliefs and practices drive maternal food intake. Women's nutritional status is influenced by cultural food habits and traditions. Nutritional status of PLW impacts women's own health, important development stages of their children's lives, and the wellbeing of future generations (Kominiarek, 2016). There are many factors that influence PLW to under-consume both macro- and micronutrients, notably cultural beliefs and practices that restrict intake during pregnancy and lactation (Harding, 2017). Examples include gender-discriminatory food distribution, food insecurity, and insufficient knowledge about the impacts of following PLW-related food taboos and intentionally eating down of nutrients. (Ali, 2004; Kavle, 2018; Martorell, 2012; Mukhopadhyay, 2009; Shannon, 2008).

While research about dietary habits is in high demand worldwide, specifically as it relates to proper maternal consumption during pregnancy and lactation, important gaps remain that need to be filled. Predominant livelihoods are a major factor in the level of tradition a society maintains, as well as the food items available to individuals and families. Societal norms, village-specific traditions, alterations to cultural beliefs resulting from new provision of

information enabled by changes in livelihoods, changes in community perspectives about healthy practices during pregnancy and lactation, and barriers women face to the implementation of desired behavior changes are major influencers on women's intake patterns in rural Tanzania.

Purpose

This thesis seeks to explore beliefs about proper food consumption and understand cultural practices to describe how social shifts and habits influence dietary beliefs about appropriate diets for PLW. Local beliefs were examined through participants' words from a large study in rural Tanzania. The study seeks to explain how lived experiences have affected women's consumption in pregnancy and lactation, how diet practices have changed over time, and how these changes have been impacted by shifts in social norms. Understanding how societal shifts influence dietary beliefs and practices during such a crucial time in women's lives may provide insight for programs aiming to improve maternal nutritional status, birth outcomes and child development.

The purpose of this study was to address the following **Research Question:** *How do shifts in societal norms influence dietary beliefs and practices during pregnancy and lactation?* Findings were sought through the following **Specific Aims:**

1. *To understand cultural beliefs and practices about dietary intake in pregnancy and lactation*
2. *To explore how beliefs about maternal diets have changed over time*.

Summary of Implications

While sociocultural factors have been identified as a contributor to malnutrition, the sociocultural drivers of maternal food choice remain largely unexplored (Mukhopadhyay, 2009). Current publications fail to provide explanations for why women adhere to cultural practices. There is a lack of research on PLW-related food taboos, reasons for adherence, and the impact they have on MCH, especially in the rural Tanzanian context. This study may provide insight for culturally appropriate intervention design and improvement of existing programs that benefit the health of mothers and children in these regions. Further study around why PLW-related food taboos persist and how these practices affect pregnancy outcomes rural Tanzania could be useful in improving the effectiveness of nutrition education programs in initiating change by bringing new understanding to locals. Through leveraging PLW's social networks, community engagement could help lead to effective diet improvement among women in rural Tanzania. Knowledge gained from this study may be used to inform public health practices that improve the health of current and future generations around the globe.

Definition of Terms

Eating Down – deliberately eating less during pregnancy, commonly to avoid a large baby and perceived delivery complications

Food taboos – food item prohibitions for reasons other than dislike

LBW – low birthweight – underweight for gestational age

LMICS – low- and middle-income countries

MCH – maternal and child health

PLW – pregnant and lactating women

Chapter 2: Literature Review

2.1. Importance of Sufficient Maternal Nutrition

Worldwide, approximately 211 per 100,000 live births result in maternal mortality due to pregnancy or childbirth complications (UNICEF, 2019c). Each year, approximately 20 million infants, or 15.5% of all infants, are born with LBW (WHO, 2018). One critical cause of LBW among infants is maternal undernutrition, making proper nutrition important for mothers, as well as for their infants. Women may under-consume for a myriad of reasons including food insecurity, insufficient knowledge about diet and adequate intakes, as well as cultural beliefs and practices that may restrict intake during pregnancy and lactation (Harding, 2017). Insufficient intake can have serious implications, leading to both maternal and child death. Maternal malnutrition poorly impacts global health and is often a result of not consuming adequate amounts of essential nutrients (Kohler, 2019; Shannon, 2008).

Women's nutritional needs during pregnancy are important. Women's nutritional status is influenced by cultural foods and traditions and affects their own health directly and the health of future generations (Kominiarek, 2016). It is important for women to meet their macro- and micronutrient requirements during both pregnancy and lactation. Insufficient intakes of calcium may be linked to pregnancy-induced hypertension (pre-eclampsia). Pre-eclampsia is a top cause of maternal mortality and is also a top driver of all cause global mortality (FIGO, 2019). Pre-eclampsia affects 2-5% of pregnant women and each year leads to the death of 76,000 women and 500,000 children (FIGO, 2019).

Similarly, insufficient iron intake resulting in anemia may contribute to hemorrhage during labor and delivery.

Conception through six months of exclusive breastfeeding (EBF), accounts for a child's first approximately 500 days of life, during which nutrients come entirely from the mother. Poor nutrition in a child's first 1000 days from conception is associated with impaired cognitive ability, less educational achievement, and diminished work performance, and leads to stunting (UNICEF, 2019b). Stunting is often accompanied by irreversible physical and cognitive damage that can affect the next generation. LBW correlates with an increased risk of stunted growth, lower IQ, long-term health issues, fetal mental development issues through to long-term health issues, and intergenerational effects, ultimately affecting the human capital of entire countries (Kohler, 2019; Martorell, 2012; UNICEF, 2019a).

2.2. Current Recommendations

Clinical recommendations exist to prevent these described adverse material and child health outcomes including healthy weight gain for mothers, essential micronutrient consumption, and weight loss during lactation.

Weight gain during pregnancy:

Women should enter pregnancy with a BMI in the "normal" range (18.5 – 24.9), however, women living in resource-poor settings often enter pregnancy undernourished (CDC, 2017; Koletzko, 2018; Wu, 2012). Poor maternal nutrition status can be exacerbated by the flow of nutrients from mother to fetus during pregnancy, and further through breastfeeding. The health of the mother may also be impacted by short interpregnancy intervals, additionally exhausting maternal nutritional status (Wu, 2012).

Maternal deficiencies in protein, energy, fatty acids, and micronutrients compromise fetal immune system development and have adverse long-term effects. Intergenerational maternal stunting is a product of continual generations of malnourished mothers. Babies born to these mothers frequently begin early childhood malnourished and remain undernourished through adulthood, ultimately leading to women of short stature and at an increased risk of obstructed labor due to small frames. Poor maternal nutrition due to insufficient intake is common among low-income women. Undernourished women living in low- and middle-income countries (LMICs) are at an increased risk of protein and micronutrient deficiencies (Wu, 2012). There is a five-fold higher risk of pregnancy-related mortality in areas with high rates of protein-energy malnutrition (PEM) among women (Christian, 2002).

Both macro- and micronutrients affect maternal, newborn and child health outcomes. Macronutrients (carbohydrates, lipid, and protein) are sources of energy substrates, more of which are required for physiological processes associated with pregnancy. Carbohydrates, lipids, and proteins must be balanced in order to meet the needs of both mother and fetus. While pregnant women should increase their total caloric intake, they should maintain a diet with similar percentages of carbohydrates and fats as non-pregnant women, 45-64% and 20-35%, respectively (Kominiarek, 2016). It is especially important for mothers to consume adequate amounts of protein for her developing fetus's amino acid requirements. Women are recommended to increase their protein intake from the non-pregnant recommendation of 46 g per day to 60 g per day during pregnancy. Animal-source foods are recommended for meeting these needs. Vegetarians are often particularly deficient in protein. Good protein sources for

vegetarians are milk and egg products, however, these items are often avoided during pregnancy in populations that practice eating down.

While deficiencies of macro- or micronutrients during the first trimester are most detrimental to fetal development, the recommendations for maternal weight-gain are more specific for the latter periods of pregnancy. Current recommendations suggest that women with a pre-pregnancy BMI of <18.5 kg/m^2 should gain 28-40 pounds throughout pregnancy, with a rate of 1.0-1.3 pounds per week during the second and third trimesters (Kominiarek, 2016). It is even more important, however, for underweight women to undergo sufficient weight gain throughout pregnancy, paying close attention to diet quality (Koletzko, 2018)). Those with BMIs of 18.5-24.9, 25.0-29.9 and ≥30.0 kg/m^2 are recommended to gain 25-35, 15-25 and 11-20 pounds, respectively, with second and third trimester rates of 0.8-1.0, 0.5-0.7 and 0.4-0.6 pounds per week (Kominiarek, 2016). To do this, women need to intake approximately 340 kcal per day more than their normal diet in the second trimester of pregnancy and 452 kcal per day in the third trimester. Weight-gain less than the necessary amount for maternal tissue adaptions, amniotic fluid volume, the placenta and fetus itself, approximately 17.6 pounds, implies that maternal adipose and protein stores would need to be mobilized to account for these factors.

Vitamins, minerals, trace elements:

In addition to healthy weight gain, micronutrients are essential for a healthy pregnancy and fetus. Women's vitamin, mineral and trace element requirements increase much more during pregnancy than do their energy needs. The body cannot synthesize micro-minerals, so they must be consumed (Wu, 2012). Underweight women are particularly likely to be deficient in micronutrients and should supplement their diets as needed (Koletzko, 2019). Deficiencies in

folate and vitamins A, B_6 B_{12} (only found in animal products) and D, are most associated with poor pregnancy outcomes (Wu, 2012) and fetal malformations.

Calcium and Magnesium are important in preventing hypertensive disorders related to pregnancy, and supplementation may reduce the risk of preterm delivery. Calcium homeostasis is crucial for both maternal and infant outcomes, as deficiency is associated with increased hypertensive disorders (Wu, 2012). Calcium and Vitamin D work together, therefore it is essential for mothers to ensure adequate Vitamin D intake, especially for those with insufficient UV sun exposure (Koletzko, 2019). Vitamin D deficiency is common in pregnancy, especially among women with darker skin and those who are vegetarians. As with protein, vegetarians are also likely to be deficient in iron, calcium, zinc, and vitamin B12. Inadequate zinc intake contributes to malnutrition and can be detrimental to immune function. To meet Vitamin D needs, pregnant and lactating women should take supplements containing this vitamin if they do not consume vitamin D-rich food sources, such as milk, fatty fish, or egg yolks. Additionally, vitamin B12 supplements should be taken if egg and meat products are avoided.

While anemia can result from a deficiency of amino acids or rapid DNA synthesis, it is most commonly due to insufficient iron in the diet. Iron requirements nearly double during pregnancy and deficiencies are typically due to poor nutritional intake. Iron is the most abundant trace element in the body. Deficiency of this mineral is the most common cause of anemia of pregnancy (Lee, 2011). Anemia during pregnancy poses an increased risk of maternal hemorrhage, the leading cause of maternal death globally. (Wu, 2012). Anemia negatively impacts women’s ability to tolerate blood loss and increases risk of acquiring infection.

Iron deficiency can also pose a risk of hypoxia and preterm birth. It is best for women to have adequate stores of iron before becoming pregnant, however this is unlikely in developing countries. Competition between fetus and mother for nutrients causes both maternal and fetal undernutrition. The recommended daily allowances (RDA) of iron have been modified for pregnant women. RDA of iron for women of childbearing age is 15 mg, which most women cannot maintain even with optimal diets (Lee, 2011). On top of this, pregnant women need double the amount of iron than do nonpregnant women for making more blood to deliver oxygen to their developing fetuses (MFMER, 2019). Iron-rich sources include red meat, pork, fish, and eggs; however, the WHO, CDC and FDA recommend adding oral iron supplementation of 27-60 mg/d from the beginning of pregnancy until three months after birth (Kominiarek, 2016).

Greater importance should be placed on the quality of women's diets, especially in resource-poor settings where their intake of numerous micronutrients is often insufficient (Torheim, 2010). Daily prenatal multivitamins are recommended before and during pregnancy, particularly to address the increased importance of folic acid in pregnancy (Kominiarek, 2016). Folic acid, the synthetic form of folate, is an extremely important vitamin for developing fetuses and is found in fortified foods and folate-rich sources such as dark-green leafy vegetables and liver (Kominiarek, 2016). Research shows that a lack of folic acid in maternal diets may be a key factor in spina bifida, incomplete development of the brain, spinal cord, or their protective membranes (Boston Children's Hospital, 2019). Due to the importance of folic acid in fetal development, all women of childbearing age are recommended to take multivitamins that contain 400 mcg/day folic acid (CDC, 2019). Multiple-micronutrient (MMN) supplementation and iron-folate supplements have comparable impacts on maternal anemia and help prevent pregnancy

complications and reduce adverse pregnancy outcomes for mothers as well as LBW babies (Haider, 2011).

The risk of maternal and child morbidity resulting from poor maternal nutrition may be ameliorated by optimizing nutrition during pregnancy. Greater importance should be placed on the quality of women's diets, especially in resource-poor settings where their intake of numerous micronutrients is often insufficient (Torheim, 2010). Supplementation, food fortification, dietary diversification and nutrition education are effective strategies for alleviating poor health outcomes (Wu, 2012). Micronutrient-deficient women are recommended to supplement their diets with micronutrients in order to reduce the risk of preterm birth.

Weight loss during lactation:

Similar to the clinical recommendations for macro- and micronutrient intake for pregnant women, there are recommendations for healthy weight management during lactation. Breastfeeding is the global standard for infant feeding, ideally exclusively for the first six months and then continuing to breastfeed throughout the first year of infants' lives (Kominiarek, 2016). It is important that women meet their energy and nutritional requirements, which differ from those of pregnancy and non-pregnant, non-breastfeeding women. An additional 500 kcal per day more than non-pregnant women is required for those who are breastfeeding.

While mothers' folate and iron requirements decrease in lactation as compared to pregnancy, the need for many micronutrients increases in lactation over pregnancy (Kominiarek, 2016). A mother whose diet is deficient in thiamine and vitamins A and D, however, produces less of these in her milk (Ares Segura, 2015). Thiamin, riboflavin,

vitamins A, C B-6, B-12, iodine, and selenium are affected by the amount mothers consume, therefore, women are recommended to take a prenatal vitamins throughout the breastfeeding phase of life (Bravi, 2016; Drake, 2011; LINKAGES, 2014).

Women in the lactation period should consume a diet adequate in nutrients to maintain her nutrient status, while promoting postpartum weight reduction, typically 1.1-2.2 pounds per day (Koletzko, 2019). While folate, calcium, iron, copper, and zinc micronutrient levels are fairly high in breastmilk regardless of maternal reserve or intake, calcium and iron are needed to protect maternal reserves (LINKAGES, 2014). Even if mothers consume insufficient amounts of carbohydrates, protein, fat and minerals, breastmilk contents do not change much (Bravi, 2016; Ares Segura, 2015). Weight loss does not usually impact breastmilk quality nor quantity (Kominiarek, 2016).

2.3. Drivers of Maternal Food Intake

The practice of eating down, or deliberately eating less food during pregnancy for fear of having a large baby, and food taboos during pregnancy and lactation are relatively common within global communities. Common drivers influencing women to alter their diets and not meet current nutrient recommendations include a lack of knowledge about those recommendations and about the impacts of eating down, gender discriminatory food distribution patterns, fears of having a large baby, and beliefs about hot foods (Ali, 2004; Kavle, 2018; Martorell, 2012; Mukhopadhyay, 2009; Shannon, 2008).

Communities and individuals care for women and infants. Longstanding practices are frequently followed, often out of traditional habit, for the purpose of avoiding true and perceived hazards and to ensure successful pregnancy outcomes (Meyer-Rochow, 2009; Riang’a, 2017;

Ugwa, 2016). These methods have developed over time in rural communities and have become culturally rooted, remaining prominent among traditional women today and fairly preserved even among those with more modern lifestyles (Sharifah, 2012). Many of these beliefs come from tribal sources, are passed intergenerationally, and are enforced by elders (Iradukunda, 2019). These practices are followed especially in villages without knowledge against them, misbelief, and lack of awareness about intake and weight gain recommendations for pregnancy (Kavle, 2018; Mukhopadhyay, 2009).

Societal systems can be a driver of maternal food choices and level of intake (Kohler, 2019), with sociocultural beliefs being a risk factor for intentionally eating down. Societal food taboos and concerns about baby size, as well as SES and local customs of discriminatory food allocation, influence women to not increase their intake in pregnancy (Harding, 2017; Mukhopadhyay, 2009). When beliefs develop into practice, local habits are formed and are acknowledged as a part of their ways (Ugwa, 2016). Following food taboos therefore brings identity to groups. Group cohesion is strengthened when these cultural traditions are observed and create a feeling of belonging within these communities (Meyer-Rochow, 2009).

Due to dietary regulations associated with pregnancy, compounded by societal customs regarding women, food is often allocated discriminatorily and distributed unevenly, leaving pregnant women with last shares at meals (Shannon, 2008). The importance of these women's increased needs due to the caloric and nutritional demand of their growing fetuses and expenditure of lactation are not always recognized or valued. Rural women living in cultural settings often have stringent pregnancy and lactation-related food taboos pressed upon them (Bently, 1999). Lese women of the Democratic

Republic of the Congo, for example, are prohibited from eating forest animal meat, which highly limits their meat consumption. This often results in pregnant and lactating women missing key nutrients, especially in rural contexts with village-specific constraints (Chanchani, 2017; Meyer-Rochow, 2009).

While community members may not know the science behind why certain foods may be beneficial and would rather practice traditions based on cultural norms, some of these practices align with scientific evidence (Iradukunda, 2019). For example, some fish and shellfish are toxic to the nervous system of developing fetuses due to high levels of mercury (Mayo Clinic Staff, 2017). While this is one instance where pregnancy-related food taboos align with medical recommendations to avoid seafood, most of the time these practices are harmful to both the mothers who follow them and their children.

Fears and taboos related to pregnancy outcomes are closely integrated with culture (Chakrabarti, 2019). Communities and individuals take the information they have and put it into practice, doing their best to bring about desired outcomes throughout pregnancy, childbirth, and lactation (Ugwa, 2016). Despite good intentions, a lack of knowledge can lead to harmful practices being pressed upon women and lead to adverse health outcomes for infants. For example, eating down for fear of having a large baby that obstructs the maternal pelvis is a cyclical practice with compounding consequences. It leads to insufficient nutrient intake, continued growth hindrances throughout generations, and onto small maternal stature (Martorell, 2012).

The fear of having a baby too large to birth naturally may occasionally hold true because of intergenerational maternal stunting resulting from eating down and poor nutrition. However, in reality, rarely do babies get stuck in the birth canal during delivery due to disproportionate

fetus-to-pelvis size ratios (Chanchani, 2017; Martorell, 2012; Riang'a, 2017; Sharifah, 2012). In fact, babies born having LBW are a significant problem around the world, with Bangladesh having one of the highest rates (Shannon, 2008). LBW feeds back into the very problem of small maternal stature by leading to childhood malnutrition and subsequent poor nutritional status throughout adulthood. This cycle is further worsened in response to increased requirements during pregnancy (Martorell, 2012).

Intentionally not increasing intake during pregnancy and avoiding or eating down nutrient-dense foods in response to sociocultural beliefs is a common occurrence in rural locations (Harding, 2017). Here, women are often told that they should avoid nutritious foods during pregnancy, due to the belief that "baby will be too big" (Shannon, 2008). In Bangladesh as well as many other LMICs, women are recommended to eat specific foods that decrease thirst (Kavle, 2018). Water is typically restricted in rural locations, including areas of India. The purpose is to keep pregnant mothers' stomachs empty for fear of "cramping the baby in the womb" (Chakrabarti, 2019; Chanchani, 2017).

Restrictions in volume and nutrient avoidances can be detrimental to the health of both a mother and her child (Iradukunda, 2019; Mohammed, 2019; Shannon, 2008). Resulting health issues are often compounded in rural areas with low access to healthcare. A high percent of mothers in Pakistan report restricting all foods, in order to have a smaller baby, and intentionally avoiding "hot foods" (Ali, 2004). Hot foods are generally believed to be harmful to the fetus during pregnancy (Choudhry, 2019). Meat, eggs, fish, and papaya are all considered hot foods and are largely avoided in pregnancy globally, specifically in rural areas (Chakrabarti, 2019; Choudhry 2019; Kavle, 2018). Asians traditionally avoid items considered hot, including supplements such as iron

tablets (Meyer-Rochow, 2009). Since limiting nutritious food impairs fetal growth, these items are eaten down in regions of India to facilitate having easier deliveries (Chanchani, 2017; Hutter, 1996; Mukhopadhyay, 2009).

Animal-sourced foods provide important protein and micronutrients as previously discussed in depth, and help pregnant women meet their nutritional needs. However, many animal-based food taboos are followed around the world, especially in Southeast Asia (Kohler, 2019). Taboos in Ethiopia specifically inhibit iron-rich foods (Mohammed, 2019). Animal-based foods that are commonly reported as eaten down due to cultural beliefs are meat, fish, and eggs, all three of which are considered "hot" (Harding, 2017). These items are particularly avoided by women who practice eating down (Chakrabarti, 2019). Women in Malaysia are prohibited from eating seventeen types of foods during the prenatal period, many of which are fish (Sharifah, 2012). Some ethnic groups also prohibit milk consumption for women during pregnancy, while others promote dairy products such as milk (Iradukunda, 2019). Milk, eggs, cheese, and meat are largely prohibited during pregnancy in Nigeria (Ugwa, 2016).

Some regions of Bangladesh recommend papaya during pregnancy; however, most Bangladeshis and Indians avoid green leafy vegetables and papaya (Chakrabarti, 2019; Harding, 2017; Kavle, 2018; Mukhopadhyay, 2009). South Indians avoid these items due to fears of perceived miscarriage and disease, and Ethiopians also avoid these items for fear of imminent death at birth (Iradukunda, 2019). Green vegetables are also avoided in areas of Nigeria (Ugwa, 2016). Similarly, Ethiopian women also follow taboos related to dark green leafy vegetables such as spinach and kale. Unfortunately, these foods are also iron-rich (Mohammed, 2019). Reducing iron intake by eating fewer rich sources leads to a dangerous state of a lack of red

blood cells (RBC). This low supply of RBC's to carry oxygen to pregnant women's tissues is insufficient and is linked to increased fetal morbidity and mortality (Abu-ouf, 2015).

2.4. Current Knowledge Gaps

The practice of eating down is widespread globally. Even though it is commonly known that maternal nutrition is important, many worldwide communities follow cultural practices that impair maternal nutrition status. The existing published literature is generally lacking research on eating down as well as the sociocultural determinants driving these practices. Research is inadequate concerning the social-cultural drivers of maternal food choice and current publications fail to provide explanations for why women adhere to cultural practices, specifically eating down.

Some of the world's most nutritionally insecure people live in Sub-Saharan Africa (Fanzo, 2012). Some of the major contributors to malnutrition in this region include poverty, sociocultural barriers, and lack of education among women (Bain, 2013). Individuals in East Africa are starving because of drought and war (Sung, 2012). Many follow traditional ways of life and, due to long-lasting conflict, are living in highly concentrated areas, leading to overcultivation (FAO, 2017). The rates of undernourishment and child stunting is rising. Food security has recently worsened, especially in regions of conflict, drought, and flooding and approximately one third of the East African population is undernourished (FAO, 2017).

Anemia in this region is largely due to low iron consumption and rates in these regions range between 71% and 98% (Kejo, 2018). Other indicators of maternal

undernutrition such as LBW, maternal mortality, pre-eclampsia, hemorrhage, maternal BMI, and short stature, which may be useful in identifying consequences of inadequate maternal diets to improve their intake. Major areas in need of research are pregnancy/lactation-related food taboos, drivers of maternal food choice in Rural Tanzania and the prevalence of eating down in these regions. While sociocultural factors have been identified as a contributor to malnutrition, the sociocultural drivers of maternal food choice remain largely unexplored. Studying how these practices affect pregnancy outcomes rural Tanzania could be useful in initiating change in response to a new understanding why taboos are followed and eating down persists.

The objective of this study using qualitative data is to: explore the cultural beliefs around nutrient intake during pregnancy, understand contextual determinants of maternal diets and explore women's experiences with eating down in rural Tanzania. This work will address these gaps in the literature by exploring the beliefs and practices related to food taboos and maternal intake among women in these regions. Shared experiences will shed light on influencers of maternal intake and locals' perspectives will provide insight for understanding issues that can impact these countries as a whole. Findings from this work will aid in understanding similar cultural traditions in different contexts. This work will also have an impact by informing intervention design and improving current strategies and programs that benefit the health of mothers and children in these regions.

Title Page for Manuscript

Maternal diets in rural Tanzania: An exploration of culture, lived experiences, and social shifts affecting women's intake during pregnancy and lactation

By

Lyndsey Dickson
MPH

Hubert Department of Global Health

Chapter 3: Manuscript

3.1. Introduction

Introduction and Significance

Women's diets are important in the overall health of communities worldwide. When pregnant and lactating women (PLW) consume insufficient energy or nutrients, global health is poorly impacted (Kohler, 2019; Shannon, 2008). Inadequate nutrition is crucial for maternal health as well as the growth and development of children. Insufficient iron can lead to anemia, contributing to hemorrhage during labor and delivery. Calcium deficiency is linked to pregnancy-induced hypertension – pre-eclampsia – which affects 2-5% of pregnant women, leading to the death of 76,000 women and 500,000 children annually (FIGO, 2019).

Poor nutrition in a child's first 1000 days, which encompasses conception through the first two years of life, is associated with impaired cognitive ability, diminished work performance, and leads to stunting (UNICEF, 2019b). For proper growth and development, it is crucial for children to be breastfed during this first six months of this window. Maternal undernutrition is a critical contributor to low birthweight (LBW), defined as underweight for gestational age, affecting 15.5% of all infants (WHO, 2018). LBW correlates with an increased risk of fetal mental development issues, irreversible cognitive and physical damage, and intergenerational consequences affecting the human capital of entire countries (Kohler, 2019; Martorell, 2012; UNICEF, 2019a).

Problem Statement

Traditions can affect PLW's health and impact important development stages of their children's lives and the wellbeing of future generations (Kominiarek, 2016). Various factors influence PLW to under-consume both macro- and micronutrients, notably cultural beliefs and practices that restrict intake during pregnancy and lactation (Harding, 2017). Examples include gender-discriminatory food distribution, food insecurity, and insufficient knowledge about the impacts of following PLW-related food taboos, and intentionally eating down of nutrients (Ali, 2004; Kavle, 2018; Martorell, 2012; Mukhopadhyay, 2009; Shannon, 2008).

While research about dietary habits, particularly intake during pregnancy and lactation, is in high demand worldwide, important gaps remain unfilled. Predominant livelihoods are a major factor in the level of tradition a society maintains and the food items available to individuals and families. Rural Tanzanian women face barriers including societal norms, village-specific traditions, community perspectives about healthy maternal diet, and cultural beliefs, which make it difficult to implement behavior changes they have learned about through health education.

Purpose

This thesis seeks to explore beliefs about proper food consumption and to understand cultural practices that describe how societal habits and shifting beliefs influence dietary beliefs about appropriate diets for PLW. Local beliefs were examined through participants' words from a large study in rural Tanzania. The study seeks to explain how lived experiences have affected women's consumption during pregnancy and lactation, how dietary practices have changed over time, and how these changes have

been impacted by shifts in societal norms. Understanding how these shifts influence dietary beliefs and practices during such a crucial time in women's lives may provide insight for programs aiming to improve maternal nutritional status, birth outcomes and child development through culturally sensitive public health efforts.

The purpose of this study was to address the following **Research Question:** *How do shifts in societal norms influence dietary beliefs and practices during pregnancy and lactation?* Findings were sought through the following **Specific Aims:**

1. *To understand cultural beliefs and practices about dietary intake in pregnancy and lactation*
2. *To explore how beliefs about maternal diets have changed over time*.

Definition of Terms

Eating Down – deliberately eating less during pregnancy, commonly to avoid a large baby and perceived delivery complications

Food taboos – food item prohibitions for reasons other than dislike

LBW – low birthweight – underweight for gestational age

LMICS – low- and middle-income countries

MCH – maternal and child health

PLW – pregnant and lactating women

3.2. Methods

Introduction

To understand how food taboos and eating down manifest among women of rural Tanzania, this study explores the cultural beliefs around pregnancy and lactation. Additionally, this study explores the contextual determinants of maternal diets and shared experiences from local communities. The research uses secondary qualitative data on the drivers of food choice in rural Tanzania, collected by a multidisciplinary team trained in qualitative research methods. This study was conducted in partnership with International Livestock Institute (ILRI), with offices across Africa, Sokoine University of Agriculture (SUA) of Tanzania and Emory University (EU) in Atlanta, GA, USA.

Study Population

Data were collected in two districts in Tanzania, Mvomero and Handeni. Both districts are in Eastern Tanzania, home to Maasai, Sambaa, Mbulu, Pare, Wamburu and Zigua pastoralists. Mvomero is in the productive agricultural zone of the Morogoro region, dominated by private farms, while the Handeni district is in the Tanga region, with fewer large plantations and produces agriculture for consumption by the rural populations.

Within these two regions, Tanga and Morogoro, 30 villages were selected via ongoing involvement in research and development projects with ILRI. These 30 villages constituted the sampling frame. These villages were purposively selected based on levels of sedentarization and participation in a MilkIT program developed by ILRI to improve pastoralists' dairy sales. Moreover, these villages were sampled in order to maximize diversity in the areas of market access (rural and urban), community demographics, village sizes, and livelihoods.

Six villages, three from each district, were ultimately identified for qualitative data collection with predominant livelihoods ranging from extensive pastoralism through extensive sedentary systems. One community was categorized as intensive sedentarized due to a focus on crop cultivation and a lack of a grazing system. Three of the communities practiced extensive pastoralism, with large mobile herds of over 20 cattle composed of typically indigenous breeds. Two of these three communities had multiple cohabitating tribes, while one was exclusively Maasai. The remaining two of the six villages included in the study were classified as extensive sedentary, defined as mostly farming based livelihoods with small herds of hybrid-breed cattle therefore exhibiting a mixture of pastoralism and crop cultivation.

Ethical Considerations

The Tanzanian Institutional Review Boards (IRBs) and IRB boards at EU, ILRI and SUA reviewed the study's protocols and tools. These organizations, along with the Tanzanian ethical review boards approved this research study. Participant confidentiality and privacy associated with the study was clearly explained to participants in the native language of Kiswahili or Maasai using translators. Participants were 16 years of age or older and each gave verbal consent to participate in the study prior to initiating data collection activities. Participants were compensated with snacks and transportation money.

Data Collection

All data were collected in one of two local languages, Kiswahili or Maasai. Household in-depth interviews (HHIs), focus group discussions (FGDs) and key informant interviews (KIIs) were conducted and recorded following informed consent by all study participants. This sub-

study used HHIs, FGDs, and KIIs, perspectives from male and female youths and elder men were incorporated. Women of reproductive age and elder women were the focus.

Data were collected in two seasons: the harvest and lean seasons. A grounded theory (GT) approach to data collection was used, where round one of interviews informed areas for further investigation in the second round of interviews. The data used for this study were derived from the first round of qualitative interviews, which were collected in the lean season between harvests.

In the selected communities, the team utilized previously developed networks from ILRI's research and development projects to apply a convenience sampling approach to participant identification and to select participants meeting inclusion criteria. Selection of participants was stratified by ethnicity, age group and gender to ensure heterogeneity of perspectives and experiences. The purpose of data collection in the larger study data was to explore existing diets, preferred and avoided foods, main food group types, food sustainability/availability/accessibility, market purchasing habits, food preparation/selection methods, food valuation, perceived health of foods, gender roles and how these are changing in each of the villages involved. Households for the HIIs were purposively selected to include diversity in aspects such as food security status, livelihood strategy and presence of young children. Household data collected as part of ILRI's ongoing program monitoring enabled participant selection for household-level in-depth interviews.

FDGs obtained participants' perspectives on typical community diets, food valuation (healthy, prestigious, non-prestigious), reasonings behind distinctions made for foods, household roles and responsibilities regarding food

production/sale/purchase/preparation, and changes in all of those aspects over time. Discussions were supplemented with activities that included pile sorts, free listing and ranking for more detailed understandings of participant perspectives. The KIIs were semi-structured, in-depth interviews and were focused on eliciting information about community experiences, values and beliefs regarding changing diets and the drivers of these changes. Participant expertise included livestock and agricultural extension agents, both village and religious leaders, community health workers (CHWs), as well as officials of various ministries. Saturation, where no new ideas or themes emerge from new data, was the indicator of achieved adequacy in sample size.

Data Analysis

Verbatim transcripts were produced in Kiswahili, translated to English, and then verified by bilingual members of the study team using audio files. The verified verbatim transcripts were imported into MAXQDA 2020 Software for qualitative data analysis. Memos, analytic or conceptual notes, were taken upon review, from which codes and a project-specific codebook were developed. Codes were primarily developed inductively for this study; however, some codes were developed deductively through existing literature and were validated through participants' words within the transcripts. Inductive code development in response to issues raised in the data allowed for the focus to be on capturing the emic perspective of participants. This was done using five HHIs, five FGDs with women, and five FGDs with elder women. The codes were also compared to existing literature to ensure any deductive codes that may be useful in relation to the research question, "How do shifts in societal norms influence dietary beliefs and practices during pregnancy and lactation?" were not missed in the first set of data used in code development.

The codebook was tested and verified through an Intercoder Agreement (ICA) test, on a new set of data including three HHIs, three FGDs and three KIIs, resulting in 82% agreement between coders. Discrepancies between coders were discussed and then resolved by revising/adding/removing codes, improving clarity of code definitions, ensuring relevance to the research question, and rectifying differences in coding styles with new coding protocols. Coding in the test set was then revised and the original dataset from which the preliminary codes were developed was then coded with the revised codebook. Coding concluded at saturation.

A constant comparison method was used for analysis to answer the research question, "How do shifts in societal norms influence dietary beliefs and practices during pregnancy and lactation?" Comparisons included deductive demographic sub-groups. The sites of data collection were compared since villages' level of tradition varies, which is tied to predominant livelihoods employed, and is important for this paper's research focus and is correlated to livelihoods, of which predominance differs from village to village. Cross comparisons between codes and developed categorizations allowed for patterns to be identified and deepened understanding around how eating down manifested in these communities.

From these analyses, data were then conceptualized, broader concepts were grouped together, existing literature was re-reviewed for reference, and theory was developed to illustrate the relationship between eating down and societal habits among women in rural Tanzania. Conceptualization took a wholistic approach, exploring various contributors to the phenomenon of eating down, and data visualization was developed in

Microsoft PowerPoint. The final theory developed explains how cultural beliefs and lived experiences contribute to the practice of eating down among women in rural Tanzania.

The GT analysis method ensured explanations of the research question were well supported by and rooted in the data. Description and comparison lead to an understanding of the depth, breadth, context, and nuance among the codes and around the issue of eating down. Further validation of the theory was achieved through returning to the data, ensuring each concept was grounded in the words of the participants. The application of this theory is not limited to sub-group, as systematic consideration of various groups were considered throughout the analysis process.

3.3. Results

In this research, pastoral communities were found to be more traditional, holding tightly to cultural beliefs and practices about maternal diets, whereas sedentarized communities were more modernized, influenced by globalization, and accepting of change. In these communities, maternal diets have shifted substantially over the years and many factors were identified as contributing to these changes and current patterns. Primary drivers of maternal diet shifts included increased education and societal shifts in livelihoods, changes in availability of foods, as well as traditional beliefs and practices. These influences have increased communities' repertoire of foods, raised awareness of nutrition, normalized previously tabooed foods, and altered mealtime food allocation. Shifts in gender norms, increased education, and intercultural exchange have impacted women’s role in food purchasing decisions. However, traditional

gender norms, respect for elders and limited food availability were found to hinder women from implementing new knowledge.

Community Diet Changes

Key changes in food items consumed in the past versus now were consistent among villagers of all ages and genders in both sedentary and pastoral communities. Key drivers of these general changes were deemed to be changing availability, increased social interaction among different ethnic groups, formal education of children, and community health education. Among participants in both community types, beans, milk, eggs, meat, and fish were described as good for health. Participants of all demographics, with the exception of pastoral men, mentioned fish as good for women's health specifically. Each group noted that milk consumption has declined in recent years; however, it was cited that this decline was due to reduced availability rather than changing preference.

There was frequent discussion among females in pastoral communities about how cooking methods have changed due to globalization. Rather than the traditional method of boiling, almost everything is now fried in cooking oil. They expressed concern about the impacts of excess oil on human health. Among younger generations, sunflower oil was considered good for health because it is natural. Industrial oil for frying was considered bad for health because of the believed chemical content. Among elders, oil was focused on for delivery, recovery, and breastfeeding. They believed that good oil in milk is removed in food processing, which they expressed as bad for human health.

Similarly, elders believed that processing maize and unhusking it removes the “oil,” but said that unprocessed, un-hulled maize is good for health, especially for PLW.

When describing how diets had changed, pastoralists focused more on additional foods eaten, particularly eggs, chicken, fish, and cultivated vegetables. Adults mentioned that previously they only ate foods that were room-temperature and now they also consume hot foods because they have learned to do so from other ethnic groups. Additionally, respondents mentioned cultivating nutritious crops in the forest as a result of education and that children have learned to eat eggs at school. Kids see food items others have and beg their parents for those foods, expanding households’ repertoire of foods consumed. As a result of increased education, pastoral communities now consume more vegetables and have even begun incorporating rice. A major change noted by many Maasai respondents was the elimination of blood which they attributed to a variety of education fronts including formal schooling of children, health education and beliefs of the church. These changes are increasingly reflected in maternal diets during pregnancy and lactation, though elders still speak of the need for women to consume blood during pregnancy and blood mixed with milk in the postpartum period.

Some pastoralists, particularly elders believe that blood mixed with milk is good for mothers who have just delivered because consumption boosts women’s blood levels. Younger generations said that consuming blood could lead to infection and sedentary women expressed knowledge of health concerns associated with consuming blood. Pastoralists described how sheep fat for breastfeeding mothers has replaced blood consumption. Those in sedentary communities focused more on increased consumption of high value foods saying they now eat more chicken, eggs, and fish than before. The influence of increased interaction with outsiders has brought sedentary communities to believe milk, eggs and meat improve health.

Drivers of Changing Diets

Social interaction, education, changing food systems and a gradual shift in gender norms were strong influencers of the observed changes in maternal diets. Sedentary villagers widely attributed positive changes in maternal diets to modernization, globalization, and social interaction.

Social Interaction as a Driver

Elders discussed how human interaction and the education of younger generations has accelerated changes in food consumption. Similarly, the younger generation attributed diet changes to increased interaction with other tribes and villages. Normalization of previously tabooed foods, changes in food item availability, nutritional education, prioritization of children's diets, and mutual decision-making between partners are recent changes that have developed as a result of social interaction (Table 1).

Health Education as a Driver

Messages delivered by clinics in both pastoralist and sedentary communities seem to be widely accepted. No negative comments were expressed concerning the knowledge these services impart. Locals spoke highly of these efforts and requested more widespread health education. Clinics teach locals food safety information, such as not keeping leftovers on the stove overnight. Those in sedentary communities repeatedly mentioned education when discussing diet changes, acknowledging the influential role clinics have in the health of their communities.

While community healthcare workers in pastoral communities described taking advantage of the opportunity to educate men to better meet the needs of their households

when they visited clinics with their pregnant wives, villagers in these regions made no mention of these efforts nor any instruction directed toward men. Conversely, women in sedentarized communities expressed that men have recently been educated to better meet domestic needs. Sedentarized villagers frequently discussed the role of MCH education to men in increasing women's participation in food purchasing decisions.

Social Shifts

Increased education and interethnic exchange, facilitated by sedentarization, has increased in rural Tanzanian villages, leading to social shifts in the communities. Participants described positive health and nutrition changes as byproducts of tribal interaction. In addition to intercultural exchange, communities are accepting of and even praised health messages from radio announcements, hospitals, and clinics, all of which provide knowledge about proper dietary intake.

Participants from villages with both types of predominant livelihoods said that education has led to more balanced nutrition for the whole family and a higher valuation of child diets. As parents came to more fully understand the importance of intake for growth and development, children became more of a priority for food allocation in households. Sedentarized parents said that while they cannot afford meat and milk for the whole family, they give what little they can obtain to their young children. Pastoralists spoke of similar knowledge and allocation, saying they were taught that children are supposed to eat more frequently so they feed them four times a day. Adults only eat twice per day.

Villagers talked of how milk provides them with nutrients and protein but that it is less available now due to recent droughts. They expressed how important drinking milk was in

keeping their stomach full and bodies strong when they had access to it. Participants said that because milk has become less available, stiff porridge consumption has drastically increased.

Eating separately was said to be less taboo now because of recent food shortages. Elders in sedentarized communities said that if everyone ate individually there would not be enough food, mentioning recent food shortages as the reason more families eat together now. Similarly, pastoralists said that foods are scarce so all members of the household eat the same items because they cannot buy a variety of foods.

Inability to Act

While there has been a dramatic increase in knowledge about dietary practices and nutrient consumption, many women have been unable to act upon the new knowledge they possess due to strongly held social and gender norms. Adherence to traditional and cultural practices such as food allocation and gender norms were found to hinder participants from implementation. Cultural norms for food allocation at mealtime make it hard for women to get the nutrients they need. Sedentarized people said that women cook, fathers eat first, then kids eat until satisfied and mothers eat last, by tradition. The father gets his own plate and the children share a plate with the mother. Some husbands in sedentary communities did not like the idea of separating to eat, preferring to serve children first and then eat with the adults. Pastoralists tended to eat in three household groups – fathers with Morans, younger boys, women with girls, and very young boys. Elder women believe that children should be the biggest priority because of their need to grow. Maternal intake is least valued in households and women typically eat

last and less, especially meat. Since women are told what to cook, what activities to do and what they may or may not eat, it makes acting upon new information challenging (Table 2).

Distinct views about women's limitations were strongly held by both elder men and elder women which limited their mobility, voice, and access to foods. Women in pastoral communities were described as more restricted than those in sedentary communities. Once married, pastoral women were said to lose the opportunity to engage in business and be expected to stay home solely to give birth. Elders noted mothers can only visit markets in their village because they are discouraged from driving motorbikes and are therefore incapable of visiting markets in other locations. Women may help prioritize necessities and direct fathers in what to buy but only the fathers buy food items. Regardless of who earns money, pastoralists believe that nutritional food purchases should be left up to men, despite increased education and mutual decision-making. Women often request items such as meat and men forget these requests or say that they cannot afford meat (Table 2). It was noted that some women may need to support their families out of necessity, causing them to work laborious jobs that burn energy reserves. This is especially dangerous to women's health if they are receiving less food than other family members due to household food allocation norms described previously. Thus, while education has increased women's participation in some decision-making, women still have limited autonomy in governing their households and own consumption, even when more educated than their husbands.

Taboos – Decreasing Yet Persistent

Due to education and interaction, some food taboos have become less common in rural Tanzania (Table 3). However, many PLW-related food taboos are held onto by villagers due to

respect for elders and long-held traditions along with fears of larger infants causing delivery complications (Table 4). This adherence to and persistence of PLW-related food taboos is a threat to maternal and child nutrition, as it hinders uptake of maternal nutrition recommendations. Women are told stories that invoke fear (Table 3). Pastoral men said that women are counselled by elder women to reduce their overall food intake when they are 7-8 months pregnant to control maternal weight gain and fetal size.

Elders believe that age and gender food taboos are good for society (Table 3). Elders noted that Maasai women traditionally avoid chicken, eggs, honey, and sugarcane for various reasons. Elders and youth across respondent groups noted that green grams and cowpeas cause gas and lead to cramps when eaten during pregnancy. Across communities, respondents noted that pregnant women were strongly discouraged or prohibited from consuming certain foods, notably milk, to prevent large babies and complicated births. While youth in sedentary communities recommend pregnant women avoid fermented milk, elder pastoralists discourage the consumption of hot milk during pregnancy and recommend yogurt. They believe that if a pregnant woman consumes eggs, she could suffer umbilical cord problems, nausea, or convulsions possibly giving birth to a child that looks like a chicken. Specific diet advice and restrictions also existed in the postpartum women. Younger women said that breastfeeding women should avoid beans, maize, and sardines because they produce gas in the mother's stomachs. Elder women believe that women should drink milk on the fourth day after giving birth and that eating meat for three months helps mothers recover. Interestingly, while many noted following these practices, some younger women noted they only pretended to follow them.

3.4. Discussion

Maternal diets are crucial to women's health and their children's future. This study aimed to answer how shifts in societal norms influence dietary beliefs and practices during pregnancy and lactation in rural Tanzania. Cultural influencers were discovered as a major driver of maternal diet. Changes in social norms significantly influenced societal beliefs about proper diets for PLW. Barriers to implementation of proper intake also played a large role in PLW's intake. Education and social interaction have impacted dietary habits, especially in sedentary communities where alterations to tradition are more acceptable, yet village-level barriers to change are pervasive, especially among pastoralists. Primary shifts observed were due to interethnic exchange and include increases in food items eaten and mutual decision-making. Key findings include altered mealtime practices and normalized PLW-related food taboos.

Persistent Beliefs

While some pregnancy- and lactation-related food taboos have been normalized in rural Tanzania, many persist. Primary reasons for adherence were fears of adverse birth outcomes, respect for elders and tradition, and the role food habits play in identification within and between cultural groups. This is supported by literature that states that culture-specific food taboos become a part of a groups' ways, bringing a sense of identity and cohesion (Meyer-Rochow, 2009; Ugwa, 2016).

Gender Norms

Women in rural Tanzanian communities now have knowledge of proper diet practices during pregnancy and lactation yet face obstacles to implementing healthy changes. Women struggle to obtain foods they desire because they are restricted from driving, visiting markets, purchasing food, and working. They request food items from their husbands, but often do not get what they ask for. Fathers frequently eat in others' homes during the day, causing them to miss opportunities for income to provide food for their families. The effects of household food scarcity on women's nutrition is compounded by a low valuation of women's diets, which common to many rural regions. Participants said women eat alone after everyone else has been satisfied. This adds to literature stating that food is allocated discriminatorily between genders, leaving pregnant women worldwide with last shares (Shannon, 2008). Participants of this study reported that women consider the whole family and future needs more than men when making food purchases. Advocacy for women could be influential in rural Tanzania, considering that, while mutual decision-making has increased due to globalization, gender norms are slow to change, especially in traditional communities.

PLW are restricted as to when, with whom, what foods and even the amount of food they may or may not eat. Literature says PLW in rural contexts have stringent food taboos placed upon them (Bently, 1999). Cultural prohibitions in rural villages cause PLW to miss key nutrients, contributing to intergenerational stunting (Chanchani, 2017; Martorell, 2012; Meyer-Rochow, 2009). Sociocultural beliefs are a common driver of not increasing and even reducing intake of nutrient-dense foods (Harding, 2017). Mothers in this study and others are encouraged to restrict all foods in order to have a smaller baby

for fear of birth complications, and to avoid nutritious foods during pregnancy due to the belief that the “baby will be too big” (Ali, 2004; Shannon, 2008).

Interethnic Exchange

Shifts in livelihoods to more sedentary lifestyles have facilitated an increase in education, modernization, interaction with other tribes, and women’s empowerment resulting in more balanced diets. Intercultural exchange has increased food types consumed and lessened stigma associated with tabooed foods. Consumption, acceptability, and affordability of animal products has resulted from sedentarization. This study revealed that egg, chicken, and fish consumption has especially increased in rural Tanzania, adding a new perspective to existing literature that had previously found PLW to avoid protein rich foods such as meat, fish and eggs (Ali, 2004; Chakrabarti, 2019; Choudhry 2019; Kavle, 2018). This Incorporation of animal products may improve the health of mothers and their children in these regions.

Strengths & Limitations

A limitation of this study was that the primary researcher was not involved in data collection, nor able to understand the languages data were collected in. This was circumvented by close communication with an advisor involved in all steps, start to finish, and the provision of translated verbatim transcripts of FGD’s, HHI’s and KII’s translated by professionals fluent in these languages. Major strengths of this study were the size of the team and high level of qualitative research training the collection team possessed. Intercoder agreement, formal qualitative data analysis training, and numerous cross-checkers ensured validity. The large cohort provided various perspectives, led to saturation of information and an extensive dataset.

Public Health Implications

Literature related to social forces influences on PLW's diets is lacking. Publications fail to explain why women adhere to cultural practices related to sociocultural drivers of maternal food choice and how food taboos affect birth outcomes. Recent published literature does however provide insight that societal systems drive maternal intake and that sociocultural beliefs are a risk factor for intentionally eating less and avoiding nutritional foods during pregnancy (Kohler, 2019). This study strengthens these findings and has implications for intervention design and scale-up of current programs through integration of culturally sensitive nutrition communication. Social forces majorly influence maternal diet through barriers they place on implementation of new understanding of proper intake for PLW. Social forces such as PLW's personal networks can be leveraged to improve program effectiveness. This could strengthen efforts to improve maternal and child nutrition in rural Tanzania. Community engagement could allow shifts in dietary beliefs to develop into practice and improve women's food intake in these regions. Findings of this study should be further explored in settings other than eastern Tanzania to develop context-specific nutrition recommendations in different locations.

References

Ali, N. S., Azam, S. I., & Noor, R. (2004). Womens' beliefs and practices regarding food restrictions during pregnancy and lactation: a hospital based study. *J Ayub Med Coll Abbottabad, 16*(3), 29-31.

Bentley, G. R., Aunger, R., Harrigan, A. M., Jenike, M., Bailey, R. C., & Ellison, P. T. (1999). Women's strategies to alleviate nutritional stress in a rural African society. *Soc Sci Med, 48*(2), 149-162.

Chakrabarti, S., & Chakrabarti, A. (2019). Food taboos in pregnancy and early lactation among women living in a rural area of West Bengal. *J Family Med Prim Care, 8*(1), 86-90. doi:10.4103/jfmpc.jfmpc_53_17

Chanchani, D. (2017). Maternal and child nutrition in rural Chhattisgarh: the role of health beliefs and practices. *Anthropology & Medicine*, 1-17. doi:10.1080/13648470.2017.1361654

Choudhry, U. K. (1997). Traditional practices of women from India: pregnancy, childbirth, and newborn care. *J Obstet Gynecol Neonatal Nurs, 26*(5), 533-539. doi:10.1111/j.1552-6909.1997.tb02156.x

FIGO. (2019). FIGO releases new guidelines to combat pre-eclampsia. Retrieved from https://www.figo.org/preeclampsia-guidelines

Harding, K. L., Matias, S. L., Mridha, M. K., Vosti, S. A., Hussain, S., Dewey, K. G., & Stewart, C. P. (2017). Eating down or simply eating less? The diet and health implications of these practices during pregnancy and postpartum in rural Bangladesh. *Public Health Nutrition, 20*(11), 1928-1940. doi:10.1017/S1368980017000672

Kavle, J. A., & Landry, M. (2018). Addressing barriers to maternal nutrition in low- and middle-income countries: A review of the evidence and programme implications. *Maternal & child nutrition, 14*(1), e12508. doi:10.1111/mcn.12508

Kohler, R., Lambert, C., & Biesalski, H. K. (2019). Animal-based food taboos during pregnancy and the postpartum period of Southeast Asian women - A review of literature. *Food Res Int, 115*, 480-486. doi:10.1016/j.foodres.2018.10.026

Kominiarek, M. A., & Rajan, P. (2016). Nutrition Recommendations in Pregnancy and Lactation. *The Medical clinics of North America, 100*(6), 1199-1215. doi:10.1016/j.mcna.2016.06.004

Manda-Taylor, L., Mwale, D., Phiri, T., Walsh, A., Matthews, A., Brugha, R., . . . Byrne, E. (2017). Changing times? Gender roles and relationships in maternal, newborn and child health in Malawi. *BMC Pregnancy Childbirth, 17*(1), 321. doi:10.1186/s12884-017-1523-1

Martorell, R., & Zongrone, A. (2012). Intergenerational influences on child growth and undernutrition. *Paediatr Perinat Epidemiol, 26 Suppl 1*, 302-314. doi:10.1111/j.1365-3016.2012.01298.x

Meyer-Rochow, V. B. (2009). Food taboos: their origins and purposes. *J Ethnobiol Ethnomed, 5*, 18. doi:10.1186/1746-4269-5-18

Mukhopadhyay, S., & Sarkar, A. (2009). Pregnancy-related food habits among women of rural Sikkim, India. *Public Health Nutr, 12*(12), 2317-2322. doi:10.1017/S1368980009005576

Shannon, K., Mahmud, Z., Asfia, A., & Ali, M. (2008). The social and environmental factors underlying maternal malnutrition in rural Bangladesh: implications for reproductive

health and nutrition programs. *Health Care Women Int*, *29*(8), 826-840. doi:10.1080/07399330802269493

Ugwa, E. A. (2016). Nutritional Practices and Taboos Among Pregnant Women Attending Antenatal Care at General Hospital in Kano, Northwest Nigeria. *Annals of medical and health sciences research*, *6*(2), 109-114. doi:10.4103/2141-9248.181846

UNICEF. (2019a). Low birthweight. Retrieved from https://data.unicef.org/topic/nutrition/low-birthweight/. Retrieved October 4, 2019, from UNICEF https://data.unicef.org/topic/nutrition/low-birthweight/

UNICEF. (2019b). Malnutrition. Retrieved from https://data.unicef.org/topic/nutrition/malnutrition/. Retrieved October 4, 2019, from UNICEF https://data.unicef.org/topic/nutrition/malnutrition/

WHO. (2018). Care of the preterm and low-birth-weight newborn. *Maternal, newborn, child and adolescent health* Retrieved from https://www.who.int/maternal_child_adolescent/newborns/prematurity/en/

Tables

Table 1.

Representative Quotes Portraying Drivers of Diet Change	Source
I think it is because of human interaction, people from different tribes have come together and started new human settlements, so people have shared traditions and living styles.	(FGD Konje Adult Women)
our children have gone to school and we are also more the wiser and have been given education on that and in the mixing of tribes we are doing now we meet other people and learn things that we did not know.	(FGD Manyinga Women Reproductive Age)
Eggs, chicken, fish, sardines, etc. these were not eaten in the past years but due to human social interaction, we eat them nowadays.	(FGD Konje Adult Men)
Human interaction, people coming together from different places and tribes has also caused the above changes, education provided to our sons and daughters has also accelerated some changes.	(FGD Konje Elder Men)
Nowadays food taboos have declined because of social interaction, people move from one place to another, on their movement they learn new customs and norms, and forget some of their tribal customs. For example in the past years people were not allowed to eat wild meat of "red parahala" because it was said that when you eat its meat, you suffer from leprosy. Moreover in the past years pregnant women were not allowed to eat eggs, more especially among the Sukuma people.	(FGD Manyinga Youth Male)

Table 2.

Representative Quotes for "Inability to Act" Theme	Source
I usually wait until they all satisfied… my grandmother used to watch all the people eating after they finished she is then start eating… She said is a good thing for a woman to watch all the people in her household eating first until they are satisfied then washing your utensils after that you can sit and start eating	(HHI Konje Han232)
The women eat alone. The children separately and the father eats separately. The father and the male boys are served separately. We serve ourselves as women separately and the children are also served separately.	(HHI Kambala MVO335)
At Kambala, market day is only once a week and that is Friday. Other markets are very far away. So the mother going to market is very difficult. The husband has to go as many of us here have transport and the wife cannot drive a motor bicycle or use a bicycle. So we are the one who go to bring the household necessities.	(FGD Kambala Elder Men)
You find that some women don't know how to make plans for the foodstuffs. She will only go and buy that maize flour and bring home or she does not know which food can last for a long time depending on the budget that we have. She can only go to buy something nice but to last for a short period. So, it is only a man who might have a decision…First, she is not the head of the household. For her as an	(KII Mela CHW)

assistant in the household, the woman in most instances has not been given full control over the assets. She has not been given ownership. She is only called home to give birth to children. The assets are for our children. Therefore, she does not see any decisions she can make because there are no assets that were allocated to her…. they are not given an opportunity to engage in any business.	
Yeah she will have some considerable authority to make some decisions because the money is hers. For example if you find out that she has bought body jelly of which a man was supposed to buy, there will be no problem at all because it would be helping each other out…. But today most women are more independent in making decisions in the house than men as long as their character is good. Even for a man with bad character for example of selling land, his wife will always oppose him. Therefore, women are denied or given more freedom than men just depending on their behaviours and character.	(KII Masatu CHW)

Table 3.

Representative Quotes for Taboo Reduction and Persistence	**Source**
It is like what we have said like the women are restricted from eating sugarcane. Sugarcane were for men only as they say if you do that you will end up having children who are always convulsing or you will have very frequent urinating problems. Or in the case of honey	(FGD Manyinga Women Reproductive Age)

they say if you use that the umbilical cord in pregnancy will have some problems; it will be eroded and hence endanger the life of the infant or they say that the fetus will be too big for you to deliver comfortably. For us who were hearing these stories at that time, they made us afraid and so we had to abide to the restrictions.	
Food taboos based on age group or gender are just normal procedure prepared to shape the society to have good morals and maintain society dignity.	(FGD Kambala Elder Women)
there is a belief that if she eats that she will also deliver a person who looks like a chicken.	(FGD Mela Adult Women)
In general this is everywhere even where we were coming from before coming here; there are these restrictions. For example where I am coming from, we were restricted from eating chicken; but as we are getting education we gradually realize that these types of food do not have any negative effect to the body. So we just do this quietly as the elderly people have spoken that we are not to eat the types of food; we just keep quite but then we eat as we know there is no effect in eating the food.	(FGD Manyinga Women Reproductive Age)

Table 4.

Taboo	**Description**	**Still Held?**	**Why?**
Eggs	Forbidden from pregnant women to	No, consumption	Primarily tribal mixing, but also children attending school, community nutrition

	avoid child looking like chicken.	has increased universally.	education, affordability, and an all-around decrease in following taboos.
Blood	PLW drank blood or blood + milk to increase blood levels.	No, replaced by stiff porridge.	The young in pastoral and sedentary communities, as well as elders in pastoral communities said this is no longer practiced due to education and health concerns.
Milk	Types of milk (hot, fermented, skimmed) discouraged from PLW.	Yes, not by all.	Elders believed skimmed milk is bad for health and hot milk in pregnancy leads to a fat baby and birth complications. The young believe that to be true with fermented milk.
Meat	Girls prohibited from slaughtered cow that died before complete birth.	Yes, this is an all-tribe custom.	WRA were said to not be allowed to eat the meat of a cow when they did not know the cause of death because it could cause illness or that died in birth for fear of the same happening in their deliveries.
Oil	PLW supposed to eat or drink sheep or goat oil.	Reports inconsistent among ages & genders.	The young did not mention this practice. Pastoral healthcare workers suggest it in delivery but to vomit thereafter. Elder women said oil should be consumed the day after delivery, elder men said two days after.

Chapter 4: Discussion & Implications

Maternal diets are crucial to women's nutritional status and overall health, as well as their children's health and viability. The goal of this study was to answer how shifts in societal norms influence dietary beliefs and practices during pregnancy and lactation. Cultural influencers were found to play a major role in maternal diet and changes in social norms influence societal beliefs about proper diets for PLW among rural Tanzanians. Habits, alterations to these habits, and implementation are major drivers of PLW's food intake. Sufficient nutrient and energy intake is essential for mothers, yet women in this region face barriers to obtaining dietary balance and sufficiency. Despite recent advances in livelihoods, education and intercultural exchange, tradition persists in all rural Tanzanian villages, challenging women's ability to implement new knowledge. Alterations to maternal diet are more acceptable in sedentary communities due to their shift toward modern behaviors such as males and females eating together at mealtime, however pastoral communities hold more tightly to local tradition and face more barriers to change.

Education and social interaction have impacted dietary practices in rural Tanzania, especially in communities that are more sedentarized. Although globalization has led to increased healthy practices, much of communities' gained knowledge remains unimplemented because village-level barriers to change are pervasive, especially among pastoralists. Primary observed shifts made in rural Tanzanian villages include increases in variation of household food items eaten, mutual decision-making, communal eating, and normalized food taboos. Key findings include that tribal exchange has altered mealtime practices and normalized food taboos related to PLW and that many traditional beliefs opposing these changes persist due to respect

for tradition and availability of food in rural Tanzania. These findings are discussed below with incorporation of existing publications and offering a new perspective to the current literature.

Persistent Beliefs

While some pregnancy- and lactation-related food taboos have been normalized in rural Tanzania, many still remain. Taboos related to beliefs about specific food items' outcome on mothers or their children if consumed are equally held onto by both men and women, young and old. Primary reasons for adherence to culturally practiced food taboos were respect for elders, devotedness to tradition, and the role they play in identifying cultural groups and bringing a sense of belonging to members within these groups. These reasons are consistent with existing literature describing that tradition and culture-specific food taboos become a part of a groups' ways, bringing a sense of identity and cohesion (Meyer-Rochow, 2009; Ugwa, 2016).

Gender Norms

While many women in rural Tanzanian communities now have knowledge of proper diet practices during pregnancy and lactation, and even desire to implement healthy changes, they face obstacles to making these changes. Women in these villages are restricted from activities such as driving, visiting markets, purchasing food items, and working. These limitations restrict their ability to obtain foods they desire. Since most women cannot make purchases, they request items from their husbands, but often do not get what they ask for. Sometimes fathers forget requests, but this is not always the reason

households do not obtain items mothers request. Fathers frequently eat in others' homes on visits during the lunch hour, missing income opportunities that would enable them to bring food home for their families.

Even if items mothers request are brought to the home, these women many not have the ability to consume them since their diets are so lowly valued in many rural communities. The majority of participants in this study said that women in rural Tanzania commonly eat alone after everyone else has eaten and been satisfied, which adds to existing literature that says food is allocated discriminatorily between genders around the world, leaving pregnant women with last shares at meals (Shannon, 2008). Additionally, the amount of food in households is already scarce, reported by locals as not enough to feed everyone if individuals ate from their own plate, compounding the effects that eating last has on a women's nutrition status.

Mutual decision-making is increasing in communities with more provision of education, primarily more modernized villages influenced by globalization, but gender norms are not quick to change, especially in more traditional communities and those with less access to nutrition education. Mutual decision-making is good for families because women more than men were reported to consider the whole family and future needs when deciding items to buy. Advocacy for women in these communities could be positively influential.

Taboos related to PLW's diets are closely integrated with culture and also influence maternal food intake (Chakrabarti, 2019). This finding is in concurrence with literature that says PLW in rural contexts have stringent food taboos placed upon them (Bently, 1999). Women in general but especially PLW are restricted to when, with whom, what specific foods and even the amount of food they may or may not eat. Sociocultural beliefs have been reported as a common driver of pregnant women in rural locations intentionally not increasing, even reducing intake

and consumption of nutrient-dense foods (Harding, 2017). A common theme seen in the data used for this study as well as prior research was that mothers report restricting all foods in order to have a smaller baby for fear of birth complications (Ali, 2004). Women are told to avoid nutritious foods during pregnancy due to the belief that the "baby will be too big" (Shannon, 2008). Due to cultural prohibitions and restrictions, often occurring in a village-specific manner, PLW often miss key nutrients, thereby contributing to intergenerational stunting (Chanchani, 2017; Martorell, 2012; Meyer-Rochow, 2009).

Interethnic Exchange

Villages of rural Tanzania have recently seen more interaction with other tribes and ethnicities than before. Shifts in livelihoods to more sedentary occupations and lifestyles have facilitated an increase in education and modernization. With these shifts came women's empowerment and more balanced diets. Intercultural interaction has increased food types eaten and broken down the stigma associated with tabooed foods.

A shift seen in all communities but particularly in sedentarized locations more influenced by intercultural exchange than pastoral villages is an increase in meat consumption. The new wealth of information from education and exchange facilitated by sedentarization has not only increased consumption but the affordability of animal products. Egg, chicken, and fish consumption has especially increased in rural Tanzanian communities. This result adds a new perspective to existing literature that discusses rural PLW around the globe often avoid micronutrient rich foods, especially those high in protein such as meat, eggs and fish, which can be a detriment to their health and their children's future (Ali, 2004; Chakrabarti, 2019; Choudhry 2019; Kavle, 2018).

Strengths & Limitations

This study had limitations but also many strengths. A limitation was that the primary researcher was not involved in data collection, nor able to understand the languages data were collected in. The researcher could therefore not understand recordings. This was circumvented by close communication with an advisor who was involved in all aspects of the study from start to finish and having translated verbatim transcripts to work from, provided by team members fluent in the native languages data were collected in. The limitation of missing inflection or tone was mitigated by the FGD's, HHI's and KII's being translated by professionals who typed the transcripts. Major strengths of this study were the size of the team and high level of qualitative research training those who collected and translated the data possessed. Intercoder agreement, formal qualitative data analysis training, and numerous cross-checkers ensured validity. Another useful and important strength was that the large cohort provided various perspectives, led to saturation of information provided and produced an extensive dataset from which to analyze.

Recommendations for Future Research

This study explored how beliefs about maternal diets have changed to understand how societal influences affect PLW's intake in rural Tanzania and found that social forces are major influencers on maternal diet. While nutrition education has increased in rural Tanzania, bringing understanding about proper intake for PLW and balanced diets for children, barriers hinder effectiveness of implementing related changes in consumption practices. Despite obstacles, pertinent efforts to improve the health of mothers and children in rural Tanzania have seen success, especially villages with more provision of nutrition education and intercultural

exchange. Locals are eating more animal-based products and new information has given women more say in food items purchased for their households.

Literature specifically related to social forces influences on PLW's diets in rural Tanzania, however, is lacking. Current publications fail to provide explanations for why women adhere to cultural practices and habits related to these sociocultural drivers of maternal food choice. Increased understanding about why PLW-related food taboos persist could be useful in initiating change. More research is needed on how cultural beliefs and practices related to intake during pregnancy and lactation affect birth outcomes in rural Tanzania. To ensure that nutrition recommendations are context-specific and appropriate for the setting they are applied to, findings of this study should be further explored in settings other than eastern Tanzania and communications should be adapted accordingly.

Public Health Implications

While nutrition communications have been widely accepted by communities in eastern Tanzania, barriers to achieving the changes necessary to improve the health of PLW persist. Recent published literature provides insight showing that societal systems are drivers of maternal food choices and levels of intake, sociocultural beliefs being a major risk factor for intentionally eating less and avoiding nutritional foods during pregnancy (Kohler, 2019). This study strengthens what has been found by other researchers and has implications for intervention design and scale-up of current programs to integrate culturally sensitive nutrition communication. Integration of community-based strategies are needed in order for programs to effectively promote implementation of

PLW nutrition information and benefit the health of mothers and children in these regions through improved maternal diet.

Findings of this study suggest that traditional social forces are a major hinderance to the implementation of behavior change in response to information provided by public health resources. These influencers can be leveraged to improve program effectiveness, strengthening efforts to improve maternal and child nutrition in rural Tanzania. Programs should leverage personal networks to decrease community stigma related to PLW's diets, as these social forces are a powerful tool that can bring about change. For example, programs could build upon the positive attitudes rural Tanzanians have toward health education by expanding activities to engage men. Literature shows traditional views of men as decision-makers and socio-cultural influences on MCH, initiatives to involve men in the health of their female partners and children need to be gender-sensitive (Manda-Taylor, 2017). Programs may implement this through inclusivity, welcoming men in spaces and activities, acknowledging their part as integral in achieving goals to improve MCH outcomes.

In addition to providing information on benefits of proper maternal consumption, specifically the importance of both macro- and micronutrient and sufficiency, interventions should address adherence to cultural beliefs and societal norms, offering tips to help PLW implement their new knowledge gained through public health efforts. This would allow the influences of shifts in dietary beliefs resulting from increased social interaction to develop into practice, thereby improving the health of mothers and children in rural Tanzania. Advocacy for women's rights and increased access to nutritional foods would also improve the health of current and future generations in rural Tanzania.

References

Abu-Ouf, N. M., & Jan, M. M. (2015). The impact of maternal iron deficiency and iron deficiency anemia on child's health. *Saudi medical journal, 36*(2), 146-149. doi:10.15537/smj.2015.2.10289

Ali, N. S., Azam, S. I., & Noor, R. (2004). Womens' beliefs and practices regarding food restrictions during pregnancy and lactation: a hospital based study. *J Ayub Med Coll Abbottabad, 16*(3), 29-31.

Ares Segura, S., Arena Ansótegui, J., Díaz-Gómez, N. M.,. (2015). The importance of maternal nutrition during breastfeeding: Do breastfeeding mothers need nutritional supplements? *Anales de pediatria (Barcelona, Spain : 2003), 84*. doi:10.1016/j.anpedi.2015.07.024

Bain, L. E., Awah, P. K., Geraldine, N., Kindong, N. P., Sigal, Y., Bernard, N., & Tanjeko, A. T. (2013). Malnutrition in Sub-Saharan Africa: burden, causes and prospects. *The Pan African medical journal, 15*, 120-120. doi:10.11604/pamj.2013.15.120.2535

Bentley, G. R., Aunger, R., Harrigan, A. M., Jenike, M., Bailey, R. C., & Ellison, P. T. (1999). Women's strategies to alleviate nutritional stress in a rural African society. *Soc Sci Med, 48*(2), 149-162.

Boston Children's Hospital. (2019). Spina Bifida in children. *Conditions.* Retrieved from http://www.childrenshospital.org/conditions-and-treatments/conditions/s/spina-bifida

Bravi, F., Wiens, F., Decarli, A., Dal Pont, A., Agostoni, C., & Ferraroni, M. (2016). Impact of maternal nutrition on breast-milk composition: a systematic review. *Am J Clin Nutr, 104*(3), 646-662. doi:10.3945/ajcn.115.120881

CDC. (2017, August 29, 2017). About adult BMI. *Assessing your weight.* Retrieved from https://www.cdc.gov/healthyweight/assessing/bmi/adult_bmi/index.html

CDC. (2019). Recommendations: Women & folic acid. *Folic Acid.* Retrieved from https://www.cdc.gov/ncbddd/folicacid/recommendations.html

Chakrabarti, S., & Chakrabarti, A. (2019). Food taboos in pregnancy and early lactation among women living in a rural area of West Bengal. *J Family Med Prim Care, 8*(1), 86-90. doi:10.4103/jfmpc.jfmpc_53_17

Chanchani, D. (2017). Maternal and child nutrition in rural Chhattisgarh: the role of health beliefs and practices. *Anthropology & Medicine*, 1-17. doi:10.1080/13648470.2017.1361654

Choudhry, U. K. (1997). Traditional practices of women from India: pregnancy, childbirth, and newborn care. *J Obstet Gynecol Neonatal Nurs, 26*(5), 533-539. doi:10.1111/j.1552-6909.1997.tb02156.x

Christian, P. (2002). Maternal nutrition, health, and survival. *Nutr Rev, 60*(5 Pt 2), S59-63. doi:10.1301/00296640260130759

Drake, V. (2011). Micronutrient needs during pregnancy and lactation. *Pregnancy and lactation.* Retrieved from https://lpi.oregonstate.edu/mic/life-stages/pregnancy-lactation

Fanzo, J. (2012). The Nutrition Challenge in Sub-Saharan Africa. *United Nations Development Programme*. Retrieved from https://www.undp.org/content/dam/rba/docs/Working%20Papers/Nutrition%20Challenge.pdf

FAO, I., UNICEF, WFP and WHO,. (2017). *The state of food security and nutrition in the world*. Retrieved from Rome, FAO:

FIGO. (2019). FIGO releases new guidelines to combat pre-eclampsia. Retrieved from https://www.figo.org/preeclampsia-guidelines

Haider, B. A., Yakoob, M. Y., & Bhutta, Z. A. (2011). Effect of multiple micronutrient supplementation during pregnancy on maternal and birth outcomes. *BMC Public Health, 11*(3), S19. doi:10.1186/1471-2458-11-S3-S19

Harding, K. L., Matias, S. L., Mridha, M. K., Vosti, S. A., Hussain, S., Dewey, K. G., & Stewart, C. P. (2017). Eating down or simply eating less? The diet and health implications of these practices during pregnancy and postpartum in rural Bangladesh. *Public Health Nutrition, 20*(11), 1928-1940. doi:10.1017/S1368980017000672

Hutter, I. (1996). Reduction of food intake during pregnancy in rural south India. *Trop Med Int Health, 1*(3), 399-405. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/8673846

Iradukunda, F. (2019). Food taboos during pregnancy. *Health Care Women Int*, 1-10. doi:10.1080/07399332.2019.1574799

Kavle, J. A., & Landry, M. (2018). Addressing barriers to maternal nutrition in low- and middle-income countries: A review of the evidence and programme implications. *Maternal & child nutrition, 14*(1), e12508. doi:10.1111/mcn.12508

Kejo, D., Petrucka, P. M., Martin, H., Kimanya, M. E., & Mosha, T. C. (2018). Prevalence and predictors of anemia among children under 5 years of age in Arusha District, Tanzania. *Pediatric health, medicine and therapeutics, 9*, 9-15. doi:10.2147/PHMT.S148515

Kohler, R., Lambert, C., & Biesalski, H. K. (2019). Animal-based food taboos during pregnancy and the postpartum period of Southeast Asian women - A review of literature. *Food Res Int, 115*, 480-486. doi:10.1016/j.foodres.2018.10.026

Koletzko, B., Cremer, M., Flothkotter, M., Graf, C., Hauner, H., Hellmers, C., . . . Wockel, A. (2018). Diet and Lifestyle Before and During Pregnancy - Practical Recommendations of

the Germany-wide Healthy Start - Young Family Network. *Geburtshilfe Frauenheilkd, 78*(12), 1262-1282. doi:10.1055/a-0713-1058

Koletzko, B., Godfrey, K. M., Poston, L., Szajewska, H., van Goudoever, J. B., de Waard, M., . . . Zalewski, B. M. (2019). Nutrition During Pregnancy, Lactation and Early Childhood and its Implications for Maternal and Long-Term Child Health: The Early Nutrition Project Recommendations. *Annals of Nutrition and Metabolism, 74*(2), 93-106. doi:10.1159/000496471

Kominiarek, M. A., & Rajan, P. (2016). Nutrition Recommendations in Pregnancy and Lactation. *The Medical clinics of North America, 100*(6), 1199-1215. doi:10.1016/j.mcna.2016.06.004

Lee, A. I., & Okam, M. M. (2011). Anemia in pregnancy. *Hematol Oncol Clin North Am, 25*(2), 241-259, vii. doi:10.1016/j.hoc.2011.02.001

LINKAGES. (2004). Breastfeeding and maternal nutrition frequently asked questions. In: Academy for Educational Development.

Manda-Taylor, L., Mwale, D., Phiri, T., Walsh, A., Matthews, A., Brugha, R., . . . Byrne, E. (2017). Changing times? Gender roles and relationships in maternal, newborn and child health in Malawi. *BMC Pregnancy Childbirth, 17*(1), 321. doi:10.1186/s12884-017-1523-1

Martorell, R., & Zongrone, A. (2012). Intergenerational influences on child growth and undernutrition. *Paediatr Perinat Epidemiol, 26 Suppl 1*, 302-314. doi:10.1111/j.1365-3016.2012.01298.x

Mayo Clinic Staff. (2017). Pregnancy week by week. *Healthy lifestyle.* Retrieved from https://www.mayoclinic.org/healthy-lifestyle/pregnancy-week-by-week/in-depth/pregnancy-nutrition/art-20043844

Mayo Foundation for Medical Education and Research (MFMER). (2019). Iron deficiency anemia during pregnancy: Prevention tips. *Pregnancy week by week.* Retrieved from https://www.mayoclinic.org/healthy-lifestyle/pregnancy-week-by-week/in-depth/anemia-during-pregnancy/art-20114455

Meyer-Rochow, V. B. (2009). Food taboos: their origins and purposes. *J Ethnobiol Ethnomed, 5*, 18. doi:10.1186/1746-4269-5-18

Mohammed, S. H., Taye, H., Larijani, B., & Esmaillzadeh, A. (2019). Food taboo among pregnant Ethiopian women: magnitude, drivers, and association with anemia. *Nutr J, 18*(1), 19. doi:10.1186/s12937-019-0444-4

Mukhopadhyay, S., & Sarkar, A. (2009). Pregnancy-related food habits among women of rural Sikkim, India. *Public Health Nutr, 12*(12), 2317-2322. doi:10.1017/S1368980009005576

Riang'a, R. M., Broerse, J., & Nangulu, A. K. (2017). Food beliefs and practices among the Kalenjin pregnant women in rural Uasin Gishu County, Kenya. *J Ethnobiol Ethnomed, 13*(1), 29. doi:10.1186/s13002-017-0157-8

Shannon, K., Mahmud, Z., Asfia, A., & Ali, M. (2008). The social and environmental factors underlying maternal malnutrition in rural Bangladesh: implications for reproductive health and nutrition programs. *Health Care Women Int, 29*(8), 826-840. doi:10.1080/07399330802269493

Sharifah Zahhura, S. A., Nilan, P., & Germov, J. (2012). Food restrictions during pregnancy among Indigenous Temiar women in peninsular Malaysia. *Malays J Nutr, 18*(2), 243-253.

Sung, J. Y. (2012). *History of nutrition in East Africa* Retrieved from https://www.zum.de/whkmla/sp/1314/anastasia/sjy1.html#v

Torheim, L. E., Ferguson, E. L., Penrose, K., & Arimond, M. (2010). Women in Resource-Poor Settings Are at Risk of Inadequate Intakes of Multiple Micronutrients. *The Journal of Nutrition, 140*(11), 2051S-2058S. doi:10.3945/jn.110.123463

Ugwa, E. A. (2016). Nutritional Practices and Taboos Among Pregnant Women Attending Antenatal Care at General Hospital in Kano, Northwest Nigeria. *Annals of medical and health sciences research, 6*(2), 109-114. doi:10.4103/2141-9248.181846

UNICEF. (2019a). Low birthweight. Retrieved from https://data.unicef.org/topic/nutrition/low-birthweight/. Retrieved October 4, 2019, from UNICEF https://data.unicef.org/topic/nutrition/low-birthweight/

UNICEF. (2019b). Malnutrition. Retrieved from https://data.unicef.org/topic/nutrition/malnutrition/. Retrieved October 4, 2019, from UNICEF https://data.unicef.org/topic/nutrition/malnutrition/

UNICEF. (2019c). Maternal mortality. Retrieved from https://data.unicef.org/topic/maternal-health/maternal-mortality/. Retrieved October 4, 2019, from UNICEF https://data.unicef.org/topic/maternal-health/maternal-mortality/

WHO. (2018). Care of the preterm and low-birth-weight newborn. *Maternal, newborn, child and adolescent health* Retrieved from https://www.who.int/maternal_child_adolescent/newborns/prematurity/en/

Wu, G., Imhoff-Kunsch, B., & Girard, A. W. (2012). Biological mechanisms for nutritional regulation of maternal health and fetal development. *Paediatr Perinat Epidemiol, 26 Suppl 1*, 4-26. doi:10.1111/j.1365-3016.2012.01291.x