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**The Nutrition Transition in Tanzania: Examining Changing Food, Diet, and
Food Culture Among Pastoralists and Agro-Pastoralists**

By

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An abstract of
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the Rollins School of Public Health of Emory University
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Abstract

The Nutrition Transition in Tanzania: Examining Changing Food, Diet, and Food Culture Among Pastoralists and Agro-Pastoralists

By Hosana Nagasaka

Background: The Nutrition Transition is a term used to describe shifts in diet and physical activity that occur within a global context of agroecological and sociocultural change. Over the past half century, an increasing number of Tanzanian pastoralist communities have been leaving mobile pastoralism and adopting sedentarization, as well as leaving traditional food customs and adapting Western dietary patterns.

Objective: This thesis seeks to understand how various sociocultural drivers are influencing and accelerating the rate of the Nutrition Transition among Tanzanian pastoralists and agro-pastoralists. This thesis also examines how community members perceive this transition is changing traditional food, diet, and food culture.

Methods: Using data collected during 2016–2017 among pastoralists and agro-pastoralists living in the Morogoro and Tanga regions in Eastern Tanzania, the Grounded Theory approach to qualitative research is used to analyze 34 key informant interviews and 15 focus group discussions conducted among extensive pastoralist, extensive sedentary, and intensive sedentary agro-pastoralist communities.

Results: Diets are changing across pastoralist and agro-pastoralist communities. Interethnic exchange acts a critical social driver of these changes, and spurs prioritization of child and adolescent school, livelihood training and nutrition education, and religious discourse. These social drivers are not only changing traditional food practices, norms, and values, but are facilitating the emergence of a new food culture among pastoralist and agro-pastoralist communities.

Conclusion: The Nutrition Transition may be in its nascent stage among communities in Eastern Tanzania, but examples from countries further along the transition indicate a troubling trajectory requiring targeted public health interventions. Collaboration and investment in the rural economy and provision of increased outreach, education, and extension services should be prioritized to increase social capital and strengthen, improve, and sustain public health nutrition in these communities.

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Table of Contents

Chapter 1: Introduction	1
Introduction and Rationale	1
Problem Statement.....	3
Purpose Statement	4
Research Objectives	4
Definition of Terms	5
Chapter 2: Comprehensive Review of the Literature	7
Background	7
Justification for Selected Studies	10
The Socioecological Model	10
The Traditional Diet	11
Food and Community.....	12
Land Settlement and Livelihood Diversification	13
Nutrition Transition	14
Infants and Children	17
Adolescents	20
Women of Reproductive Age.....	21
Elderly and Disabled	23
Gaps in Research.....	24
Chapter 3: Manuscript	25
Introduction	25
Population and Sample	26
Methods.....	28
Ethical Considerations	30
Chapter 4: Results	30
Introduction	30
Findings.....	31
Overview of Agroecological Drivers.....	31
Overview of Sociocultural Drivers	33
Food Availability.....	33
Food Convenience	36
Food Desirability	37
Interethnic Exchange as a Dominant Social Driver	39
Livelihood and Nutrition Education on Changing Food Practice	40
Child School and Education on Changing Food Values	43
Religion on Changing Food Norms	47
The Case for Cow Blood	47
Summary	51
Chapter 5: Discussion and Conclusion	52
Discussion and Implication of Findings.....	51
Strengths and Limitations.....	57
Recommendations for Policy, Programming, and Research	59
Appendix	62
References	63

Chapter 1: Introduction

Introduction and Rationale

The United Republic of Tanzania is a country in East Africa covering a geographical area that was historically occupied by hunter-gatherer communities (Ekaya, 2005). Over millennia, these communities experienced local extinction as historical lands became unavailable due to population growth, human settlement patterns, and change in land tenure (Ekaya, 2005; Galvin, 2009a). Hunter-gatherers adapted mobile pastoralism and began traversing swaths of the East African drylands in search of pasture and water for their livestock (Ekaya, 2005). Over time, pastoralism became more than a system of production but its own sociocultural system with its own established customs, culture, and mores (Salih, 1990b).

Today, pastoralists belong to two distinct groups. Pastoralists, or “pure pastoralists” rely on their livestock and practice little to no agriculture, while agro-pastoralists, or “new pastoralists,” practice both livestock-rearing and agricultural cultivation (Salih, 1990b). Agro-pastoralism, which combined farming by sedentarizing the household with pastoral stock farming, emerged from pastoralism in the 1970s and 1980s after successive weather crises decimated livestock (Grandval, 2012). Among agro-pastoralists, extensive sedentary communities practice a mix of pastoralism and crop cultivation, while intensive sedentary communities practice crop cultivation in addition to keeping a limited number of livestock through zero-grazing strategies (Dixon & Guilliver, 2001). The primary difference between pastoralists and agro-pastoralists lies in land ownership. The former relies on communal pastoral land systems, while the latter own land for crop agriculture while practicing stock farming, albeit with a strong cultural preference for livestock-raising over farming (Grandval, 2012). Pastoralist and agro-pastoralist livelihoods remain vulnerable to climate variability; successive seasons

of poor rains contribute to livestock deaths and crop failure, which consequently increases undernutrition and malnutrition among women and stunting and wasting among children, especially in rural communities (Sellen, 2000; UNICEF 2000b).

Despite strong cultural ties to pastoralism, an increasing number of East African pastoralists have transitioned away from mobile pastoralism since the late 20th century (Ekaya, 2005). Many have adopted agro-pastoralism and diversified livelihoods to remain economically viable or have abandoned pastoralism altogether (Ekaya, 2005; J. McPeak & Little, 2005). On one hand, the idea of livelihood diversification and sedentarization remain unacceptable to many pastoralists, who are reluctant to leave their traditional livelihoods (Dixon & Guilliver, 2001). On the other, livelihood diversification appeals to those who are hopeful for modernization, innovation, and social mobility, and some have adapted by choice rather than necessity (Grandval, 2012; Keding et al., 2001; Pederson & Benjaminsen, 2007).

In addition to the increasing number of pastoralists transitioning from mobile pastoralism to sedentarization, food supplies have grown closer to reaching a “global average diet,” reflected in increased demand and consumption of commodity cash crops, such as wheat, corn, and soy over the past half century (Ekaya, 2005). Low-to-middle income countries (LMICs) in Sub-Saharan Africa (SSA) are believed to have undergone the greatest change, and pastoralist and agro-pastoralist communities are experiencing this dietary transition first-hand (Ekaya, 2005; McPeak et al., 2012). This global phenomenon, coined the Nutrition Transition, describes shifts in diet and physical activity occurring within a larger global context of livelihood diversification and sedentarization patterns, and signifies a major epidemiological transition in human history (Galvin, 2009a; Popkin et al., 2002). The downstream consequences of the Nutrition Transition include increasing incidence and prevalence of overweight,

obesity, and diet-related non-communicable diseases (NCDs) around the world (Sellen, 2000). Epidemiological studies support these findings, and have identified a correlation between changing food environments and increased NCD incidence throughout the life-course (Alderman & Fernald, 2017; Ginsburg et al., 2013). Available literature appears to confirm that the Nutrition Transition's influence on food and diet is also changing traditional food practices, norms, and values (Cairns, 2019). The Socioecological Model can be used to conceptualize how the Nutrition Transition is affecting diet and health at the individual, relational, communal, and societal levels (Rural Health Information Hub, 2020). In fact, food and diet change is evident across all socioecological levels among rural pastoralists and agro-pastoralists. Food purchasing, preparation, and consumption patterns indicate simple carbohydrates, added sugars, and oils are beginning to replace and overtake traditional food staples, such as roots, tubers, and fruits and vegetables in families and communities across livelihoods (Keding et al., 2011; Kuhnlein et al., 2009; Monteiro et al., 2013).

Problem Statement

In the past half century, an increasing number of formerly nomadic pastoralist tribes have adapted sedenterization. In the same span of time, traditional diets have become increasingly globalized (Popkin et al., 2002). An array of negative health consequences accompany these livelihood and diet shifts, including an increased incidence and prevalence of overweight, obesity, and diet-related NCDs (Sellen, 2000). Although Tanzanian pastoralist communities have historically experienced high prevalence of undernutrition, the possible coexistence of undernutrition and overnutrition in the country signifies a troubling trajectory, as evidenced by an increasing number of LMICs shouldering the double burden of malnutrition (Sellen, 2000; Popkin et al., 2002). As

the global food environment changes, traditional food and diet are rapidly changing alongside it to create a new food culture (Cairns, 2019; Fratkin, 2001; Roth et al., 2004). As local markets sell more energy-dense yet nutrient-poor foods, they are beginning to replace local and indigenous foods, indicating the Nutrition Transition may be underway among Tanzanian pastoralist and agro-pastoralist communities.

Purpose Statement

Tanzanian pastoralists and agro-pastoralists are living in the midst of a global Nutrition Transition (Fratkin, 2001; Roth et al., 2004). Previous studies have investigated the drivers of diet change among these communities, but a paper studying the various drivers of Nutrition Transition and its relationship with and effect on traditional food, diet, and food culture in these communities remain largely unexplored (Dixon & Gulliver, 2001; Fratkin, 2001; Grandval, 2012; Roth et al., 2004). The purpose of this thesis is to employ qualitative research methods to understand the drivers influencing and accelerating the rate of Nutrition Transition, and to understand how communities in pastoralist and agro-pastoralist communities perceive changes in traditional food, diet, and food culture.

Research Objectives

Tanzanian pastoralist communities are leaving mobile pastoralism, adopting sedentarization, and replacing traditional foods for Western diet patterns. This thesis examines how the global phenomenon of the Nutrition Transition is changing traditional food, diet, and food culture among Tanzanian pastoralists and agro-pastoralist communities. The Socioecological Model places traditional food, diet, and livelihoods in the context of their communities and accounts for the sociocultural

factors influencing each community, providing a potential explanation for how various drivers are influencing the Nutrition Transition at the individual, communal, and societal levels (Rural Health Information Hub, 2020). The Nutrition Transition further contextualizes these drivers against a global backdrop of agroecological and sociocultural changes that are taking place over an extended period of time (Popkin, 1993).

Research follows the interpretative paradigm of qualitative research and seeks to identify the drivers influencing and accelerating the rate of Nutrition Transition, and to understand how pastoralist and agro-pastoralist communities are perceiving these changes in traditional food, diet, and food culture. This thesis uses secondary qualitative analysis from qualitative data collected from 34 key informant interviews (KIIs) and 15 focus group discussions (FGDs) during 2016–2017 among pastoralists and agro-pastoralists living in the Morogoro and Tanga regions in Eastern Tanzania. Utilizing a Grounded Theory approach to qualitative research, this thesis selects participants from a diverse array of lived experiences by stratifying by sedentarization level, community role, life-stage, and gender, to better understand how participants perceive the Nutrition Transition is influencing food, diet, and food culture among their respective communities.

Definition of Terms

- **Agropastoralism:** A farming system commonly practiced in East Africa where crops and livestock are considered equally important (Dixon & Guilliver, 2001). Communities are sedenterized, although herds may seasonally migrate; livestock are kept for subsistence – for their milk and milk products – as well as

for offspring, land preparation, sale or exchange, and insurance against crop failure (Dixon & Guilliver, 2001).

- **Food culture:** Socially accepted values, eating patterns, and practices around food purchasing, provisioning, preparation, and consumption; thought to be an outward expression of world views and belief systems (Cairns, 2019).
- **Food environment:** A term used to encompass conditions that influence food choices and nutritional status, which spans multiple dimensions of food availability, affordability, convenience, and desirability (Turner et al., 2018).
- **Food norms:** Observable, common practices around socially acceptable and unacceptable behaviors around food, thought to emerge from an iterative process of exposure to external factors and subsequent changes in response to those exposures (Cairns, 2019).
- **Food practices:** Habitual or ritualized food behaviors followed by a community which serve both semipublic and functional roles, and are the result of historic and present day sociocultural and agroecological influences and material characteristics of food systems (Cairns, 2019).
- **Food values:** Assumed socially acceptable behaviors or practices around food and dietary culture which emerge from social imitation and adaptation in response to social innovation, such as social networks (Cairns, 2019).
- **Globalization (Food Systems):** Increasing intranational and international exchange of products, technology, and information, leading to changes in costs of agricultural production and trade (Anderson, 2010).
- **Nutrition Transition:** Global change in diet, health, and nutritional outcomes as a consequence of demographic transitions and epidemiologic shifts as

countries industrialize, characterized by a decreasing prevalence of infectious diseases associated with diet-related malnutrition, to an increasing prevalence of non-communicable diseases (Popkin, 1993).

- **Pastoralism:** A livelihood system where livestock, including cattle, sheep, and goats, are of primary importance (Dixon & Guilliver, 2001). These communities seasonally move in response to dry and rainy seasons; among pastoralists, socioeconomic status varies widely, and livelihoods are negatively influenced by stock theft or animal deaths due to drought (Dixon & Guilliver, 2001).
- **Socioeconomic Model:** Framework that recognizes the existence of multiple levels of influence on health behaviors, starting at the individual level and expanding into the interpersonal, institutional and organizational, community, and policy levels (Rural Health Information Hub, 2020).

Chapter 2: Comprehensive Review of the Literature

Background

In East Africa, agriculture accounts for 20 percent of the region's gross domestic product and is considered the primary livelihood for many of the poor (Dixon & Guilliver, 2001). According to the Food and Agriculture Organization (FAO), out of the twenty-five broad farming systems identified throughout Africa, pastoralist and agro-pastoralist livelihoods are considered two of Tanzania's major farming systems (Dixon & Guilliver, 2001). While the average caloric intake of those living in Sub-Saharan Africa is projected to increase by 2030, the number of undernourished people has also been steadily rising, with a higher incidence found among rural over urban populations (Dixon & Guilliver, 2001). The rural poor account for up to 90 percent of those living in poverty, and an estimated 80 percent of the poor depend on agriculture

for their primary livelihood (Dixon & Guilliver, 2001). In addition to food insecurity and malnutrition, the region has experienced a surge in diet-related NCDs over the past several decades, believed to be led in part by the introduction of Western foods and modern conveniences into the traditional African diet (Monteiro et al., 2013; Raschke & Cheema, 2008).

Pastoralist livelihood depends on breeding and remittance of cattle, sheep, and goats, and their food systems depend on seasonal passage with their herds (Dixon & Guilliver, 2001; Salih, 1990b). Poverty is both extensive and severe for these communities, whose cattle assets are vulnerable to climatic variability and prolonged drought (Dixon & Guilliver, 2001; Sellen, 2000). Pastoralists have historically resisted domestication despite challenges to livelihood from multiple fronts; their dependence on seasonal movement makes settling within a local or national boundary seem contrary to their way of life (Salih, 1990b). Even so, successive government policies favoring land fragmentation and settlement have negatively affected pastoralists (FAO, 2001). With increasing pressure to diversify livelihood or abandon pastoralism altogether, many have adapted agro-pastoralism — the most frequently used method of livelihood diversification — while other pastoralists have fully sedenterized or moved into urban city centers (Grandval, 2012; Ndagala, 1990).

Primary livelihoods among agro-pastoralists include farming of sorghum, millet, and pulses, in addition to keeping cattle, sheep, goats, and poultry for subsistence, land preparation, sale or exchange, and insurance against crop failure (Dixon & Guilliver, 2001). With the exception of seasonal cattle migration, most agro-pastoralists live in permanent communities and practice crop agriculture (Dixon & Guilliver, 2001). Dependence on crop yields makes drought the primary threat to agro-pastoralist

livelihoods; poor rains lead to crop failure, which is often followed by food shortage, increased crop prices, and decreased livestock prices (Dixon & Guilliver, 2001).

Although an in-depth discussion of colonialism's effects on the African continent is beyond the scope of this thesis, a long history of European colonialization is thought to lie at the heart of present-day food insecurity in many African countries (Ekaya, 2005; Raschke & Cheema, 2008). Centuries of suppression of indigenous religion, culture, and tradition – including knowledge of local food habits – has negatively affected food sovereignty in the continent (Raschke & Cheema, 2008; Salih, 1990a). Neo-colonial forces groomed the region to remain economically dependent upon foreign aid and assistance (Raschke & Cheema, 2008). Even today, inefficient and ineffective international response has invested in food aid distribution rather than sustainable, long-term solutions, exacerbating food insecurity in the region (Bain et al., 2013).

Furthermore, anti-agricultural and anti-trade government policies marginalize farming communities (Ekaya, 2005; Fratkin, 2001; J. G. McPeak et al., 2012). Fallacious and harmful perceptions that industrialization is key to economic growth has prevailed, and domestic production and trade controls have exhibited an anti-agriculture bias favoring industry's "increasing returns" over agriculture's "decreasing returns" (Baliño et al., 2019; Lipton, 1977; Schiff & Valdes, 2013). Urban growth has increased food demand in cities, and agricultural surplus have been drained from farms to reflect these changes (Lipton, 1977). Globalized trade has affected many farming systems, which are subject to ever-fluctuating international commodity prices (Anderson, 2010; Dixon & Guilliver, 2001; Salih, 1990a). Increased demand for energy-rich yet nutrient-poor export-found flex crops have led to farmers to transition away from cultivating local staples (Muller et al., 2021). Despite increased demand, smallholder farmers face decreasing access to agricultural inputs, including better quality seeds, and soil

nutrients (Dixon & Guilliver, 2001). Slow increases in farm productivity relative to the rest of the world and an ongoing presence of foreign aid have contributed to reduced agricultural self-sufficiency in the region (Alston et al., 2009; Anderson, 2010). Changing global food production patterns have also been identified as one of the largest drivers of climate change (Willett et al., 2019). Historical records in temperature and rainfall confirm climate change is increasing the frequency of famine in SSA Africa (Dixon & Guilliver, 2001). Related stressors, such as increasing periods of poor rainfall, land degradation, biodiversity loss, increased migration, and land-system changes, are contributing to a food environment that is becoming increasingly unfriendly to pastoralist and agro-pastoralist livelihoods (McCabe et al., 2010; Willett et al., 2019).

Justification for Selected Studies

The following literature review discusses two frameworks to understand the influences of changing food, diet, and food culture among Tanzanian pastoralist and agro-pastoralist communities. First, the Socioecological Model identifies the multiple levels of influences on behavior through a societal and cultural context (Rural Health Information Hub, 2020). Second, the Nutrition Transition theory, and the primary focus of this thesis, discusses how various drivers are influencing and accelerating the rate of global changes in food, diet, and nutrition-related health outcomes (Popkin, 1993). Nutrition and health implications for Tanzanian pastoralists and agro-pastoralists are discussed in light of these frameworks.

The Socioecological Model

Changes in food, diet, and health must be understood and interpreted within the context of changes in economy, society, and culture (Rural Health Information Hub, 2020).

Population-level changes in food intake can be identified through a wider societal and cultural context by examining at the internal and external influences affecting those behaviors. The Socioecological Model recognizes the interplay between behavior and health within and across individual, relational, communal, and societal levels (Rural Health Information Hub, 2020). The following review will discuss the traditional East African pastoralist diet, examine the role of food in shaping food practices, norms, and values within these communities.

The Traditional Diet

East Africa developed a rich food culture despite a long history of colonialism, imperialism, and foreign occupation (Raschke & Cheema, 2008). Indigenous communities shared and transferred knowledge about traditional food systems in their diverse ecosystems and food resources over generations (Kuhnlein et al., 2009; Lipski, 2010). Foods varied widely as communities consumed what was seasonally available, but the traditional diet consisted of local plants and animal source foods (ASF) (Kuhnlein et al., 2009). Communities enjoyed a diverse array of traditional foods with known health benefits — including close to forty wild, indigenous, and edible vegetables — and healthy food preparation practices, including boiling and roasting (Raschke et al., 2007). Meals followed local customs and traditions, and were likely prepared in ways that maximized nutrient availability (Government Portal Content Committee, 2015; Lipski, 2010). Millet and sorghum were considered primary energy sources, which contributed up to 90 percent of dietary protein, as well as high amounts of vitamin A, vitamin B1, calcium, nicotinic acid, and phosphorus (Raschke et al., 2007). Staple roots and tubers included tannia, taro, and yam, with cassava and sweet potatoes introduced into the diet in more recent years. Common protein foods included

kidney beans, cowpeas, and groundnuts. Among traditional nomadic pastoralists, the Maasai, Samburu, Turkana, and Chagga tribes traditionally consumed a significant amount of animal blood, animal meat, and ASF as sources of energy and protein (Raschke et al., 2007). Food beliefs and taboos were also common, especially among pregnant and lactating women; many avoided eggs, chicken, mutton, and fish, although the rationale for avoidance has not been clearly understood (Bentley et al., 1999; Chege et al., 2015; Raschke et al., 2007).

Food and Community

A host of community characteristics, including livelihood, income, religion, life stage, and gender affect individual diet (Potts et al., 2019; Powell et al., 2013). Diet and health-related decisions continue to be influenced by many intra- and extra-household factors, which include traditional gender hierarchies and multi-generational family dynamics (Pilla & Dantas, 2016). For example, older males prefer traditional foods compared to younger generations across communities, and males, by and large, continue to receive preferential treatment with food quantity and quality within the household (Chege et al., 2015). Traditional gendered stereotypes and spiritual beliefs continue to shape food intake and consumption patterns (Chege et al., 2015; Kuhnlein et al., 2009; Oliffe et al., 2010).

Livestock ownership continues to be associated with personal wealth among settled pastoralists, and livestock are slaughtered for special occasions and celebrations but rarely sold (Chege et al., 2015). Traditional food systems and beliefs are changing due to increasing influence from urban movement and interaction; less food is prepared and eaten at home, and more food is eaten outside the home, including high quantities of sugar-sweetened beverages, processed snacks, and fried foods (Keding et al., 2011).

Regarding livelihood, pastoralist households had higher mean diet diversity scores than urban dwellers and were more likely to have consumed more ASF within the previous 24-hour period compared to agro-pastoralists or agriculturalist households (Mayanja et al., 2015; Potts et al., 2019). Poor dietary diversity was common among female-headed households and elder-headed households, while specific factors associated with poor dietary diversity and low fruit and vegetable intake among young Tanzanian males included low education, low-income occupation, low alcohol intake, and high tobacco use (Mayanja et al., 2015; Msambichaka et al., 2018).

Land Settlement and Livelihood Diversification

In Tanzania, increased migration and social and economic stratification among pastoralists are displacing traditional food environments, leading to associated dietary shifts and rising prevalence of obesogenic diseases (Drivers of Food Choice, n.d.; Levira & Todd, 2017; Singh et al., 2020). The consequences of a Westernized, obesogenic diet include increased adverse health outcomes (Vincenzi, 2018). While sedentarization increases access to health facilities, they show greater disadvantage in life expectancy, maternal mortality, and child morbidity (UNICEF, 2019a). Many communities have shown resilience and adapted to modern life, while some tribes that culturally favor pastoralism, such as the Maasai, have been slower to adapt (Government Portal Content Committee, 2018). Even so, knowledge of traditional food patterns and behavior is being lost with few exceptions across pastoralist communities (Ntwenya et al., 2017; Raschke et al., 2007). For example, in one qualitative study conducted among elderly Maasai men, many participants felt it was not appropriate for cattle to be used as “beasts of burden” for cultivating fields; however, this sentiment

was not held among the younger generations, and the study noted an increase in use of livestock as an agricultural input as the elderly ceased to work (McCabe et al., 2010).

The Nutrition Transition

Changes in food production have contributed to decreased hunger and global poverty in the past half century (Willett et al., 2019). However, these changes came at a cost. As a result of increased imported foods and expansion of food retail markets, new consumption patterns have started to emerge (Salih, 1990a). Over the past half century, food supplies have grown closer to reaching a “global average diet,” with LMICs in Southeast Asia and SSA thought to have undergone the greatest change (Khoury et al., 2014).

In 1993, Barry Popkin published a paper documenting population-level changes resulting from modernization, urbanization, and economic development (Popkin, 1993).¹ He coined the phenomenon known as the “Nutrition Transition,” which he defined as shifts in diet and physical activity taking place within the larger contexts of changing land tenure and land usage, livelihood diversification, sedentarization, and climate change (Galvin, 2009b; Popkin et al., 2002). While affluent societies took thousands of years to transition over the stages from a hunting and gathering society to industrialized nations, LMICs have been forced to adapt to an ever-accelerating

¹ Popkin (1993) described the transition occurring over five distinct stages. In the first stage, nomadic hunter-gatherer communities enjoy a diverse diet of plant and animal source foods. In the second stage, “early agriculture” communities adopt land cultivation, though this is soon followed by a surge in famine and infectious disease due to decreased land availability and increased proximity. In the third stage, famine recedes, income rises, and nutrition improves. In the fourth stage, obesity-related diseases overtake infectious disease because of food availability. Finally, in the fifth and final stage, individuals and communities change their behavior to improve their health.

Nutrition Transition in the past several decades (Monteiro et al., 2013). The stage of transition appears to vary among countries, with some areas further along the transition than others, even within the same country (Popkin et al., 2019).

In 2015, the United Nations General Assembly announced one of its Sustainable Development Goals was to “end hunger, achieve food security, and improved nutrition” by 2030 (UNICEF, 2019a). Yet, hunger and food insecurity abound for millions around the world, and many countries are beginning to bear the double burden of malnutrition (Willett et al., 2019). Low-to-middle income countries have historically been subjected to famine and infectious disease, but the increasing circulation and availability of saturated fat and added sugars are associated with increasing prevalence of overnutrition, obesity, and diet-related NCDs (Maletnlema, 2002; Singh et al., 2020). While nearly all countries are witnessing declines in child wasting and stunting, the same countries also seeing overweight increasing (Popkin et al., 2019). In Tanzania, the proportion of child stunting fell from 50% in 1998 to 34% in 2008, while the prevalence of overweight and obese females increased from 11.3% in 1992 to 31.7% in 2018 (UNICEF, 2019b; Willett et al., 2019). Non-communicable disease-related disabilities, years lived with disability, and deaths are on the rise among all LMICs, and diabetes and hypertension have been identified as two of the most prevalent diseases to emerge out of countries in Africa (Popkin, 2017).

Experts have identified increased consumption of ASF and increased intake of highly processed foods, including refined-grain breads, sugar-sweetened beverages, candy, cereals, and pre-prepared mixed dishes, as two of the main global dietary changes responsible for increasing disease burden and mortality (Popkin, 2017). In response to the evidence, the Lancet published guidelines for a planetary diet and called for rapid global reduction in ASF intake. Of note, the authors make a caveat for reducing ASF

consumption among certain populations, including traditional pastoralists, where ASF has decreased over the past several decades while malnutrition and micronutrient deficiencies remain high (Willett et al., 2019). A 2008 report by the FAO reported only 3 percent of the rural population in Tanzania were eating fruits, vegetables, and ASF on a daily basis (Kinabo, 2008). In addition, high carbohydrate intake and inadequate protein intake from plant sources persist in much of SSA (Willett et al., 2019). Food and nutrition experts agree that promotion of ASF may be vital for improved dietary quality, micronutrient intake, nutrient status, and health among pastoralist communities to ensure proper growth of infants and young children and muscle mass maintenance among the elderly (Willett et al., 2019). Thus, experts believe messages regarding ASF intake should be carefully phrased and delivered, especially for communities transitioning from a traditional diet to a Westernized diet (Willett et al., 2019).

However, with an increasing number of former pastoralists adopting sedentarization – and with agro-pastoralists diversifying their livelihoods and opening shops and businesses – diet change, overnutrition and overweight, and diet-related chronic disease appear to be public health concerns, if not now, then in the imminent future (Grandval, 2012; Keding et al., 2001; Pederson & Benjaminsen, 2007). In rural Tanzania, food purchasing behaviors indicate simple carbohydrates, added sugars, and oils are beginning to overtake and replace traditional food staples, such as roots, tubers, and fruits and vegetables (Keding et al., 2011; Kuhnlein et al., 2009; Monteiro et al., 2013). Similarly, shifts to sedentarization has been associated with increased risk for chronic disease incidence, which only increase as villages grow and urbanize (Dounias & Froment, 2011; Roth et al., 2004). Studies have discovered a positive rural-urban gradient between cardiometabolic risk factors and increased prevalence of diabetes and hypertension (Batal et al., 2018; Chiwanga et al., 2016; Maletnlema, 2002). Other

studies have detected urbanization and concurrent shifts away from a traditional diet to increased cancer incidence among transitioned communities (Katsidzira et al., 2018; Wiseman, 2015). Although the negative effects of the Nutrition Transition appear more pronounced in urban areas, the transition also appears to be becoming a present reality among rural pastoralist and agro-pastoralist communities (Wiseman, 2015).

Inasmuch as dietary and nutrient needs change during the course of human growth and development, the Nutrition Transition has been identified to affect nutrition outcomes across the life course (Ruel et al., 2017). Although the older generations have the largest stake in continuing traditional diet practices, these wishes are not always observed in younger generations. From preferred foods and food preparation methods to understanding of the roles that livestock play in livelihood, perspectives and values are changing as the younger generation begins to replace their parents and grandparents at home and work (McCabe et al., 2010).

Infants and Children

The Nutrition Transition describes a shift away from traditional diets towards diets higher in saturated fats and added sugars (FCRN, 2018). Poor dietary diversity is associated with poor or inadequate nutrition, and unsurprisingly, the risk for poor dietary diversity and inadequate nutrition increase among households who are food insecure (Hanselman et al., 2018). Early weaning and premature introduction of complementary food is associated with adverse infant outcomes, including underweight, stunting, and wasting, yet remains prevalent in Tanzania (De Bruyn et al., 2019; Mosha et al., 2000). Although factors influencing infant and young child feeding practices are complex and multifaceted, mothers in Manyoni District, Tanzania, discussed how weaning was influenced by perceptions of insufficient milk supply due

to their own insufficient dietary intake (Ahishakiye et al., 2019; De Bruyn et al., 2019). In another study, almost all mothers breastfed their infants, but 54 percent of mothers weaned as early as two months after giving birth due to similar perceptions and concerns to mother in Manyoni District (Nyaruhucha et al., 2006). Land and livestock ownership have been associated with early introduction of complementary foods among agro-pastoralist communities; however, access to livestock, especially cow milk, have been associated with improved child growth regardless of seasonality and breastfeeding status (Hanselman et al., 2018; Roth et al., 2004).

Access and availability to diverse diets have been repeatedly associated with reduced underweight, stunting, and wasting among young children (Willett et al., 2019). Child stunting, defined as low height-for-age, remains prevalent in Tanzania, with a higher prevalence among children under 5 in rural areas over urban areas (Shilugu & Sunguya, 2019; UNICEF, 2018). One study found nearly 35 percent of children in the sample population were stunted; data from the 2015-2016 Tanzania Demographic and Health Survey (DHS) concluded 74 percent of young children aged 6 to 23 months in Tanzania were not meeting Minimum Dietary Diversity (Huang et al., 2018; Khamis et al., 2019). Child food intake has been directly correlated with seasonal food security; episodes of acute malnutrition occur during the “lean” seasons (lasting from December through February), and are more pronounced among low-income households with many dependents (McQuade et al., 2019). The study found that 8.7 percent fewer caregivers provided their child animal milk during the lean season compared to the rest of the year; similarly, root vegetable consumption was 76.6 percent lower during the lean season (McQuade et al., 2019). In rural environments, family members often eat from the same pot, which negatively affects food intake among the young who do not eat fast enough;

furthermore, children are fed first or last depending on community norms, which can also affect their food and nutrient intake (Kinabo, 2008).

In addition to seasonal food insecurity and community norms, displacement of traditional food environments has exacerbated food and diet quality (Drivers of Food Choice, n.d.; Levira & Todd, 2017; Singh et al., 2020). These changes have downstream consequences on health, as evidenced by the increasing incidence and prevalence of NCDs in many LMICs (Vincenzi, 2018). Studies have shown that sedentarization also negatively affects nutritional health for young children. In a study conducted among 331 formerly nomadic Fulani pastoral children, researchers found 38.7 percent of children were stunted, 28.7 percent were underweight, and 13.6 percent were experiencing wasting (Ekpo et al., 2008). While researchers were unable to compare fully nomadic Fulani children from the settled Fulani children to determine whether sedentarization directly affected the prevalence of stunting, underweight, and wasting, they hypothesized that disruption in traditional food habits decreased protein intake and compromised their diet (Ekpo et al., 2008). These conclusions are supported by similar studies conducted among the Rendille in Kenya, where malnutrition was three times higher in sedentary children than nomadic children; in a study conducted in Somalia, child malnutrition was four times higher among settled children than nomadic children (Ekpo et al., 2008). Further complications arise when underweight and obesity coexist. A study observed both marasmus and obesity occurring among 2 year old children in the same community (Maletnlema, 2002). Mothers were observed overfeeding their children based on their assumption that “fatness means well-being”; researcher concluded that they were influenced by the changing food environment, characterized by increased availability of energy-dense foods, including cereals, full-cream milk, sugar, and honey (Maletnlema, 2002).

Adolescents

Ensuring adequate nutrition remains critical even after childhood. Adolescence is understood to be a critical period in the life course due to greater independence and sexual maturation—including menses and possibility of pregnancy for young females (Arlinghaus et al., 2018). Food security influences adolescent present and future decision-making, including choices on education, work, and marriage; on the converse, food insecurity negatively affects adolescent health and school performance (Crookston et al., 2014; Kinshella, 2014). Household food insecurity has been associated with increased school absenteeism among rural adolescents (Morrow et al., 2017; Tamiru et al., 2017). A multi-site study concluded household food security during adolescence was as important as sufficient access to economic and educational resources (Crookston et al., 2014).

Despite the prevalence of food insecurity, the Nutrition Transition is adding another layer of complexity in the health of adolescent populations. On one hand, many adolescents in LMICs are consuming well below their energy and dietary needs; on the other hand, consumption of energy-dense foods is increasing while dietary diversity is decreasing (Ochola & Masibo, 2014). One study examined changes in dietary diversity and dietary composition among adolescents in Ethiopia, India, Peru, and Vietnam (Aurino et al., 2017). Although fruit and vegetable intake were increasing among adolescents in Ethiopia, there was also a notable increase in added sugar intake. Researchers noted significant changes in dietary diversity across all four countries, but believed Ethiopia was in an earlier stage of the Nutrition Transition compared to adolescents in the other countries studied, many of whom were consuming greater amounts of ASF in lieu of traditional foods, such as pulses, legumes, and nuts (Aurino et al., 2017). This shift toward increased consumption of ASF and processed foods have

been documented in other LMICs (Popkin et al., 2012). Changing food environment appears to have a significant effect on adolescents, who are likely to have greater exposure to modern foods, and who are also likely to be more readily influenced by food advertisements and peer behavior (Aurino et al., 2017; Cairns, 2019).

Women of Reproductive Age

The prevalence of undernutrition and chronic energy deficiency remains high among women of reproductive age (Sellen, 2000). In one study, researchers used the Household Food Insecurity Access Scale and Household Hunger Scale to measure household food insecurity in Sidama, Ethiopia, one of the most populous zones in the Southern Nations, Nationalities, and Peoples Regions (SNNPR). Findings suggested around 87 percent of households surveyed faced food insecurity; around 40 percent of participants reported experiencing food shortage for 3-4 months, and 75 percent reduced their meal intake to less than 3 meals per day to conserve food (Nyaruhucha et al., 2006; Regassa & Stoecker, 2012). Other studies also report that food insecure households consume significantly less frequent ASF and fruits and vegetables compared to households who are food secure (Leyna et al., 2010).

Studies have documented several risk factors that increase the likelihood of malnutrition. In certain communities, food distribution is determined by gender norms; for example, in some communities, males and females eat separately, and females are only allowed to eat once the males are finished and satisfied with their meal (Kinabo, 2008). The prevalence and severity of undernutrition among women has also been attributed to their role in ensuring the nutritional welfare of their families; however, although an increasing number of women are beginning to work outside of the home to support their family, they continue to have little to minimal decision-making power

within the home (Hyder et al., 2005; Negesse et al., 2020; Shell-Duncan & Obiero, 2000). Widows and women of female-headed households remain especially vulnerable to food insecurity and malnutrition, with one meta-analysis estimating a two-fold increase in experiences of food insecurity among female-headed households compared to the national estimate (Jung et al., 2017; Kisi et al., 2018; Negesse et al., 2020).

Women living in rural areas are more likely to be undernourished and food insecure than urban women (Abdu et al., 2018; Huang et al., 2018). For example, one study reported around 40 percent of rural Tanzanian mothers were not meeting Minimum Dietary Diversity for Women; over half (52.7%) of mothers consumed 5 or less food groups, indicating poor dietary diversity, while only 13.7 percent had consumed 7 or more food groups, meeting high dietary diversity (Abdu et al., 2018). Participants reported most commonly consumed food groups were milk and milk products (94.5%), cereals (85.3%), sugar (77.8%), and miscellaneous foods like tea and coffee (77.6%), while they reported the least consumed food groups were fish (0%), fruits (2.0%), egg (2.9%), non-root vegetables (2.9%), and root vegetables (9.2%) (Ahmed et al., 2020).

Studies have concluded that agricultural policies unfriendly to smallholder farmers may be indirectly enforcing poor dietary choices, where families are forced to sell high-quality food in exchange for increased amounts of nutritionally sub-standard foods (Weatherspoon et al., 2019). Animal-source foods are high in protein and energy, and are considered critical to improving dietary quality, but poor pastoralists prefer to sell their livestock in exchange for money and other foods rather than slaughtering them for food (Chege et al., 2015). As a country's per capita income increases, protein consumption shifts from vegetable-based protein to animal-based protein (Aurino et al., 2017). Consequently, this pressures pastoralists and agro-pastoralists to allocate the best of their livestock for selling at the market instead of home consumption, or to keep

them alive as assets for financial safety; among agro-pastoralists, some admit they give the vegetables to their livestock, which they later intend to sell at market, instead of eating the produce themselves (Chege et al., 2015; Sadler et al., 2009; Smith et al., 2013).

Despite the prevalence of undernutrition, a growing number of women of reproductive age in Tanzania qualify as overweight and obese (Ahmed et al., 2020). Based on analysis of Tanzania's National Census, Household Budget Survey, DHS, and Health Demographic Surveillance System, overweight, obese, and anemic women were associated with purchase patterns of food low in fiber and high in saturated fats and added sugars (Levira & Todd, 2017). The country's increasing rates of NCDs, including hypertension and obesity, have been attributed to diets high in salt and low in nutrients and minerals (Batal et al., 2018; Maletnlema, 2002). Traditional food staples and native fruits and vegetables, have been replaced by rice and maize; increased demand for imported foods have resulted in decreased local production of indigenous crops (Maletnlema, 2002). Traditional food preparation methods, such as boiling and steaming, are being replaced by fried, processed, or packaged foods, including cereals, cheap snacks, and foods high in sugars and simple starches (Maletnlema, 2002).

Elderly and Disabled

The elderly and those living with disability are at increased risk for food insecurity, which is associated with numerous adverse health effects (FAO, 2001; Gajda & Jeżewska-Zychowicz, 2021). Although healthy, younger adults are able to relocate from rural areas to urban cities in search of new opportunity, the elderly and those living with disability remain confined to rural areas and suffer from reduced productive capacity and diminished social networks (Dixon & Guilliver, 2001). The risk of food

insecurity is directly related to financial ability; however, many lack the necessary social and economic support, resources, and assets required by their livelihoods, making them vulnerable to poor dietary diversity and inadequate nutrition (FAO, 2001; Gajda & Jeżewska-Zychowicz, 2021). One qualitative study consisting of in-depth-interviews and focus group discussion among 50 elderly living in Tanzania discussed the magnitude of food insecurity among the older generation. Among those interviewed, researchers found participants often lacked access to food, ate fewer number of meals, and reduced the amount of food at each meal, due to limited strength to engage in productive livelihood activities and prepare food, inadequate financial and food assistance from their children, and additional burden of caring for grandchildren (Kilume & Nyamhanga, 2019). Although the elderly remain the most reticent to adopt new dietary patterns, they are no less affected by the changing food and dietary patterns within their communities. As the elderly lose autonomy and independence, they often move in with their families where they have little choice but to eat the meals prepared for them (Chege et al., 2015; Kuhnlein et al., 2009; Oliffe et al., 2010).

Gaps in Research

The traditional food environment is changing due to increasing influence from globalization and sedentarization. Less food is being prepared and eaten at home, and more food is being eaten outside the home, including high quantities of sugar-sweetened beverages, processed snacks, and fried foods (Keding et al., 2011). Pastoralist and agro-pastoralists are experiencing rapid changes in the traditional food, diet, and food culture in their communities (Cairns, 2019; Fratkin, 2001; Roth et al., 2004). Despite the transition from traditional dietary staples to a Western, “global average diet,” Popkin has hypothesized that different generations are presumed to

respond differently to change (Popkin et al., 2012). Food and diet continue to be influenced by many intra- and extra-household factors, including traditional gender hierarchies, multi-generational family dynamics, and religious beliefs (Cairns, 2019; Pilla & Dantas, 2016). Although adolescents and younger adults may more readily embrace and adopt new dietary patterns, the elderly are less easily swayed and less likely to change their food values (Chege et al., 2015; Kuhnlein et al., 2009; Oliffe et al., 2010). While literature confirms that food practices, norms, and values are rapidly changing around the world, the influence of the Nutrition Transition on these changes among pastoralist and agro-pastoralist communities, and their perspectives on these changes have not been intensely scrutinized (Cairns, 2019). This thesis seeks to understand what drivers are influencing and accelerating the rate of the Nutrition Transition among Tanzanian pastoralist and agro-pastoralist communities, and how communities perceive this global transition is changing traditional food, diet, and food culture.

Chapter 3: Methods

Introduction

Pastoralist and agro-pastoralist communities in East Tanzania are living in the midst of a global Nutrition Transition, a phenomenon describing shifts in diet and physical activity that occur within a larger global context of climate change, economic development and increased sedentarization (Popkin, 1993). This thesis conducts secondary qualitative data analysis based on data collected from a longitudinal, mixed-methods study with the International Livestock Research Institute (ILRI), Sokoine University of Agriculture (SUA) in Tanzania, and Emory University (EU) in Atlanta, Georgia. The initial study was conducted between 2016 and 2017 and focused on

identifying drivers of diet change and food choice among Tanzanian pastoralist and agro-pastoralist communities. The thesis uses a portion of the initial study to examine what drivers are influencing and accelerating the rate of the Nutrition Transition among these communities, and to understand how participants perceive this global transition is changing traditional food, diet, and food culture locally.

Population and Sample

The target population included communities and villages in Tanga and Morogoro, two regions in Eastern Tanzania. Within Tanga and Morogoro, the study team identified and purposively, or intentionally, sampled 29 communities from Mvomero and Handeni districts. The ILRI and SUA selected communities using established relationships from prior projects, as well as participatory scoping, observation, and livestock reports from district livestock officials. Varying levels of sedenterization, livelihood strategies, and market proximity determined initial community selection to increase heterogeneity of experiences and responses. Community participation in “More Milk in Tanzania” (MoreMilkiT), an ongoing dairy development project led by the ILRI, was also used to inform community selection of households. Of specific interest to this thesis, the initial study identified 6 communities from the 29 sampled communities. Kambala, Manyinga, and Mela were 3 communities selected from Mvomero district; Kibaya, Konje, and Masatu were 3 communities selected from Handeni district. The sampled communities exhibited 3 different levels of sedentarization.²

² The levels of sedentarization identified in this thesis includes Extensive Pastoralism (EP), Extensive Sedentary (ES), and Intensive Sedentary (IS). Extensive pastoralism involves pastoralist remaining with mobile herds; ES involves agro-pastoralists

The primary data collection team collected qualitative data by conducting life-stage stratified FGDs, household semi-structured in-depth interviews (IDIs), and community stakeholder KIIs. Five hundred households participated in household surveys, and a subsample of these households participated in qualitative research and market surveys. Fifty-four FGDs were conducted, with topics and activities centered around discussion of typical diet and categorization of different foods. Sixty households participated in IDIs, with interviews consisting of questions about livelihood, family, and food security. Community stakeholders, including village elders and religious leaders, as well as community educators, including community health officers, district nutrition officers, and livestock extension officers participated in fifty-four KIIs, covering an array of topics including diet change, community resources, and food-related gender roles. Qualitative data collection stopped at data saturation when new information about topics of interest stopped emerging from the data. Data collection occurred over two seasons: once during “learn” season, during periods of lowest rainfall; and once during the “rainy” season, during periods highest rainfall. After the initial round of data collection, the study team identified saturated categories alongside issues requiring further exploration, inductively refined the data collection instrument, and used theoretical sampling to inform the second round of data collection. Research assistants with relevant education and experience collected qualitative data from participants. After obtaining permission, participants were recorded in Kishwahili or Maasai, the local languages. The research team transcribed all FGDs, IDIs, and KIIs, and trained,

practicing a mix of pastoralism and crop cultivation; and IS involves agro-pastoralists practicing crop cultivation with a limited number of livestock through zero-grazing strategies.

bilingual members of the study team translated transcriptions from Kishwahili and Maasai into English.

Methods

For this thesis, 34 KIIs and 15 FGDs were analyzed, with participants stratified by community role, sedentarization level, life-stage, and gender, to understand the different perspectives on how the Nutrition Transition is informing food, diet, and food culture change among pastoralist and agro-pastoralist communities. Data were imported into MAXQDA 2020, a computer-assisted qualitative data analysis software. Although this thesis uses secondary qualitative data, purposive sampling of participants during initial qualitative data collection enabled KIIs and FGDs to be reviewed and assessed for data quality and relevance to the research topic.

The research objectives were defined based on deductive reasoning, including theoretical orientation and review of existing literature, as well as inductive reasoning, based on recurring topics and themes from the interviews and focus groups. Research followed the interpretive paradigm of qualitative research, and sought the emic perspective, or insider's point of view, among pastoralists and agro-pastoralists, by focusing on participants' individual descriptions of food, diet, and food culture change (Hennink, Hutter & Bailey, 2011).

Transcripts were prepared for data analysis by close reading of each text segment and transcript, analytic memo-ing, and codebook development. Inductive codes were identified from transcripts, and deductive codes were formulated from background research and a comprehensive literature review. Initial coding occurred by applying relevant codes to each text segment using a topical-issues approach, or following topics

discussed in the text from beginning to end. Codes were modified by adding, collapsing, and revising through multiple reads through the data.

A data analysis plan was developed by identifying recurring issues and themes and searching transcripts using single codes by subgroups. Thick descriptions of relevant codes were first developed to define the core concepts of each category, then iteratively modified after rereading the data and reviewing each code in the codebook. Constant comparison was used to differentiate between categories and explore issues to identify patterns using both inductive and deductive subgroups. Codes were compared to search for reinforcement or contradiction in responses using cross-case comparison and lexical searches were used to identify when two codes appeared together. Codes were grouped into broader categories, then conceptualized to identify the “central story.” This process involved categorizing codes, returning to the literature with reformed insight and objectives, and exploring links between individual accounts and social domains to identify overarching issues or contexts in the data. Data consistency was assessed by looking for repetition of themes across participants, and applicability was assessed by looking at whether the issues were limited to specific sub-groups. The conceptual framework was compared with the data to check whether similar themes were consistently repeated across participants. Concept applicability was employed to identify whether concepts were only true for specific sub-groups. Negative cases that seemed to contradict emerging theory were noted, and alternative theories to explain the data were considered.

Theory development also used inductive and deductive strategies; the former focused on the participant’s own explanations and reasoning, while the latter used deductive logic and explanations from literature. A primary conceptual diagram was created, which was iteratively refined after assessing relevance to the research objectives and

conducting a secondary literature search for research studies conducted in similar contexts. Links and processes between codes and categories, as well as themes in literature that were relevant, or transferable, were integrated to create a relational network of relationships and finalize the conceptual framework (Appendix, **Figure 1**).

Ethical Considerations

This initial study included human subjects and was reviewed and approved by the respective Institutional Review Boards (IRB) at ILRI, SUA, and EU. All participants received information about the study, the purpose of the study, and privacy and confidentiality of responses through translators in Kiswahili or Maasai. Quotes are deidentified to preserve participant confidentiality.³ Participants provided verbal consent to participate in research activities. The study excluded participants under the age of 16, the legal age of consent in Tanzania. Participants received refreshments and travel reimbursement for compensation. This thesis was exempt from IRB review and approval, due to use of data for secondary data analysis.

Chapter 4: Results

Introduction

Food signifies a cultural code that holds significance beyond their value as crops or commodities; however, food and diet are rapidly changing among pastoralist and agro-pastoralist communities. Various drivers appear to be influencing and accelerating this

³ Quotes from participants in Handeni and Mvomero Districts, are labeled as H and D, respectively, followed by level of sedentarization: extensive pastoralist (EP), extensive sedentary (ES), and intensive sedentary (IS).

transition. Climate change, globalization of food systems, and decreasing capital act as stressors to the agroecological food environment. Changes in local food availability, as well as shifts in food preference and demand for increasingly convenient foods, are altering the sociocultural food environment. Participants identify interethnic exchange between communities and tribes as a dominant social driver behind these changes. Interethnic exchange has increased opportunities for livelihood training and nutrition education, influenced food-related beliefs and practices around religion, and promoted child and adolescent education. As these social drivers do their part to influence traditional food practices, norms, and values, they are simultaneously changing local food, diet, and food culture among Tanzanian pastoralist and agro-pastoralist communities.

Findings

Overview of Agroecological Drivers

Although a detailed discussion of the economic drivers of food and diet change are beyond the scope of this thesis, participants report changing climate, globalization of food systems, and decreasing capital act as stressors to the agroecological food environment, each of which will be briefly summarized below.

Climate change, identified by participants as “*changes in weather,*” “*changes in the system,*” and “*too much sun,*” are influencing food and diet patterns. Those living in extensive pastoralist communities report drought has reduced milk output from their cows: “[L]ife was very good in previous time [sic] because there was no drought[,] the farm were [sic] very good but now days farm dried up no pastures, no yield if you cultivate” (H-EP1, Youth 1). Poor quality livestock bring in less money; worse still, many livestock die during severe drought conditions, leading to loss in personal assets:

“In previous time, cow usually was producing 3 bottle of milk per day, but now because of drought there are no grasses, a cow can produce one bottle of milk, also cattle die, they also got sick” (H-EP1, Youth 1). Environmental effects are equally deleterious for agro-pastoralists, many whom report seasons of poor rainfall have damaged crop production and harvest. Changes in the global food system are forcing local food markets to adapt and transform, and has led to increased availability of foods which were previously unavailable. Even so, community development officials report food prices remain vulnerable to supply and demand, increasing during periods of low food availability and plummeting during periods of food surplus. While a globalizing food system and local markets increase food access, the resulting volatility in food prices are affecting food affordability. Seasonal variability in food affordability and unpredictable income flow exacerbates food insecurity, especially among families who use the money earned from selling livestock and crops to purchase their own food.

Livestock ownership indicates wealth and food security among pastoralists, but large herds are becoming increasingly difficult to sustain financially. Both land and livestock indicate wealth among extensive sedentary agro-pastoralists, but those who practice zero-grazing face high costs of purchasing feed, and often feed their harvested crops to their livestock. Similarly, many smallholder farm owners lack the capital needed to invest in high-quality seeds and do not produce enough food to succeed commercially. Across livelihoods, changes in climate, food systems, and personal capital are pushing families to change or reduce their usual food intake. These agroecological stressors coexist with sociocultural influences to change traditional food, diet, and food culture.

Overview of Sociocultural Drivers

Participants report that shifts in food availability, as well as changing beliefs around food convenience and food desirability, are altering the sociocultural food environment across pastoralist and agro-pastoralist communities. Interethnic exchange appears to be a critical driver behind these changes. First, interethnic exchange is increasing opportunities for livelihood training and nutrition education across communities. Second, interethnic exchange is encouraging adolescents, parents, and community members to value the importance of school education. Finally, interethnic exchange is influencing spread of religion; Christianity in particular is changing food-related gender norms, as well as norms around acceptable and unacceptable foods. Each of these themes and its influence on changing food, diet, and food culture will be discussed at length below.

Food Availability

Extensive pastoralist livelihoods revolve around moving with large mobile herds. Traditional food staples include cow meat, intestines, and blood, as well as its byproducts, including cow milk, yogurt, and butter. In contrast, extensive sedentary agro-pastoralists cultivate and farm in addition to keeping livestock. Traditional foods include *ugali* made from nightshade (cassava), corn (maize), and banana flour, a variety of native vegetables, including *mchungu*, *ndula*, and *mando*, and protein foods, including chickens and eggs. Two extensive sedentary communities in Handeni district report practicing crop cultivation in addition to breeding cows, goats, and sheep for consumption and commercial purposes. Intensive sedentary agro-pastoralist (farming) livelihoods depend on crop cultivation; two farming communities in Handeni district report specializing in agricultural cash crops, including maize and rice.

However, participants report that changes in food availability are influencing food choice and dietary patterns. Some participants believe crops are becoming less available. For example, agro-pastoralists report crop yields for traditional food staples, such as cassava, sorghum, and maize, are steadily decreasing: “*We used to harvest good amount of cassava but today...you can only find cassava far on the mountains*” (H-ES2, Religious Leader 5). Pastoralists believe decreased milk availability has led to increasing intake of other foods: “*We eat stiff porridge with vegetables like amaranths [sic], spinach, cabbage because the milk is not available*” (H-EP1, Youth 1).

On the other hand, some agro-pastoralists report increased local food availability due to the growing number of local markets. In the past, food markets were uncommon, and buyers were required to travel long distances to purchase locally unavailable food. Today, buyers are able to purchase those foods at local food stalls and markets: “*We did not have food markets. In case you went to the market and you missed certain food items you had to go to the next village...to find different food items and other needs. But now the markets are self-sufficient, you can get all that you need*” (M-EP1, Elder Female, 4). Although some extensive sedentary communities lack an official food market, food availability appears to be increasing overall, with novel foods such as avocados, bananas, beans, cucumbers, green and root vegetables, and rice, appearing alongside traditional food staples.

Both agro-pastoralists and pastoralists report eating a variety of foods, including vegetables, such as avocados, beans, cabbage, cowpeas (*choroko*), eggplants, jute mallow, lettuce, okra, onions, peas (*mbaazi*), pigeon peas, spinach, squash (*ubuyu*), and sweet potato leaves; fruits, such as bananas, baobab fruit, coconuts, jackfruit (*fenesi*), mangoes, oranges, pawpaw, pineapples, tamarind (*ukwaju*), tomatoes, and watermelon; starches, such as amaranth (*mchicha*), cassava, maize, millet, nightshade, rice, potatoes,

sweet potatoes, and yams, and *ugali*; alternative protein sources, such as chicken and eggs, dried freshwater fish (*dagaa*) and tinned fish, goats, and rabbit; mixed meals, such as maize with beans (*makande*) and rice with vegetables (*pilau*); snacks and pastries, such as flat breads (*chapati*), fried flour (*mandazi*), fried maize (*mkasingo*), rice donuts (*kitumba*), and rice pancakes (*vitumbua*); processed foods, such as breads and biscuits, chips, fries, spaghetti, and ice cream; and sugar-sweetened beverages and commercial drinks, such as soda, beer (*viroba*), and tea. In two transitioning extensive pastoralist communities, participants noted their maize intake increased after they began cultivation: “*We didn’t cultivate[,] we didn’t eat maize meal, we used to graze cattle and milk was the key. But now we cultivate in farms*” (H-EP1, Youth 2). Pastoralists also appear to be influencing agro-pastoralists. Intensive sedentary communities who exclusively cultivated are now adopting cattle herding and livestock raising, which has led to increased consumption of animal meat and milk.

District nutrition officers believe that diet and nutrition have improved as communities begin to consume more fruits and vegetables and decrease intake of starchy diet staples. However, one district livestock officer believes local market development is introducing new foods into the diet that are beginning to overtake locally available foods. Children are beginning to reject traditional foods such as *makande* and *ugali* made from cassava flour and preferring to eat foods like *maandazi*. Several community educators admit they are noticing increased incidence of cancer, diabetes, and hypertension. They report many children are beginning to exceed recommended weight for height, and more adults are becoming overweight or obese. These changes are especially notable among formerly nomadic, pastoralist communities: “[B]ecause [pastoralists] eat plenty of grains, and then they consume plenty of sugars implying

sodas and alcohol also. You find that the weight has increased above average” (M1, District Livestock Official, 5).

Food Convenience

Pastoralists and agro-pastoralists also report changes in traditional food practices, including food processing, preparation, and cooking. Across communities, traditional foods were minimally processed and mostly prepared at home. Pastoralists consumed meat and milk sourced from their own livestock; among agro-pastoralists, maize was threshed and ground in the house and most vegetables were eaten raw, straight from the farms. However, these traditional processing methods are changing. Pastoralists are beginning to take livestock to auctions and processing plants, and agro-pastoralists are taking maize to commercial mills rather than grinding at home. With food processing and preparation beginning to take place outside the home, children are seeing fewer meals prepared from scratch in the home and are growing accustomed to processed foods. Some believe the younger generation is beginning to assume that food can be purchased as long as one has money: *“[T]he children will not get worried of struggling in the future looking for food because they know that the same food would be available throughout...now they grow up knowing that they will always need money to buy cooking oil from the shop instead of just grinding the sesame seeds”* (M-IS1, Community Development Officer 2). On the other hand, one participant attributes increased disease prevalence to processing mills: *“[Y]ou go to dehull and mill, the machine's metal was thick like hand [sic] as it mills, the machine's metal is diminished in size, so where is [sic] the dust go? It has entered into the flour and the flour has entered into the stomach too. Does the stomach grind a metal? No. So you find that you are producing diseases such as cancer”* (H-ES1, Livestock Extension Officer).

Community health educators and district nutrition officers attribute changes in foods eaten and prepared to communities placing more value on convenience. Convenience encourages consumption of certain foods over others, and traditional dishes, which often take time to prepare, are being replaced by pre-cooked and packaged meals. Community health educators have observed many mothers and caregivers buying cooked *ugali* and offering them to the children without knowing how the meal has been prepared. They report trying to teach mothers and caregivers how to prepare *ugali* from mixed cereals – even teaching them the ratio of ingredients – but report facing some pushback: “*You will find them telling you, instead of making the porridge by ourselves from the scratch, why cant [sic] you make it, cook it[,] and sell the ready to eat porridge to us?*” (H1, District Nutrition Officer 1). Mothers and caregivers who purchase pre-packaged foods and feed them to their children cite lack of time as a primary reason they are no longer cooking and preparing traditional meals. They favor store-bought over home-cooked *ugali* due to the large amount of preparation time required. Among those interviewed, many also consider beans and cowpeas – traditional diet staples – “difficult to prepare” due to the amount of time required to cook them. Time is considered to be an asset across participants: “*If you can afford to buy something then you can as well afford to prepare it even if it means for the whole day*” (H-ES2, Youth 3). A district nutrition officer suspects it is “*the hustles [sic] of lives [sic] that make the mothers and caregivers fail to prepare porridge to their children*” (H1, District Nutrition Officer 1).

Food Desirability

Perceived social desirability of food is also changing, beginning with how foods are prepared and cooked. Households are adding ingredients, spices, salt, oil, and cream,

and incorporating oil and fat into foods and dishes that were previously eaten raw, boiled, or roasted. Among pastoralists, meat was traditionally roasted and boiled with minimal spices and ingredients: *“I was told by an old man in the past people used to boil meat and then add some salt only and serve nothing more”* (M-IS1, Religious Leader 4). However, pastoralist households are increasing fruits, vegetables, and alternative protein sources into their culinary repertoire. For example, the Zigua tribe traditionally used 3 ingredients – oysternut, pumpkin seeds, and cucumber seeds – to season their dishes, but are now adding oil and vegetables, such as tomatoes and onions. Even the Maasai are changing their traditional diet, and beginning to eat more fried foods, and dishes with chicken and fish. One participant reports, *“In the past, we used to extract cooking oil from pumpkin seeds, or we used to eat ripen bananas which you can eat with ugali but today when you tell a child to eat ripe banana with ugali or ripe banana with honey they will not accept as they would want fried fish”* (H-ES1, Elder Female, 5).

The changing desirability of cow milk and blood is perhaps the most notable and significant change in dietary behavior. Cow milk continues to be considered a main dish or diet staple, rather than a drink or relish among the elderly Maasai. Coagulated cow blood or cow blood soup (*kisusio*) remain delicacies that are cherished not only for their significance in traditional dietary culture, but for its perceived benefits on human health, and its administration as “first aid” for those who are anemic, have lost blood, or who have just given birth. However, participants report that the practice of consuming cow blood is steadily decreasing across pastoralist communities. This is especially notable among younger generations who are beginning to refuse to drink cow blood altogether: *“Drinking cow blood among the youths has rapidly decreased... they*

interact with other Swahili people, so they forgot some of their norms and decide to abandon them” (M-EP1, Elder Male 2).

Interethnic Exchange as a Dominant Social Driver

Traditional food, diet, and food culture often vary from community to community, and are shaped by and passed on over multiple generations. Tribes often have their own specific staple foods; for example, the Maasai traditionally consume cow milk and cow blood, while the Zigua favor *ugali* and sorghum. Customs and traditions dictate how, where, and why foods are eaten: *“That is done according to tradition and it has been there for years and years...it is something that has been followed over the generations”* (H-ES2, Youth 3).

However, as formerly nomadic pastoralists settle and interact with sedentary agro-pastoralist communities, and vice versa, these new social networks change food availability and shape and modify perceptions and beliefs around food convenience and desirability, resulting in changes to traditional food and diet: *“[Diet change is] not the education of attending classes. It is education of learning from neighbors during cooking after visiting or a person can travel and observe some cooked foods”* (M-EP1, Elder Male). For example, a district nutrition officer notes that local mothers who were offering *ugali* to their infants and young children improved their feeding practices after interacting with mothers from the neighboring Chagga tribe. Although the Maasai remain slow to change their food practices at home, interactions with neighbouring agro-pastoralist communities have increased exposure to different food practices outside the home: *“Even though some of the foods will not be prepared at a household level, [the Maasai] will go and purchase from the restaurants or other food vendors. They are also eating fried bananas, chicken and French fries”* (H1 District Livestock

Officer 2). Therefore, increased community and tribal interaction – or interethnic exchange – acts as a primary driver behind food, diet, and food culture change. More specifically, interethnic exchange is increasing opportunities for livelihood training and nutrition education across communities, encouraging adolescents, parents, and community members to value school education, and promoting the spread of religion and its associated beliefs and practices around food-related gender roles and diet. Each of these themes and its influence on changing food, diet, and food culture will be discussed in more detail below.

Livelihood and Nutrition Education on Changing Food Practice

Food practices, defined as habitual food behaviors resulting from both historic and contemporary influences, play a significant role in shaping local food and diet (Cairns, 2019). Community educators believe lack of education is one of the primary reasons communities engage in certain unhealthy food practices, such as eating the same foods for every meal: *“The biggest problem is ignorance. Most people are not educated hence do not know that they can mix a variety of foods for a balanced diet”* (M-IS1, Community Development Officer 2). Migration and increasing population in communities foster the development of businesses, clinics, and education and community centers, which encourage health and nutrition officials to enter into communities and begin providing livelihood training and nutrition education.

Livestock extension officers, district livestock officers, and development officers are educating communities on animal husbandry, irrigation farming, and basic business practices; they believe this will benefit families by improving quality of livestock, quantity of harvest, amount of income. Livestock extension officers report pastoralists are heeding their advice and beginning to raise poultry and goats and selling meat and

eggs for additional income, while allocating a portion for household consumption. When asked what has made communities begin to eat animal products, one participant responds, “[i]t is the education; we have been informed that these food items are very healthy” (M-EP1, Elder Female 1). Farmers are learning how to differentiate between food crops and cash crops, and many intensive sedentary communities are expanding crop variety by planting cassava, sorghum, sunflower, and sesame, spurred by community development officials who are advising farmers to stop relying so heavily on maize and begin cultivating other crops for additional income. While some remain resistant to expanding crop variety, others are increasing their income and diversifying their diet in the process: “*This change is as a result of different seminars, meeting[s] and forums organised by leaders with the purpose of educating the community, where people are now enlightened and know what needs to be done in line with the modern changes*” (M-IS1, Elder Female 4).

Food convenience is becoming increasingly valued among mothers and caretakers, as more married men expect their wives to work and earn an income; this has led to more women spending more time outside the home, leaving less time for domestic activities. Unlike in the past, when women solely relied on men to provide, women are beginning to actively participate in economic development and income-earning to support the family. While many mothers recognize the value tradition and home-cooked meals, they also embrace new opportunities to work, recognizing that “*the world is changing*” and admitting “*older things are being abandoned*” for new practices and behaviors (H-EP1, Youth 4). By the same token, more adolescent females are attending school, leaving less time to learn traditional food preparation methods and practices from their mothers at home: “[T]he girls are educated, and they spend most of their time in school” (M-EP1, Elder Female). Community educators report they are teaching parents

and caregivers about the health and nutritional benefits of home-prepared meals, and are demonstrating how to wash produce, boil vegetables, and prepare maize – grinding, instead of “polishing” – to minimize nutrient loss during cooking. They regard this education to be success overall: “*For the communities that see this and they say ‘Indeed, we were making mistakes.’ At least, when you go the second time you find that they have changed*” (M-1, District Nutrition Officer 1). Nutrition education appears to be benefiting new mothers. In the past, in-laws had the right to beat mothers if they gave birth to a low-birth weight baby, but these practices have ceased as communities are educated about the importance of good nutrition during pregnancy and lactation: “[*W*]ith time, the society has been educated and they have learned that this practice is bad so they have stopped. Now they have been educated on the importance of good nutrition during pregnancy, lactation and also for the infant and young child” (M-EP1, Elder Female 1).

In addition to mothers and caretakers, district nutrition educators report their education is benefiting entire communities. Agro-pastoralists traditionally consumed *ugali* once per day, and fruits and vegetables were only consumed during peak season when they were available; however, health educators advise taking advantage of local markets and consuming a variety of produce throughout the year. One participant reports, “*We also started cooking different dishes because initially we were only drinking milk, if we had to cook, we were only cooking maize and beans dish “kande” where we were only boiling them. In cooking ugali we could only eat it with a single relish and we were not adding anything. But after receiving education, we have started to change because nutrition education was brought to us*” (M-EP1, Elder Female 1). In pastoralist communities, district livestock officers report they are teaching households to incorporate poultry and eggs into the diet for increased dietary diversity. Pastoralists

dislike slaughtering their livestock for household consumption, and households who keep poultry and eggs prefer to sell rather than consume because they see poultry as a source of income rather than as a food or protein source. Nutrition officers report they are teaching pastoralists about the dietary benefits of poultry and eggs, and believe their education is having an impact: *“The meals in the community have changed...They would be like I can’t add vegetables when I have slaughtered a chicken... But when you speak to them and tell them that a balanced diet is not [meat alone]. No. We say it is a mixture of all food groups. Slowly, they will say, they never knew that”* (M1, District Nutrition Officer 1).

Overall, health educators believe food practices are changing among pastoralists and agro-pastoralists. Some community members attribute positive changes in diet and nutrition to the seminars, meetings, and forums organized by community educators and organizations for the purpose of educating the community. One participant living in an extensive pastoralist community credits her increased consumption of poultry and fish to nutrition education: *“It is the health and nutrition education that have brought changes in our dietary habits”* (M-EP1, Elder Female 2). However, some community members recognize the need for more nutrition education: *“[Y]ou should provide nutrition education to us. Currently we are only eating but we are not aware what foods do to our body. We will highly appreciate getting nutrition education”* (M-IS1, Elder Female 4).

Child School and Education on Changing Food Values

In the past, communities lacked formal education systems or physical schools. Most school-aged children only completed primary education; once they became old enough to work, they would drop out of school to assist parents in livestock grazing or crop

cultivation. As community population increased, it gave teachers and educators more leverage to advocate for continuing education. Today, communities are placing greater emphasis on school, and more school-aged children are continuing into secondary education, with some adolescents completing their studies and attending colleges in cities. These opportunities are offered to both males and females due to changing gender norms. In the past, males received priority for school and education; today, females are attending school alongside males. Education is seen as a positive change, even among those who were formerly against school: *“Some people were saying if you will educate a girl child up to secondary education level she will end up getting pregnant. And for the boys they were afraid that if the boys will be educated, they will be thieves [or] con-people who will cheat on them and steal their cows. But now things have really changed. Both boys and girls are educated”* (M-EP1, Elder Female 1).

Across livelihoods and life stages, community members identify increased opportunities for child schooling and education as significant social drivers of changing food, diet, and food culture. Food values are defined as socially acceptable behavior around food and dietary culture in response to social imitation and adaptation (Cairns, 2019). Food values are passed down from generation to generation, often from parent to child. However, this is changing as younger generations gain exposure to different foods, often through time spent at school, rather than at home or in the field. Youth are being influenced by the purchasing and eating behaviors of their school friends and peers, and many adolescents are beginning to challenge traditional food values practiced by their parents. For example, the Maasai traditionally believe chicken is not fit for consumption: *“They say a chicken is a bird and they cannot eat a bird but rather animals”* (H1, District Livestock Official 2). Many of the elderly continue to avoid eating chicken, eggs, and fish, and believe maize flour causes indigestion. However,

the Maasai youth report consuming less milk and more grains, including amaranth, rice, sweet potato, and non-traditional protein sources, including eggs and *dagaa*. Among the youth participating in the study, many report consuming more processed foods and beverages due to increasing social acceptability. They like eating chips, fries, and sodas, and mention their favorite brands include Fanta, Pepsi, and Mirinda.

There is an interesting divide in opinion by life stage. The elders are pushing back against changing food values and continue to prefer milk over maize or even *ugali*: *“The old women and men who know that one can drink milk even for ten days without changing diet. But these children now, they can’t. So, people eat ugali more than anything else”* (M-EP 2, Religious Leader, 6). They report children prefer “modern” foods, even when traditional foods are still available: *“They will ask which type of vegetables are you cooking mum? Then if you tell them then they will tell you it is not cooked like that, let us show you how it is prepared...or they will not eat if you cook your way”* (H-ES2, Elder Female 5). Many elders believe traditional foods contribute to good health, while modern foods lead to poor health outcomes, ranging from heartburn to respiratory disease, and even malaria. However, some elders accept that times are changing: *“It is fine because I am old and very soon I will die therefore if some foods that I do not like are healthy for my children then it is well and I will not intervene and stop her from buying and if any parent or old person like me will do the same, then it will be wise because the generations have changed and the foods that children eat are different”* (H-ES2, Elder Male 4).

In addition to school and peer-to-peer exposure changing food values among the youth and inciting resistance among some elders, school-age parents are also being influenced by increased opportunities for child schooling and education. Although education itself is free, parents are still responsible for paying for school uniforms, shoes, and books.

Across livelihoods, this is affecting how parents allocate and use money, and is changing whether livestock or crops are conserved for home use or sold for money to finance their child's education. Children in poor households are forced to drop out during secondary education, especially when their parents are unable to manage or cover school expenses; participants identify the poor in their community as families who are not able to send their children to school. Among parents, mothers appear the most invested in child education, and are the most likely to route household income to pay for school fees. Livestock-keeping families often sell their livestock, with one participant describing the decision-making process: *"We sit down to make decisions with my husband to discuss that we sell that cow for purposes of food. We sell that one because of school fees so that children can go to school and for buying shoes such that the child can go to school"* (M-EP2, Elder Female). Among the Maasai, pastoralist families are beginning to bring their cattle to auction markets: *"Nowadays most pastoralist [sic].... sell their livestock [sic] and build good houses, take their children to school"* (M-EP2, Youth 4). Similarly, agro-pastoralist families are relying on selling harvested food to finance school expenditures. Among extensive sedentary communities, many families are selling the bulk of their harvest to cover school fees, leaving some households with inadequate food and inadequate income to purchase food. Intensive sedentary communities are also changing food allocation, and changing the amount of food sold versus saved: *"If [farmers] harvest 40 bags of maize they may decide to preserve 10 bags for food then sell 30 bags then use the money to build a house or buy a cow or pay school fees for a child who completed O-Level and needs to proceed to A-level or college"* (M-IN1, Elder Male 3). Many parents report their primary motivation for obtaining financial security have shifted from ensuring food security to having the financial resources to send their children to school. Inasmuch as

increased peer-to-peer exposure is changing food values among adolescents, prioritization of child education is changing food purchase and income allocation among parents.

Religion on Changing Food Norms

Food norms are defined as observable food and diet practices that emerge from iterative exposures to external influences (Cairns, 2019). Participants agree that interethnic exchange has spread religion within communities; thus, religion acts as an external influence that is beginning to change and challenge traditionally held beliefs about gender roles and food-related decision-making, as well as food consumption patterns.

In the past, men were seen as the sole decision-makers in the family and community:

“According to the beliefs of this place every decision in the family is made by a man...[women] do not make any decision, their job is to cook and prepare the meal only” (H-EP1, Religious Leader 1).

Another participant shares, *“[A]mong the Wazigua and in religion, many decisions are made by men”* (H-ES2, Elder Male).

Women living in Muslim-dominant communities continue to lack decision-making power to slaughter livestock for family consumption or choose what foods are purchased at the market,

often to the family’s detriment: *“[U]nfortunately, the father can decide to sell all the maize or rice without even consulting the mother”* (M-IS1, Religious Leader 4).

While all leaders acknowledge that lack of female voice may negatively affect family health,

Muslim leaders remain resolute in maintaining the gender hierarchy, with one leader expressing he would seek divorce if his wife tried to make decisions without his involvement:

“Men are the head of the household so if a woman is the one who make a decision...It is divorced, because you cannot say ok to everything. This will also bring problems to children as father can reduce care service to children. That's why a woman

should be behind a man” (H-EP1, Religious Leader 2). However, traditional gender roles and food-related decision-making appear to be shifting in Christian-dominant communities. Christian leaders appear open to giving more autonomy in decision-making, and one ventured to suggest food insecurity would improve if women were allowed to make decisions about food and nutrition for the family: *“If a woman is allowed to make decisions, it will be much better than a man because she is the one who cooks most of the time and knows which food is the best for the children and the whole family”* (H-EP1, Religious Leader 3). Although Christian and Muslims leaders appear to vary in their opinions about whether changes in gender roles and decision-making constitute social progress, participants appear to agree that religious influence is changing and challenging traditional beliefs, with influence reaching far beyond the home into the community.

In addition to religion’s influence on gender-based decision-making, many believe religion – primarily Christianity – has become a major social driver of food change by influencing perceptions of acceptable and unacceptable foods. Although some participants report some tribes, including the Chagga, still consume cow blood and prepare *kisusio*, this practice is declining among many communities. Among the Maasai, where cow blood was previously used as not only a culinary staple, but considered to be a health food and often offered as an oblation in ceremonies, this transition has been particularly significant: *“Yes, it’s true in the past we used to drink animal blood as part of our daily life and this was mostly due to culture and believes [sic], it was a believe [sic] that animal blood helps to increase blood to the pregnancy [sic] women also it was used during spiritual ceremonies as a sacrifice to those who have problems or who needs blessings, but now we no longer believe that, so we don’t drink animal blood”* (M-EP1, Elder Woman 7). Across pastoralist communities,

participants corroborate the sentiment, and state the church is teaching that blood consumption is sinful. Others report that churches are forbidding them to drink cow blood and teaching that “*drinking blood is not a good thing spiritually*” (M-EP1, Elder Female 6).

The Case for Cow Blood

Cow blood is a culturally relevant food for many, and will be used to illustrate how interethnic exchange and related constellation of social drivers – improved education in the community, increased school prioritization, and increased religious observance – intersect to influence practices, norms, and values around cow blood, decrease cow blood consumption, and ultimately change the traditional food culture landscape.

Among pastoralist communities, cow blood has been traditionally used and valued beyond its use as a dietary staple. According to traditional beliefs, cow blood holds medicinal properties, and drinking cow blood regulates the human body: “*Cow blood is very important for the Maasai because it helps increase blood in the body system*” (H-EP1, Youth 5). Cow blood was routinely offered to those suffering from malaria or anemia; among the Maasai and Chagga tribes, pregnant women were given cow blood to support healthy birth weight for their infants, and post-partum women were preferentially fed cow blood to facilitate recovery. Cow blood was sacrificed during traditional spiritual ceremonies to ask for healing for the ill or blessings for the poor.

While some participants continue to believe that cow blood is “*similar to a vegetable*” because it “*help[s] in building the body,*” consumption is steadily decreasing across pastoralist communities, and especially among the young (H-EP1, Youth 1). Multiple pastoralist participants report they have stopped consuming cow blood altogether; one participant shares that even though parents and elders consumed cow blood, the current

generation does not: *“Our parents and elders used to eat meat, blood and milk... but now days we no longer experience such kind of diets”* (H-ES1, Elder Male 6). Opinions vary as to why this may be the case.

Many participants suspect that increased interethnic exchange and exposure to other people and culture are decreasing cow blood consumption: *“Most of college students do no longer drink raw blood, but very few of them do drink it when they come for holidays”* (M-IS 1, Elder Male 5). As discussed above, many pastoralists believe religion is a primary driver of decreasing cow blood consumption: *“We do not eat blood because we believe in God, thus we consider blood as a bad thing”* (H-EP1, Adult Women 1). Some believe that decreased intake is due to increased availability of other food items in local markets, while others suspect it is due to lack of availability due to poor livestock quality: *“[N]owadays cow blood is not available in plenty because most cows lack pasture and water, thus little blood”* (H-ES1, Adult Male 2). Some report receiving education about food-borne illness and risks of blood infections have increased their hesitation about drinking cow blood: *“[W]hen blood is left within the animal[,] beef can cause some infections to the consumers”* (H-EP 1, Adult Male 1). Other pastoralists report their children are being educated about food safety in schools and are returning home to teach their parents: *“Nowadays there is change in using cow blood, people do go to hospital to increase blood in their body in case of anemia...It is because the world is changing. The older things are being abandoned and people do adopt new things. The main factor for this change is education”* (H-EP1, Youth 5). Although perspectives about vary across communities and livelihoods, decreasing cow blood consumption exemplifies how interethnic exchange, education, school, and religion are influencing and changing traditional food culture among pastoralist communities.

Summary

Pastoralists and agro-pastoralists are experiencing their very own food, diet, and food culture transition within their communities. Various agroecological and sociocultural drivers are accelerating this transition. Agroecological stressors include climate change, globalization of food systems, and decreasing capital, which influence the food environment. Fluctuations in food availability, shifts in food preference, and demand for convenience exemplify changes in the sociocultural food environment, which are influenced by interethnic exchange, livelihood and agricultural training, school and education, and religious influence. These drivers are changing traditional food norms, practices, and values leading to the emergence of new food, diet, and food culture within communities.

As pastoralists and agro-pastoralists experience these changes first-hand, they also appear to recognize this comes with benefits and drawbacks. Increased interethnic and intertribal interaction has opened opportunities for education, school, and religion to flourish and spread; however, this comes at the cost of losing long-held practices, norms, and values around food. As new foods flood local markets – and with it, increasing amounts of processed and packaged foods – they are beginning to overtake consumption of staple crops. Some fear this is accelerating the disappearance of traditional foods: *“People nowadays eat what they see being eaten in other places, foods that lack origin...it is just leaving your tradition and adopting other people’s culture”* (M-IS1, Community Development Officer 2).

While community educators believe livelihood training and education are improving diet and nutrition among communities, they report increasing incidence of overweight and chronic disease; while community members believe school is improving future opportunities for their children, traditional diet practices are rapidly being lost among

the younger generation; and while the elderly act as the primary carriers of traditional food culture, they are witnessing changes in traditional food practice, norms, and values, as evidenced by declining consumption of as cow blood among pastoralists.

These drivers of food change do not operate in isolation but overlap and intersect. Changes in food and diet appear to demonstrate that the Nutrition Transition is already underway among Tanzanian pastoralist and agro-pastoralist communities. Perspectives on this transition appear to vary across communities, livelihoods, and life stages. However, with few exceptions, most agree that change is an ongoing reality in their respective communities. As pastoralist and agro-pastoralist communities modify their food and diet, they are forming a new food culture composed of a new set of socially accepted practices, norms, and values. The downstream effects of these changes on health and nutrition – including increasing incidence and prevalence of overweight and obese, and diet-related chronic diseases – are only beginning to emerge; however, reports from countries further along the transition indicate cause for public health concern.

Chapter 5: Discussion and Conclusion

Discussion and Implications of Findings

The Nutrition Transition is a phenomenon explaining shifts in diet and physical activity taking place within the larger contexts of changing land tenure and land usage, livelihood diversification, sedentarization, and climate change (Galvin, 2009b; Popkin et al., 2002). While economics improvements in food production have led to decreased hunger and global poverty in the past half century, new consumption patterns are also emerging (Salih, 1990a; Willett et al., 2019). Food supplies are reaching a “global average diet,” with LMICs in SSA – including Tanzania – undergoing rapid changes

(Khoury et al., 2014). While the Socioecological Model recognizes the interplay between behavior and health spanning individual, relational, communal, and societal levels, it is limited in its ability to capture interactions between the different factors that influence diet change (Friel et al., 2017; Rural Health Information Hub, 2020). The conceptual framework (see Appendix, **Figure 1**) outlines the various drivers working in concert to influence and change traditional food and diet among Tanzanian pastoralists and agro-pastoralist communities.

The food environment influences diet by spanning multiple dimensions of food availability and affordability, and includes economy, ecology, environment, global food systems, and government policy (Neff, 2015; Turner et al., 2018). The local food environment is rapidly changing for pastoralist and agro-pastoralist communities, as evidenced by participants reporting the proliferation of new foods, such as fried and pre-packaged foods, and decreased availability of traditional foods, such as cow meat and blood. Participants attribute shifts in food and diet to the influx of new foods that were traditionally unavailable. Increased dietary diversity has the potential to increase nutritional status, and consuming a diverse diet has been associated with decreased instances of stunting, wasting, and underweight among children (Khamis et al., 2019). Although traditional diets are often criticized as being inadequate in key nutrients and minerals, studies have concluded that women who consumed a Westernized diet were associated with having low birth weight infants, while there was no such association among women who were consuming traditional foods (Hajianfar et al., 2018). Diet diversification has been associated with increased intake of a Westernized diet, and increased risk and incidence of chronic disease (Popkin et al., 2012).

Community food practices and norms are thought to be shaped by iterative exposures to various agroecological and sociocultural influences (Cairns, 2019). As formerly

nomadic pastoralists begin to permanently settle, they are influenced by neighboring tribes, and have started keeping chicken, selling milk, and changing their own food and diet patterns. Participants also observe increasing instances of intercultural and intertribal marriage are accelerating adoption of new foods and food preparation practices. Traditional diets are changing, even among the Maasai: *“In the past [the Maasai] were used of [sic] eating milk and meat as their main meals but now they have changed because of the interactions with other cultures”* (H1, District Livestock Officer, 2). However, not all influences are negative. For example, studies reported that Maasai mothers were introducing blood, animal milk, and traditional herbs to infants under six months due to cultural acceptability and norms (Chege et al., 2015). Pastoralists report their interaction with other tribes have improved young infant feeding practices, including prolonged periods of breastfeeding and delayed introduction of complementary foods.

Traditional food norms – including socially acceptable and unacceptable foods – are also changing as a result of increased opportunities in education. More school-aged children and adolescents are attending secondary school and college, spending more time outside of the home, and being exposed to new foods: *“These changes have mainly been influences [sic] by social interactions between people of different culture. For instance, you will find people of certain culture did not eat a particular food item but because of the interactions they are now eating”* (H1, District Livestock Officer 2). In one study seeking to understand factors that influence eating behavior, participants reported food preference as a major determinant of food choice (Friel et al., 2017). Food preference and acceptance were shaped by repeat exposures, and the study found participants were drawn to highly palatable foods that were high in fat, salt, and sugar (Friel et al., 2017). This has downstream consequences on health, as evidenced by the

increasing incidence and prevalence of NCDs in many LMICs (Vincenzi, 2018). Even as traditional food practices change, community educators are adapting by teaching sustainable agricultural livestock keeping technologies, while health and nutrition officers are educating on the importance of nutritional diversity and healthy cooking practices. Livelihood training and nutrition education increase skills, knowledge, and social capital to provide communities the agency to maintain their health, despite changes to food and diet.

A community determines local food values by collectively defining what is socially acceptable, but these values are also changing as a result of increased interethnic exchange (Cairns, 2019). For example, parents report their primary motivation for financial security is shifting from purchasing food to paying for school fees, given the value they place on child education. Community food values are also colored by local beliefs and faith. While some religious leaders remain resolute about maintaining traditional gender roles, other leaders are embracing female empowerment on food and food-related roles in the family. Adolescents and elders appear to have the greatest difference in food values. For the elderly, food remains primarily cultural, not nutritional, and many are attempting to preserve their cultural identity through their diet. Even though the elders are pushing back against change, they face the harsh reality of their own decreasing influence in the midst of a changing food culture.

While an in-depth discussion of the economic drivers of food and diet change are beyond the scope of this thesis, it should be noted that economic growth and development can increase inequality between and within countries (Sharma, 2013; Vincenzi, 2018). The devastation caused by European colonization perpetuate food insecurity and lack of food sovereignty (Ekaya, 2005; Raschke & Cheema, 2008). For centuries, East Africa's food security was undermined by suppression of indigenous

religion, culture, and tradition – including knowledge of local food habits – and this requires global reckoning (Raschke & Cheema, 2008; Salih, 1990a). Even today, fallacious, and even harmful perceptions that industrialization is key to economic growth has prevailed, and domestic production and trade controls have exhibited an anti-agriculture bias (Baliño et al., 2019; Lipton, 1977; Schiff & Valdes, 2013). Urban growth has increased food demand in cities, and agricultural surplus have been drained from farms to urban city centers (Lipton, 1977). Price fluctuations for agro-pastoralist food staples, such as maize and rice, are projected to more than double in the following decades; unstable and unpredictable markets place these communities at risk for food insecurity (Frumkin & McMichael, 2008). In addition, the environmental effects of climate change can compromise food production, especially in areas already at increased risk of environmental stressors, including local stresses from land-use practices and poor land quality (Frumkin & McMichael, 2008). This slashes income streams for pastoralists, whose primary livelihoods depend on the number and health of their livestock. This also harms agro-pastoralists, whose livelihood depend on selling crops for income. Statistical models project water shortages and hotter temperatures will reduce global food production by up to 2% per decade, even as demand increases by 14%; others predict wheat, maize, sorghum, and millet yields will decline by approximately 8% across Africa by 2050 (Porter et al., 2014). Climate change is heightening food insecurity risk for pastoralists and agro-pastoralists alike, leading many communities to abandon or diversify livelihoods (Frumkin & McMichael, 2008). Among pastoralists, hunger and food insecurity are driving communities to initiate crop cultivation, leading to changes in the traditional diet; among agro-pastoralists, farmers are growing dependent on casual labor, leading to further reduction in crop yields and food availability because they cannot cultivate their own land.

The various drivers of the Nutrition Transition are facilitating the emergence of a homogenous, global average diet, appearing to affect Tanzanian pastoralist and agro-pastoralist communities (Hawkes, 2007; Vincenzi, 2018). While community educators report improvement in dietary diversity, they are beginning to recognize an increasing incidence of diet related NCDs. While youths regard change to be positive, community elders fear that the youth are modernizing and shedding traditional diet practices at the expense of their health and cultural identities. Increased opportunities for livestock and nutrition education, increased education among school-aged children, and increased religious influence are identified as the three social drivers of diet change, which falls under the primary, encompassing theme of interethnic exchange. Although these social influences benefit communities, they are also causing irreversible changes to traditional food, diet, and food culture.

Strengths and Limitations

These findings should be viewed in light of several limitations. First, secondary qualitative research occurred after primary data collection and analysis, both thesis and author were far-removed from the study timeframe. Multiple KII and FGD transcripts were read to minimize the gap between data collection and data analysis, and to understand and orient the secondary researcher to the context of the study environment. Second, this thesis was written with limited understanding of culture, language and tradition of the country and region. On occasion, terms and phrases were difficult to understand or interpret without making assumptions about the text. To minimize misinterpretation, drafts were reviewed and edited by a faculty member who had spent time in Tanzania and was directly involved in primary research. Furthermore, the researcher's background in dietetics and clinical nutrition experience in the United

States may have influenced interpretation and analysis of results. To minimize bias, the researcher practiced reflexivity by cross-comparison between data, cross-examining with available literature, and reflecting on how personal experience could influence comprehension and interpretation of the data. While there is considerable overlap between the research aims of the primary study and the research focus of this thesis, the Nutrition Transition was not the focus of primary data collection. To account for this, active reading and coding of data was conducted prior to data analysis to ensure data contained the breadth, depth, context, and nuance needed to conduct Grounded Theory analysis. Finally, the Nutrition Transition is a complex, population-level shift that occurs over a long period of time, but thesis used cross-sectional analysis of KIIs and FGDs. As a result, the interpretation and extrapolation of the Nutrition Transition's influences on food, diet, and food culture change among pastoralist and agro-pastoralist communities are not longitudinal, and thus limited to one point in time. Future longitudinal studies may assist in better understanding how community perceptions change over time.

Study strengths include the juxtaposition of the Nutrition Transition phenomenon with Tanzanian pastoralist and agro-pastoralist communities, which allow for investigation of whether global changes in diet and activity are being experienced locally. Findings suggest that pastoralists and agro-pastoralists are not only aware that their food, diet, and food culture is changing within their communities, but appear to recognize these changes are nuanced, and come with its own set of benefits and drawbacks. Perceptions varied most often between the young and elderly generation. Noteworthy findings included understanding how income allocation is changing among parents as a result of increased school prioritization; how food convenience is changing among mothers and caregivers as a result of shifts in traditional gender norms and time spent out of the

home; and how traditional food norms are changing among pastoralists as a result of religious influence on food and diet. Another study strength includes combining KIIs and FGDs for secondary qualitative data analysis. The former provides information that would not be readily disclosed using other settings, while the latter provides insight into group dynamics, as well as insight into similarities or differences in opinion among participants. Use of both KIIs and FGDs provides exposure to a variety of perspectives across livelihoods, community roles, religion, life course, and gender, and assists in obtaining diversity in experiences, responses, and opinions.

Recommendations for Policy, Programming, and Research

The Nutrition Transition threatens to exacerbate existing health disparities around the world, as wealthier countries adapt while LMICs face the consequences of a Westernized, obesogenic diet (Vincenzi, 2018). Rapid economic development is necessitating change from traditional farming to industrial agriculture. However, the vast majority of transitioning pastoralists and agro-pastoralists lack the assets and necessary production inputs to keep up with demand, and are often unable to produce enough food to succeed commercially (Neff, 2015). Smallholder farmers face decreasing access to agricultural inputs, including better quality seeds, and soil nutrients (Dixon & Guilliver, 2001).

Recommendations for Policy

Policy makers should operate at both the national and subnational levels – and address both macroeconomy and rural economy – to create policies addressing the Nutrition Transition and mitigate its negative effects. Small changes in the macroeconomy, including changing economic policies and policies for economic diversification, can

produce significant population-level impacts (Baliño et al., 2019; Hawkes, 2007). Policies increasing input into agricultural markets, including seeds, fertilizer, and equipment would support agro-pastoralists; policies protecting pastoral land from conversion to unsustainable land use, whilst building resilience and capacity to survive the inevitable occurrence of drought, will support traditional pastoral livelihood systems (Aberra & Abdulahi, 2015; Baliño et al., 2019).

Recommendations for Programming

In addition to enacting and supporting policies, government agencies and organizations should collaborate and increase investment in the rural economy, and provide outreach, education, and extension services, as well as invest in farm and non-farm activities to increase social, physical, and human capital (Baliño et al., 2019). As it relates to pastoralists and agro-pastoralists in the regions and districts included in this study, building upon existing relationships with ILRI and SUA may be suitable to identify needs and requests from the community members themselves. Most participants welcomed and were grateful for livestock training and nutrition education but expressed their desire for more educational opportunities. Continuing existing dairy development projects such as “MoreMilkIT” may benefit pastoralists by maintaining or increasing access to inputs. Some participants requested poultry projects to empower pastoralists to build chicken sheds and receive education about feeding and caring for chickens. Others requested capital to invest in livestock, agriculture, or businesses ventures. Expanding reach of microcredit programs may prove beneficial to address these needs. Findings suggest that socioeconomic influences, though changing for pastoralist and agro-pastoralist communities in Eastern Tanzania, are significant and may influence policy outcomes. Therefore, any programmatic intervention must be designed with the

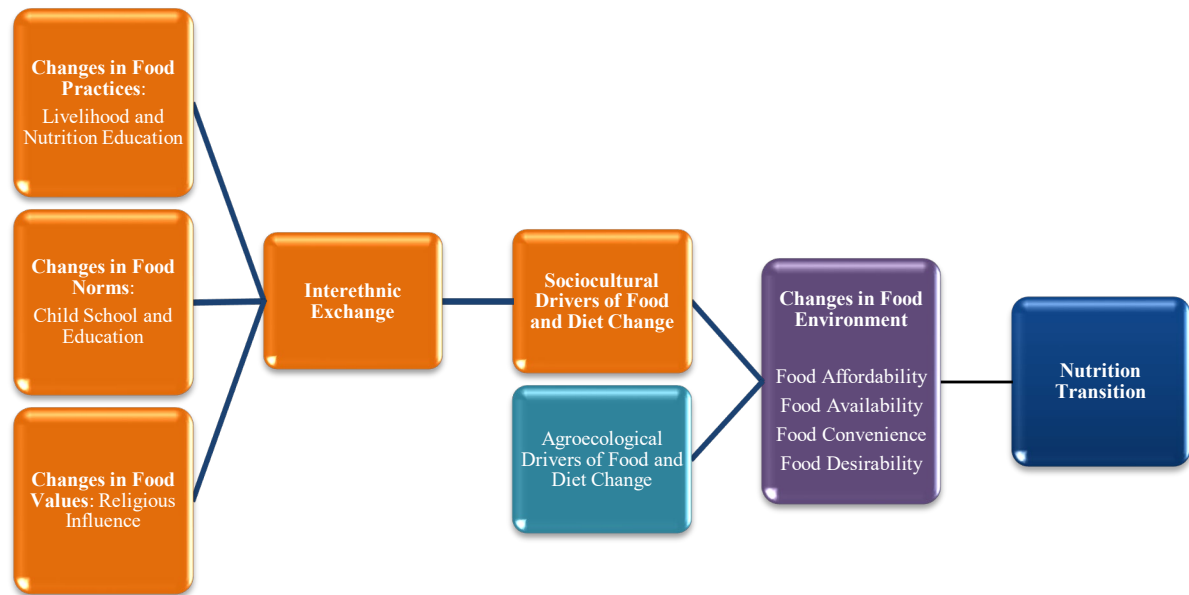
understanding of the stressors influencing the Nutrition Transition, while valuing the significance of local livelihood practices to satisfy various stakeholder groups, including pastoralists and agro-pastoralists, community leaders, and local government officials (Hawkes, 2007).

Recommendations for Future Research

Based on study findings, future research may benefit from understanding the decision-making processes on income allocation among parents and caretakers. Although this study found child education was a growing priority, it may be worthwhile to assess whether increased emphasis on nutrition education for school-aged children will influence food purchasing behavior and income allocation in future studies. In addition, convenience emerged as a driving factor behind changing food choice among mothers and caregivers. It may be worthwhile to pursue understanding whether perceived shifts in gender norms are increasing female empowerment on food-related behavior, or merely increasing female burden by adding the expectation of working outside of the home to responsibilities inside the home. Finally, participants mentioned how various agroecological and sociocultural drivers were decreasing consumption of cow blood. Among pastoralists, ASF have decreased over the past several decades while malnutrition and micronutrient deficiencies remain high (Willett et al., 2019). While experts agree that ASF may be vital for improved dietary quality, micronutrient intake, and nutrient status among pastoralists, the correct response becomes far more nuanced for communities stuck in mid-transition between a traditional and Westernized diet (Willett et al., 2019). Future research may benefit from examining the sociocultural and nutritional effects of changing cow blood consumption among pastoralists living in the Nutrition Transition.

Appendix

Figure 1: *Conceptual framework of the Nutrition Transition's effects on changing food, diet, and food culture.*



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