Environmental Change and the Physical Growth Status of Somali Children Born in the United States

Dissertation

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Abstract

Assessing the health and well-being of populations in transition from one environment to another provides insights into how humans adapt to biological and cultural stressors. Research on immigrant populations from Europe, Japan, China, Mexico, and Guatemala demonstrate that migration from war-torn or impoverished countries to the U.S. results in greater growth due to better environmental conditions. The current study examined this relationship in a population of Somalis who migrated to the U.S. following governmental collapse in 1991. A sample of 358 Somali children (179 boys and 179 girls) born and reared in Columbus, OH were examined. Anthropometrics (i.e. height, weight, BMI, skinfolds) were collected on children 6 months to 78 months of age to test the following hypotheses: 1) U.S.-born Somali children are larger than their Somali-born age-mates, 2) U.S.-born Somalis are shorter, but heavier than U.S. standards, 3) children of traditional mothers are smaller than those of more acculturated mothers, and 4) household size is negatively associated with body size.

Results indicate that U.S.-born Somalis are significantly taller and heavier than those in Somalia. Access to better quantity and quality diets, cleaner water supplies, improved sanitation, and healthcare availability are likely contributing factors. Somali-American children are also taller and heavier than U.S. standards. Two explanations are proposed. First, according to the Intergenerational Influences Hypothesis, mothers who

experienced negative health conditions during childhood are likely to have children who are overweight due to fetal programming. Second, previous studies suggest that Somalis are a genetically taller population. Research shows that Somalis are the tallest population in East Africa. However, they are substantially smaller than African-Americans. Therefore, their genetic potential is not known. More research is necessary to assess this possibility.

Anthropometric variability was observed between children of traditional and acculturated mothers. Length of time in the U.S., giving children vitamins, and breastfeeding duration were positively associated with anthropometrics. Conversely, taking pre-natal vitamins was negatively associated with body size. This was unexpected as pre-natal vitamins have important benefits for proper growth and development. However, although beneficial, they do not guarantee a child will be healthy. Many other factors such as protein intake and stress potentially negate their effects. Also unexpected, household income was negatively associated with weight. Higher incomes allow for diets of greater quantity which may increase caloric intake, leading to higher weight. On the other hand, along with quantity comes better dietary quality which likely includes low caloric, nutrient rich foods. This may result in a reduction in positive weight gain. Finally, household size was negative associated with anthropometrics as hypothesized.

These results demonstrate the ability of humans to adapt biologically and culturally to new environmental settings. Somali children in Columbus, OH illustrate this point by experiencing increased growth in response to improved living conditions. These findings are valuable in better understanding the epidemiology of health disparities within all populations, not just immigrants.

Dedicated to Somali children around the world.

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Fields of Study

Major Field: Anthropology
Minor Field: Geography

Research Interests: Human health; growth and development; body proportions; adaptation; migration; Somalia.

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Chapter One: Introduction

1.1 Statement of Problem

The goal of this research is to assess how environmental change affects the growth status of Somali children born to recent immigrants to the United States. Human phenotypes are influenced by interactions between biological and socio-cultural factors (Bogin and Varela-Silva 2003; Crews and Bogin 2010). As such, phenotypes are neither inherited nor acquired, but rather are developed through this interaction (Thoday 1953). As such, genotypes *guide* phenotypic expression, although the ultimate phenotypic outcome results from environmentally influenced biological pathways, such as hormonal integration, cell-cell interactions, signal transductions, and regulatory cascades (Johnston 2002; Sultan and Stearns 2005). Thus, multiple phenotypes may result from a single genotype exposed to different environmental stressors during ontogeny – a phenomenon known as phenotypic plasticity (Bateson et al. 2004; Pigliucci 2005). These stressors may result in several developmental responses, including: 1) permanent developmental disruptions, 2) immediate adaptive adjustments with long-term consequences, and 3) adaptive adjustments during ontogeny which bestow long-term advantages (Crespi and Denver 2005; Gluckman et al. 2005). These responses may be biologically adaptive consequences of current, and possibly future, conditions (Worthman and Kuzara 2005).

Biological adaptation involves the allocation of resources to three somatic components, including 1) survival, 2) productivity – i.e. growth, physical activity, cognition, and 3) reproduction (Bogin et al. 2007; Crews and Bogin 2010; Worthman and Kuzara 2005). Understanding circumstances surrounding somatic resource distribution is the focus of Life History Theory (LHT) (Bogin et al. 2007; Stearns 1992). LHT is defined as the study of "evolutionary strategies used by organisms to allocate… [resources] toward growth, maintenance, reproduction, raising offspring to independence, and avoiding death" (Bogin et al. 2007:2). All mammalian species have evolved their own unique set of adaptive strategies regarding such LH events as when to be born, when to mature, when to reproduce, and when to die (Bogin et al. 2007; Stearns 1992). In an 'ideal' environment, resource availability would be sufficient to realize the benefits of each strategy. However, 'ideal' states do not truly exist. Consequently, there is an inherent trade-off between the costs and benefits of allocating more resources to one component at the expense of others (Worthman and Kuzara 2005).

Under conditions of nutritional deprivation, a human fetus is able to divert available energy from somatic growth to the developing brain and other organs (Bogin et al. 2007; Worthman and Kuzara 2005). Although having immediate benefits to survival, it may have long-term consequences. Growth retardation is often associated with higher rates of hypercholesterolaemia, heart disease, obesity, insulin resistance, and type 2 diabetes (Bogin et al. 2007; Gluckman et al. 2005). Secular changes in somatic growth are viewed as "coping' mechanisms by which individuals attempt to survive and maintain reproductive health under varying environmental conditions.

The World Health Organization defines ‘health’ as "a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity" (WHO 2006:1). Health may also be described as a homeostatic condition of balanced energy inputs and energy requirements. The amount of energy (in kcal) necessary to survive is relative to the amount of energy expended on somatic maintenance and repair, voluntary activity, reproduction, and physical growth (Bogin 2002b). Maintenance refers to energy needed for necessary functions such as basal metabolism and cardiac activity. Repair refers to DNA, cell, and tissue restoration following damage, disease, and injury. Reproduction includes gamete formation, mate selection, mating effort, physiological responses to pre- and post-pregnancy, and parental investment. Growth refers to an increase in both soft and hard tissues through cellular hyperplasia and hypertrophy (Bogin 2002b).

Accordingly, ‘health’ may be understood as a broad, complex phenomenon which includes many separate but related components. Assessing the *overall* ‘health’ of an individual or population is a complicated endeavor, one which is not likely feasible. This is due, in large part, to the lack of a single measure of health. For example, measures of physical health (i.e. growth, morbidity) do not describe mental health. Similarly, measures of mental health (i.e. depression, anxiety) do not describe social well-being. A state of health therefore, is relative to the component being examined.

From an evolutionary perspective (i.e. LHT), adapting to changing environmental conditions is a matter of physical rather than mental or social health. For example, elevated morbidity often results in somatic growth restrictions in an effort to maintain survival and reproductive success. Thus, variability in body size within and between populations may be interpreted as reflecting physical health disparities.

Studies on immigrants are particularly informative in this regard by showing how improved environmental conditions may lead to increased somatic growth (i.e. physical health). The relocation of Maya from Guatemala to the U.S. during the late 1970s and early 80s provides an example. Since colonial times, Maya and other minority groups in the region experienced poor living conditions, forced labor, and loss of their economically viable land (Loucky and Moors 2000). Oppression continued into the 20th century, when opposition by guerrilla insurgents resulted in wide-spread civil unrest. During this period, the already marginalized Maya were further repressed (Loucky and Moors 2000). In the late 1970s and early 1980s, Maya began seeking refuge in Mexico and eventually, the U.S. (Loucky and Moors 2000). Maya resettled in two primary cities, Indiantown, Florida and Los Angeles, California. First generation U.S.-born Maya were taller and heavier than their Guatemalan age-mates. The increase in size was attributed to greater quantity and quality nutrition, clean drinking water, adequate sanitation, and access to medical facilities (Bogin 2002a; Smith et al. 2002).

Similar findings were reported on immigrants to the U.S. from Europe (Boas 1912; Fishberg 1905), Japan (Greulich 1957; Shapiro 1939), China (Lasker 1946), Mexico (Goldstein 1943; Lasker 1952) and Guatemala (Bogin and Loucky 1997). In each case, those born in the U.S. were taller, heavier, and had greater BMI than age-mates in their native country.

Reported here are data adding to this research by examining the effects of migration on the growth of Somali children born in the United States to first generation immigrants. Emigration of Somalis from an impoverished, resource-deprived country to the United States likely was advantageous in many respects. This contention is tested by using anthropometric data collected on a sample of U.S.-born Somali children.

In this dissertation, the term ‘health’ refers only to those aspects of physical health which can be described by anthropometrics. Therefore, no attempt is made to explain all changes in health that have occurred during this migratory transition. Further, ‘health’ and ‘well-being’ are similarly defined and therefore, are used interchangeably.

1.2 Aspects of Physical Health

Health is influenced by multiple proximate environmental factors that mediate the impact of ultimate environmental factors on health disparities. Proximate factors are those that directly influence an outcome. Ultimate factors, on the other hand, are those which affect the manner in which proximate factors influence an outcome. Two primary proximate factors affecting well-being are nutrition and disease (Norgan 2002). Adequate nutrition entails consuming multiple essential nutrients including vitamins, minerals, fats, proteins, carbohydrates, and water. Inadequate and/or lack of one or more of these nutrients may lead to poor health (Norgan 2002). Morbidity also contributes to health disparities. Frequency of disease-related events over an individual’s life correlates with the amount of energy needed to repair excessive somatic ‘damage’ (Norgan 2002). When consumption is not proportional to energy loss, aspects of health may be compromised. During the developmental period of life, reduced growth often follows stressful events.

Proximate environmental factors are influenced by ultimate environmental conditions. Ultimate factors include income, sanitation, potable water, and migration among others (Smith et al. 2002). Figure 1.1 illustrates relationships between ultimate and proximate factors in overall health. As shown, ultimate factors influence health by either decreasing nutritional availability or increasing disease prevalence. For example, income (defined as the acquisition of resources) in large part determines the quality of diet and to some degree morbidity (Larrea and Kawachi 2005). Above average income allows more diverse dietary consumption which aids in providing the six essential nutrient groups.

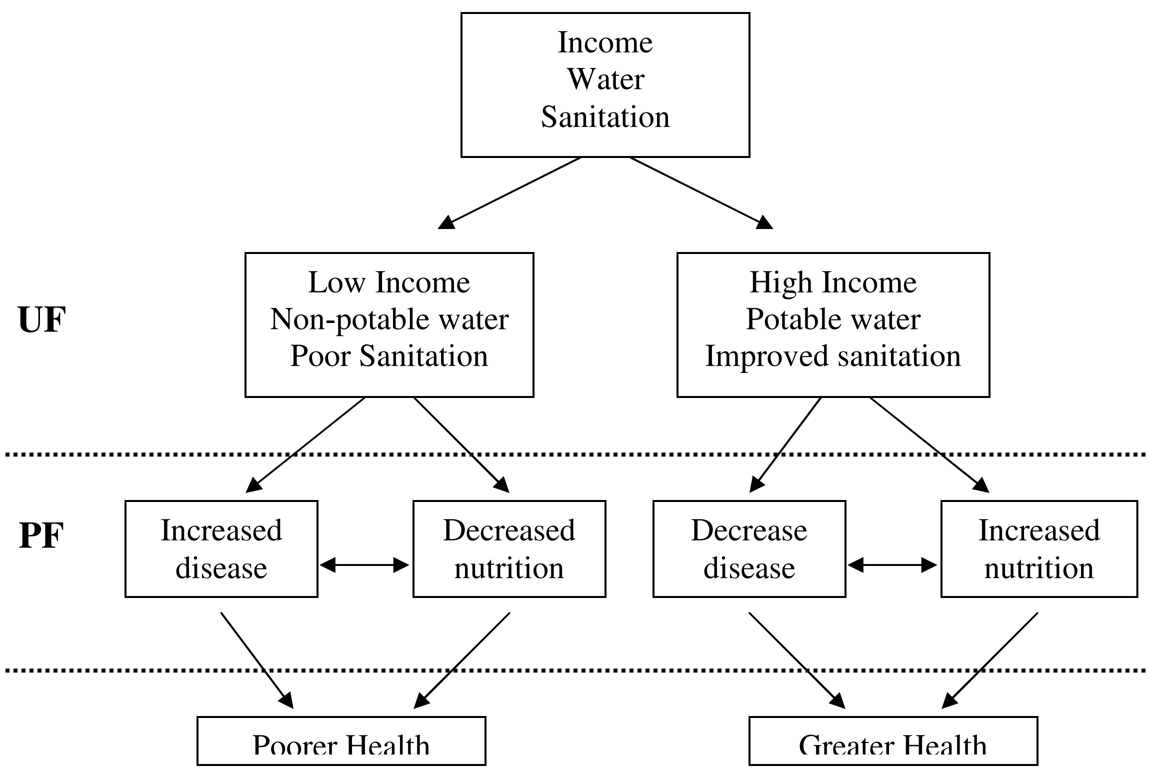

Figure 1.1 Diagram indicating the relationships between ultimate and proximate factors. UF = ultimate factor PF = proximate factor

In addition, higher incomes permit greater access to medical facilities, which likely decreases the length and/or severity of disease-related events (Larrea and Kawachi 2005).

Sanitation and water sources also influence health quality. Lack of waste management exposes a population to the risk of contracting infectious and parasitic diseases such as cholera, intestinal worms, schistosomiasis, typhoid, measles, and tetanus (WHO 2004). Water sources also introduce disease and illness through bacterial contaminants which often result in dehydration due to excessive diarrhea. In addition, stagnant waters provide an environment conducive to the formation of mosquito colonies which transmit pathogens such as malaria (WHO 2004). Causes of death among African children serve as an example of the harmful effects of these conditions. Figure 1.2 illustrates the percentage of 0-5 year olds who died of each condition in 2004 (the most recent data available) (WHO 2004). According to these data, 26% of deaths occurred as a result of malaria, measles, tetanus, and other infectious/parasitic diseases, with an additional 16% from diseases associated with diarrhea (WHO 2004).

The final determinant discussed here is migration. Emigration (the movement of people away from an area) results from two dichotomous stimuli, labeled negative and positive. Negative emigration is the product of force/coercion or ecological necessity in which subsequent conditions will be unfavorable. Positive emigration, on the other hand, is the migration of people from deprived conditions to more advantageous environments. In this form, emigration is considered voluntary. Whether positive or negative, migration has numerous effects on a population, particularly in regards to health and way of life.

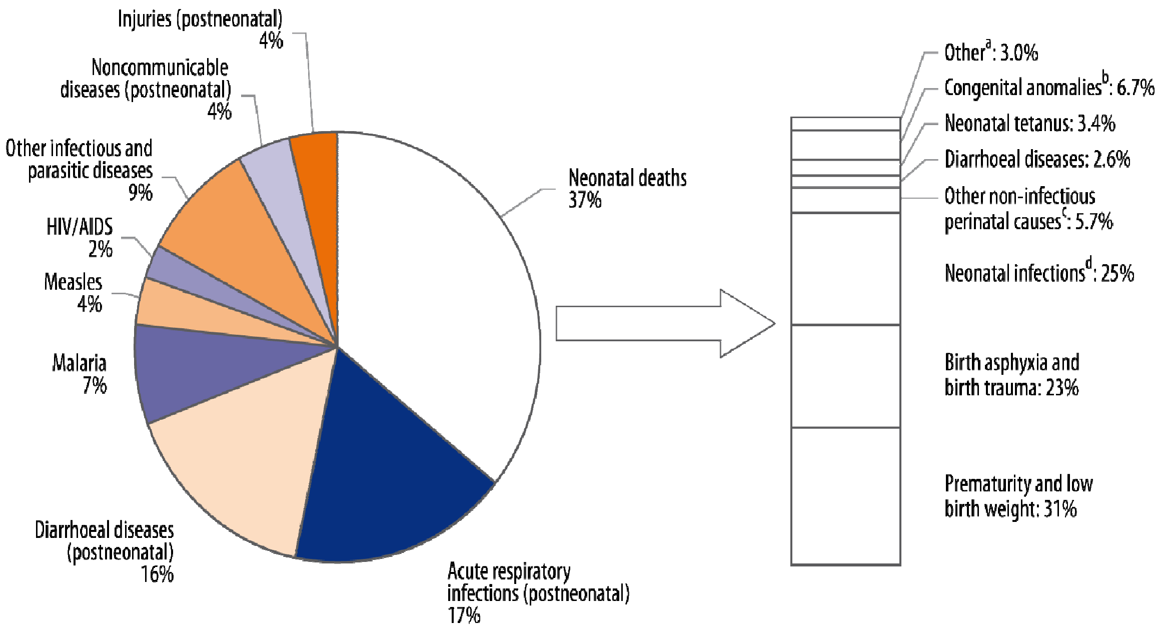

Figure 1.2 Causes of Death among African Children within the First 5 Years of Life. Source: WHO, Global Burden of Disease 2004 Update, Selected Figures and Tables.

In addition to changes in disease and nutritional environments, issues of stress, accesses to medical services, and lack of support networks, influence outcomes of migratory transitions (Kahn et al. 2003).

Immigration to the United States may be considered advantageous for most populations, particularly from developing and/or disintegrating countries (e.g. Somalia, Sudan, and Sierra Leone). The Human Development Index (HDI), produced by the United Nations Development Programme, ranks countries according to citizen welfare (UNDP 2009). The HDI is based on three criteria: health (measured by life expectancy), access to knowledge (measured by adult literacy and level of schooling), and standard of living (measured by purchasing power parity and income) (UNDP 2009). Currently, the United States ranks 13th out of the 182 countries for which data are available (UNDP

2009). It is likely then, that immigrants from most countries would experience improved environmental conditions in the U.S.

In addition to improved physical conditions, cultural customs also influence changes in health status resulting from migration (Sussner et al. 2008). Communities possess cultural behaviors and ideologies developed to reduce stressors to which they have been exposed (Sussner et al. 2008). Though these traits are adaptive in native conditions, they may be of little value or even detrimental in new environments with different stressors. As such, cultural attributes are important variables contributing to the health of immigrant children within a host country.

1.3 Study Population

Even though many studies have examined the well-being of immigrant children (see Boas 1912; Bogin and Loucky 1997; Fishberg 1905; Goldstein 1943; Greulich 1957, Lasker 1952, and Shapiro 1939), few have focused on U.S.-born children to first generation African immigrants. Two reasons may explain this dearth of research. First, environmental conditions in many African countries have either deteriorated or remained unchanged over the past several decades (e.g. Somalia, Sierra Leone, Mozambique, Sudan, etc.). Therefore, opportunities to explore these questions likely have not occurred. Second, until recently few African populations have been relocated to more developed countries in sufficient numbers to examine their well-being within the host country.

One major exception is the forced relocation of people from Africa to the United States during the slave trade. Research indicates that African-American children are taller and heavier than their African counterparts (Eveleth and Tanner 1990). Further, when socioeconomic status is held constant, African-American children are taller at almost every age than children of European and Asian descent (Eveleth and Tanner 1990; Komlos and Breitfelder 2008). Although compelling, issues of admixture (see Tang et al. 2006) and length of time in the U.S. may be confounding factors in these comparisons. Thus, African-Americans likely are not representative of other African populations.

Besides being under-represented, the significance of studying African migrants rests in their unique cultural practices. In contrast to findings based on European and Asian children, studies of African, particularly East African, cultural beliefs demonstrate that these practices significantly impact the growth environment experienced by children (Gray et al. 2004; Little et al. 1993; Nur and Darnton-Hill 1985; Vangen et al. 2002). For example, the practice of female circumcision may significantly affect a child's birth weight through intentional nutritional deprivation of the child by the mother during the prenatal period (Essen et al. 2000). Thus, studying African migrants allows us to better understand how changes in biological, cultural, and ecological conditions affect growth environments constructed by mothers, even within highly developed countries like the United States.

This study addresses these issues by examining the health and well-being of children born to first generation Somali immigrants in the United States. Somalis were selected for several reasons. First, substantial Somali populations have migrated to the U.S. over the past two decades allowing a representative sample to be examined. During the 1980s, economic and political unrest eventually culminated in the collapse of the Somali state in 1991. In the wake of these events, civil war erupted causing many Somalis to seek refuge in neighboring countries, including Kenya, Ethiopia, Djibouti, and

Yemen (Abdullahi 2001). The United Nations High Commissioner for Refugees (UNHCR) resettled many of these Somalis in foreign countries, including the United States, Canada, Norway, Great Britain, and Australia (UNHCR 2005). In the two years prior to civil war, only 217 Somali refugees arrived in the United States. However, between 1992 and 2009, more than 90,000 relocated to the U.S. This was approximately 7.1% of all refugees and 42.8% of all African refugees who entered the U.S. during this period (U.S. Department of Homeland Security 2000, 2009).

Second, Somali cultural practices regarding pre- and post-natal care often run contrary to practices in the U.S. (e.g. intentional low birth-weight). Similar customs are found in other East African populations, as well (Gray et al. 2004; Little et al. 1993). Understanding the impact of traditional cultural practices in new physical settings aids in determining how these may impact children's well-being. Because Somalis have been arriving in the U.S. since the early 1990s, the degree of acculturation regarding childcare may be highly variable. As such, Somalis represent a favorable population for analyzing how traditional African cultural behaviors influence health and well-being of children in a novel environment.

1.4 Theoretical Significance

Assessing the health and well-being of a population in transition provides insights into how humans physiologically adapt to secular changes in environmental stressors. Secular changes refer to changes in conditions (e.g. social, biological) from one generation to the next (Johnston 2002). Positive trends indicate an increase in health (i.e. a decrease in stressors), while negative trends indicate the opposite. Secular trends in health may have significant consequences for population survival. For example, a decrease in fertility may be the result of poor health affecting those of reproductive age. Further, children born and reared by these mothers may experience reduced cognitive and physiological development, a diminished work capacity, and an inability to acquire essential skills (Smith et al. 2002). Improved health increases people's productivity and decreases their financial and societal burdens, ultimately improving the viability of the entire population (Smith et al. 2002). Secular trends in health, therefore, define human adaptation throughout history, both as an agent and outcome of change.

1.5 Applied Significance

This research contributes to the fields of human biology, anthropology, and epidemiology by demonstrating the importance of identifying the ultimate factors involved in human health. Research in this area has focused primarily on immediate causes, such as birth weight and infant mortality, rather than ultimate causes such as income, sanitation, clean drinking water, maternal exposures, and family size. Research on populations in a transitory state adds to current knowledge concerning sources of health disparities. In addition, this study illustrates the importance of culturally sensitive approaches to ensuring the health and well-being of immigrant children born abroad or domestically. Finally, understanding the impact of environmental change informs parents and healthcare organizations about the advantages and disadvantages of culturally specific behaviors, both traditional and non-traditional, regarding children's health.

Chapter 2: Historical Context: From Origins to Immigration

2.1 Physical Setting

Somalia encompasses 639,540 sq. km in the Horn of Africa, lying between 2º south latitude and 12º north latitude (Lewis 1969). There are 3,025 km of coastline bordering the Aden Sea to the north and the Indian Ocean to the east (Samatar 1993). Somalis claim territorial rights over waters up to 200 nautical miles from these coasts (Metz 1993). Approximately 50% of Somalia is considered permanent pastureland, while an additional 27% is divided into forested areas (14%) and arable land (13%). The remaining 23% is deemed unsuitable for exploitation (Laitin 1993).

In the north, the topography varies from mountainous regions (Karkaar Mountain range – up to 2,400 m above sea-level) in the west to low-lying desert environments in the east (Lewis 1969). The Karkaar Mountains give way to the Ogo plateau in central Somalia which slopes to the Indian Ocean in the east and to the undulating terrain of Ethiopia in the west (Samatar 1993). In general, the north is not well suited for cultivation. The western plateau, however, is capable of sustained dry land farming. Permanent wells can be found in this region providing year-round water sources (Samatar 1993).

Southern Somalia is dominated by the country's only two permanent rivers, Webi Jubba and Webi Shabelle, which originate in the highlands of Ethiopia (Samatar 1993).

The Webi Jubba (Somalia's only navigable waterway) empties into the Indian Ocean, while the Webi Shabelle turns south-west before reaching the ocean and drains into inter-riverine sand flats (Lewis 1969). Floods are common along the banks of these rivers producing fertile soils capable of long-term sustainable agriculture (Samatar 1993).

Somalia's climate is divided into two dry (*Jiilaal*, Jan-Mar and *Haggaa*, July-Sept) and two wet (*Gu*, Apr-June and *Dayr*, Oct-Dec) seasons determined by the monsoons (Abdullahi 2001). Rainfall is highly variable during the wet seasons ranging from 1,300 mm in the Karkaar Mountains to less than 10 mm within the coastal areas (Abbas 1972). Drought conditions in the interior regions are not uncommon, with four major droughts within the past three decades alone – 1974-75, 1984-85, 1992-93, and 2006-present (Unicef 2009). Average temperatures range between 30º C (85º F) during the summer months to 18º C (65º F) during the winter (Lewis 1969). Comparatively, the northern mountainous regions are considerably cooler than the southern plains during all seasons, especially during the winter when daily high temperatures drop below freezing. Along the coast boarding the Aden Sea, temperatures may surpass 38º C (100º F) (Samatar 1993). Relative humidity ranges from an average of 40% during the day to greater than 85% at night due to the extreme temperature gradients (Samatar 1993).

2.2 Somali Origins

Details surrounding the occupation of Somalia are contentious. According to I.M. Lewis (1960), Somali oral histories indicate that this region was populated by three waves of people. Prior to the 11th century A.D., Somalia was inhabited by indigenous pre-Cushitic peoples known as Berbers who were divided into two distinct populations:

1) foragers and 2) agriculturalists. The former group is said to possess physical and cultural characteristics similar to peoples of central Africa; suggesting a northeast migration from that region. Agricultural Berbers, on the other hand, were considered descendants of Bantu peoples from northern Kenya because they spoke Swahili and were of similar physical appearance.

The second wave of inhabitants, the Gallas, forced the Berbers out of the region into neighboring countries (i.e. Kenya and Djibouti). Unfortunately, Somali oral history does not add any more details regarding the Gallas; there is no discussion about the timing of this occurrence and/or from which direction the Gallas migrated. Thus, there is little to be gleaned from these oral accounts (see below for a historical discussion of the Gallas occupation).

The final wave was that of Somalis from the Arabian Peninsula. Somalis claim to be descendants of the Prophet Mohammed and trace their ancestry to him through the influential Arabian sheiks, Agil and Hill. Somalis contend that their people followed these sheiks to the northern portion of the Horn during the 11th and 12th centuries A.D. For nearly 400 years, Somalis lived in the northern regions of Somalia, while the Berbers and Gallas were dispersed throughout the central and southern reaches. Beginning in the 16th century, however, an increase in Arabian migrants forced Berber and Galla populations to the west (Ethiopia) and south (Kenya). Today, small groups of Berber and Galla peoples still live in Somalia in the fertile lands along the banks of the Webi Jubba and Webi Shabelle.

In contrast to Somali oral history, Herbert S. Lewis (1966) proposed a theory that points to Ethiopia as the origin of Somali peoples. Historical accounts by Arabian geographers indicate that Somalis were in southern Somalia by at least the AD 11th century; no mention is made of Somalis living in the northern regions at the same time. This implies that Somalis migrated from regions to the east and/or south (e.g. Kenya and/or Ethiopia) earlier and from a different direction than stated in the oral history.

Historical records regarding Galla peoples further support H.S. Lewis' theory. Galla most likely originated in the Sagan-Dulei region (southern) of Ethiopia, near Lake Abaya. Oral traditions of the Galla discuss the migration of their people eastward from Ethiopia toward what is currently Djibouti and Somalia during the 15th and 16th centuries. Coastal Bantu (northeastern Kenya) oral histories concur, recounting the movement of Galla toward the Indian Ocean in the 17th century (Lewis 1966). The migration of Galla peoples into Somalia during this period stands in opposition to Somali oral tradition which indicates Somalis forced the Galla westward during the 16th century (I.M. Lewis 1960).

H.S. Lewis (1966) also used linguistic evidence to show that both Gallas and Somalis originated in southern Ethiopia. Gallas and Somalis are part of the Eastern Cushitic language family which is divided into 24 languages within 4 primary branches:

1) *Somali*, Rendille, Baiso
2) *Galla*, Konso, Gidole, Gato, Arbore, Magogodo, Warazi, Gawata, Tsamai, Geleb
3) Afar, Saho
4) Sidamo, Kambata, T'ambaro, Hadya, Alaba, K'abena, Marak'o, Darasa, Burji

Of the 24 languages, 21 are spoken in southern Ethiopia and northern Kenya. H.S. Lewis (1966) contends that if Somalis originated in northern Somalia, as their oral history contends, it would require 21 separate population movements into Ethiopia and Kenya.

However, based on rules of parsimony, if Somalis came from southern Ethiopia, it would only require 3 population movements: Afar and Saho to Djibouti and Somali into the Horn of Africa. Lewis (1966) concludes that Somalis originated in southern Ethiopia and not from Arabia as they believe.

More recent linguistic research also indicates a north-northeast migration of Somali peoples. According to Samatar (1993), Somali belongs to the Eastern Cushitic sub-group of Omo-Tana. The origin of this sub-group appears to be near the Omo and Tana rivers (hence the name, Omo-Tana) in present-day Kenya. Somali subsequently forms a sub-group of the Omo-Tana known as Sam; speakers of Sam where known to other indigenous groups as Samaale. Linguistic evidence suggests that proto-Samaale migrated northward from Kenya before the 1st millennium BC, eventually reaching the Ogaden region of Ethiopia (southeastern portion) by the 1st century AD. (Samatar 1993). This linguistic evidence, in conjunction with H.S. Lewis' (1966) research, supports a south-north migration of Somali peoples, rather than the north-south migration of Somali oral tradition.

H.S. Lewis (1966) and Samatar (1993) argue that the belief in an Arabian origin reflects Somali's desire to be descendants of the Prophet Mohammed and ignores the historical context of their occupation. I.M. Lewis (1962) concurs, stating Somali tribes likely created fictitious relationships in their genealogies to derive an attachment to Mohammed for religious and spiritual reasons. Whether these contentions are warranted or not, it is clear that Arabia had a significant influence on Somalia culture. In addition to the introduction of the Islamic faith, the modern Somali clan system of lineages may also be of Arabian origin. Somali oral history states that sometime prior to the 13th century

AD, Darod, the son of the Sufi Sheikh, of the Qadiriyyah Order, was driven out of Arabia for having a menstruating woman serve human flesh to guests visiting his home. Darod resettled in the Horn where he married Doombira Dir, the daughter of the Dir (Somali clan-family) leader. This union is said to have given rise to the powerful Darod clan-family (currently, the largest sub-population in Somalia) (I.M. Lewis 1969). An Arabian influence may also be seen in the Somali partriarchal ethos and patrilineal genealogies. Prior to contact with Persian and Arab commercial traders during the 7th -10th centuries AD, Somalia is suggested to have been matriarchal following matrilineal rules of descent (Samatar 1993).

2.3 Colonial Rule

Although the details surrounding Somali origins will never be reconciled, it is clear that Somalis were the primary inhabitants of the Horn of Africa by the 18th century A.D. (Metz 1993). For nearly two hundred years, Somalia was occupied by autonomous, self-governing tribal factions (clans). However, in the late 19th century, Britain, Italy, and France began colonizing the region and assuming political control (Metz 1993). Between 1891 and 1960, Somalia was divided into 5 districts (Metz 1993):

1. British Somaliland in the north central region
2. French Somaliland in the northwest (what is now Djibouti)
3. Italian Somaliland in the east and south
4. Ethiopian Somaliland in the Ogaden region of Ethiopia
5. Southwestern region later known as the Northern Frontier District (NFD) of Kenya

Britain's interest in Somalia was two-fold: 1) as a source of livestock and 2) a source of control over the coastal waters along the Gulf of Aden (Metz 1993). France colonized the northwest region because they perceived it to be a critical location along the Red Sea for a strategic naval coaling station. The goal was to use the naval position to strengthen their ties with French colonies in Indochina (Metz 1993). Italy's presence in Somalia was strategic on two fronts. First, southern Somalia is rich in agricultural lands and therefore, a considerable productive resource. Second, because Italy was not a colonial power, it was important for them to acquire land that was not contested by more powerful countries (Samatar 1993). Since Britain and France were preoccupied with the north, Italy seized the opportunity to take the south.

Ethiopian Somaliland differed from the others in that the Ogaden was, and currently still is, a highly contested region. Traditionally, both Somali and Ethiopian nomadic pastoralists utilized this area for grazing animals. However, the establishment of modern geopolitical boundaries subsumed the Ogaden under Ethiopian control (Lewis 1969; Samatar 1993). Conflict ensued between Somalis living within this region and Ethiopians who now claim legitimate ownership of the land. Ethiopians were not interested in sharing the region, so they forced hundreds of thousands of Somalis to flee to Djibouti and Somalia proper (Lewis 2008). Unfortunately, the carrying capacity of northern Somalia was not sufficient to support the increased population size. Consequently, Somalis waged war on Ethiopia to regain "their" valuable land (Lewis 2008).

The two primary colonizers of Somalia proper, Britain and Italy, were charged with establishing a functional infrastructure if they were to successfully govern their respective regions. To do so, the Italian colonial government promoted education by sending Somali children to colonial or mission schools where they could learn to read and write, among other things. Graduates obtained jobs in government as police officers, customs agents, bookkeepers, medical personnel, and teachers (Laitin 1993). Further, Italy established large networks of plantations to generate revenue through the production of citrus fruits, cotton, bananas, and sugarcare (Samatar 1993). Although cotton was Italian Somaliland's first viable export, the latter two were more successful and by the 1960s were the primary economic exports (Laitin 1993).

While the south was developing, British Somaliland was slowly lagging behind. Britain was unsuccessful in educating Somali children because families rejected the teachings of Europeans. The result was broad-scale illiteracy which undermined establishment of an effective administrative system and hindered progress in regional infrastructure improvements. Lack of education also forced the government to employ Kenyans to fulfill their basic needs (Laitin 1993). This put a strain on the urban economy (rural economies were influenced less by governmental decisions due to sustainable animal husbandry) in that monetary resources were leaving the country rather than being used to bolster the fledgling economic system.

Throughout the colonial period, Britain and Italy sought to create a unified country under their control. Support from the Somali people was critical in accomplishing this goal. In response to continual attacks on Somalis by Ethiopian rebels, Benito Mussolini, Italy's premier, waged war on Ethiopia in 1935. Italian forces defeated Ethiopian armies reclaiming the Ogaden for Somalia. Having earned their respect, Somalis aided the Italians in removing Britain from power in the north and establishing the first unified Somalia in 1940. Under Italian tutelage, the economy was stimulated by setting prices, imposing taxes, and establishing a universal currency (Samatar 1993).

Although prosperity for all was not realistic, several groups in the southern agricultural lands became very wealthy. Somalis were pleased with the economic improvements and remained confident in their success.

Italy's dominance in the region was short-lived. In 1941, British armies reclaimed British Somaliland and successfully seized Italian Somaliland in the east and south. Under pressure from the Ethiopian government, Britain relinquished control of the Ogaden back to Ethiopia (Samatar 1993). Although Somalis abhorred the decision, the promise of an independent Somalia overshadowed the situation. Britain was committed to creating an autonomous, peaceful, Somalia, which required cooperative efforts by both British and Somalis alike. Between 1941 and 1949, Britain began the rebuilding process by (Samatar 1993):

1) establishing health and veterinary services
2) improving work conditions in agricultural regions
3) increasing water supplies by drilling more wells
4) introducing secular elementary schools in the north and increasing the number of schools in the south
5) re-organizing the judicial system to include elements of both Somali and British laws
6) replacing Italian-appointed leaders with Somali clan-elected bodies

In spite of British control, Italian colonists were permitted to organize politically. Various political parties emerged, each aimed at regaining control and removing Britain from Somalia. Growing tension developed between not only Italians and British, but between Italians and Somalis. From the Somali perspective, Italian governance meant dependence, rather than independence as they desired. In response, Britain encouraged Somalis to organize politically against Italian movements. The result was the first political party known as the Somali Youth Club (SYC) – it was later renamed the Somali Youth League (SYL) (Samatar 1993).

At the Potsdam Conference in January of 1945, Italy's request to be re-appointed governance of Somalia was denied. Instead, a commissioned committee was formed to oversee the fate of the country. In January of 1948, the committee convened in Mogadishu to evaluate proposals presented by each political party. Impressed with the SYL's proposal (to reunite all Somalis under one administrative body), the committee ordered that Somalia be placed under Italian control for a period of ten-years (international trusteeship), after which independence would be declared (Samatar 1993). On July 1, 1960, British and Italian Somalilands merged creating the autonomous Somali Republic (Metz 1993)

2.4 Independence

In the years following independence in 1960, democracy reigned with freedom of expression for all. Emerging national ideals fostered an egalitarian position on political and legal systems, both traditional and Western. Political arenas were no longer based on clanships, allowing all males, no matter his clan, class, or profession, to participate (Samatar 1993). Elections were held to fill government positions, most important of which was the newly instituted presidential post. Finally, power shifted away from the separatist clanships toward a unified populace, irrespective of lineage.

From an ideological perspective, this democratic revolution was promising. However, under the façade of peace and happiness was a contentious current regarding how the country should be directed. Colonization of Somalia proper by multiple countries left the north and south with separate governmental administrations, legal systems, educational systems, police/military forces, tax policies, and exchange rates (Samatar 1993). Because the Italians had more governmental experience and better education, they argued that the country was best under their control. The north, of course, was not of the same opinion. Rather than compromise, northern army officers rebelled, urging for a disbanding of the union and reversion back into two independent states. From 1960 to 1969, continual debates between the two groups hindered the development of a functional government (Samatar 1993).

National elections in March of 1969, resulted in Abdirahiid Ali Shermaarke becoming Somalia's first president (Metz 1993). Though Shermaarke received the popular vote, it was clear than the north and south were still separate states within unified national boundaries. Military personnel, who previously were not permitted to participate in politics, became disenchanted with what they perceived to be governmental corruption and nepotism (Metz 1993). In response, President Shermaarke was assassinated in Oct. of 1969 by one of his bodyguards who promoted a new military regime (Metz 1969). The resulting governing body, the Supreme Revolutionary Council (SRC), elected Major General Mahammad Siad Barre president of Somalia (Metz 1969).

2.5 Barre's Regime

In 1970, President Barre, a member of the Darod clan-family, and the SRC sought to unify Somalia, which had yet to officially happen, and usher in a new form of politics, Scientific Socialism. The SRC began the transition by banning political parties, abolishing the National Assembly, and suspending the recently developed constitution

(Samatar 1993). The goals were to put an end to tribalism, nepotism, corruption, and misrule. As such, the country was renamed the Somali Democratic Republic (Samatar 1993). To subsume all Somalis under his socialist regime, Barre had to abolish the clan-oriented cultural system that sustained them for centuries (Samatar 1993). Thus, the SRC resettled hundreds of thousands of nomadic pastoralists in farming and coastal communities irrespective of the clan to which they belong (Samatar 1993). In addition, traditional clan elders and clan groups were replaced by peacekeepers and governmental committees, respectively (Metz 1993). Clan rights to land, water, and other resources were abolished (Metz 1993). The SRC believed these actions would weaken clan solidarity, thus improving national pride and making it easier to control the population (Samatar 1993).

Having dismantled the traditional clan structure, Barre set out to unify Somalis through education. However, two roadblocks stood in the way of educational advancement. First, due to British and Italian influences during the colonial period, Somalis spoke numerous languages including English, Italian, Arabic, Somali, and Swahili, albeit rarely. In 1973, Barre declared Somali to be the official language and demanded that all government officials be fluent within a month (Metz 1993). Second, Somalia lacked an official orthography. He ordered that one be created to facilitate the production of universal textbooks that could be used in schools. Further, he launched a 2-year literacy campaign to educate everyone, including nomadic pastoralists who still lived in the bush (Samatar 1993).

Throughout the 1970s and 1980s, Barre emphasized not just elementary education, but post-secondary education, as well. In 1970, the Somali National University was established in Mogadishu, whereby students could be trained in such fields as (Samatar 1993):

1. Agriculture
2. Economics
3. Education
4. Engineering
5. Geology
6. Law
7. Medicine
8. Veterinary sciences

A polytechnic institute and adult education center (primarily for peoples in rural areas) were also established to promote areas of study such as nursing and telecommunications (Samatar 1993).

Barre and the SRC also focused on economic improvement. In 1971, Barre implemented a 3-year plan which emphasized a better standard of living, jobs for all, and the elimination of capitalistic exploitation (Laitin 1993). He also subsumed most of the economic infrastructure under state control. The government nationalized banks, insurance companies, oil distribution companies, agricultural refineries, and developed agricultural/fishing cooperatives (Laitin 1993). Prior to the cooperatives, only 10% of the national budget was dedicated to agricultural programs, whereas in 1974, nearly 30% was so dedicated. Most of these funds were aimed at the successful production of corn, beans, peanuts, and rice (Laitin 1993).

Although the SRC was initially committed to education and economics, attention slowly turned to the political arena. In 1976, Barre dissolved the SRC and created a single national party known as the Somali Revolutionary Socialist Party (Metz 1993). To demonstrate his political and military power, Barre attempted to regain control of the

Ogaden region which had been returned to Ethiopia by Britain decades earlier. In 1977, Barre waged war on Ethiopia in what is known as the Ogaden War (Metz 1993). The result was an overwhelming defeat of Barre's armies in 1978. In the wake of the conflict, thousands were killed and more than 650,000 Somalis and Ethiopian Oromos were forced to flee to northern Somalia (Metz 1993).

Economically, the war was devastating on two fronts. First, the large influx of refugees placed an unsustainable burden on resources. The low carrying capacity of the land coupled with worsening drought conditions led to widespread illness and starvation. Second, much of the national budget (~ 30%) was spent replenishing military supplies that were lost during the war; approximately ¾ of the nation's armored units and ½ of the air force (Metz 1993, Ofcansky 1993). The excessive military spending caused Somalia's international debt to continue to grow, while export revenue did not. Barre was forced to use foreign aid to keep the economy afloat. However, because Somalia had no means of repayment, international aid ceased resulting in the break-down of Somalia's macroeconomic structure (Laitin 1993).

Barre's defeat in the Ogaden War was heavily criticized. Disenchanted by the regime's performance in the war and the subsequent economic deprivation, several opposition groups emerged, including (Metz 1993):

1) Somali Salvation Democratic Front (SSDF)
2) Somali National Movement (SNM)
3) United Somali Congress (USC)
4) Somali Patriotic Movement (SPM)

2.6 Civil War

In the early 1980s, armed resistance against the regime took place in the south at the direction of the Majeerteen (Darod clan-family) based SSDF. The resistance movement quickly spread to the powerful Isaaq clans in the north, forming the SNM (Lewis 2008). The USC (Hawiye clan-family) was also challenging Barre in the southern region in two groups organized by the Abgal and Habar Gidir clans (Lewis 2008). Growing increasingly impatient with clan dissention, Barre sought to regain control by taking advantage of clan animosity between the Abgal and Habar Gidir (Hooglund 1993; Lewis 2008) – Somalis have long struggled with one another over issues of ancestry. Throughout their history, Somali genealogies have become “convoluted” as ‘saints’ and ‘noble ancestors’ were included into their lineages (Abdullahi 2001:8). The separation of clans based on ‘fictitious’ relationships has become entrenched in Somali culture, to the extent that clan rivalry is a social institution. However, conflicts between clans were often considered only “minor vendettas between close neighbors” (Abdullahi 2001:9). Tensions escalated during European occupation in which colonial powers sought the cooperation of local clan “chiefs” to bring Somalis under their governance (Abdullahi 2001:9). This was accomplished by giving chiefs a monetary salary thereby institutionalizing the political arena in which clans were involved. Chiefs then utilized their ‘legitimized’ positions to defend their clan’s interests creating inherent conflict between groups (Abdullahi 2001).

In addition to pitting the Abgal and Habar Gidir against one another, Barre also called upon his own clan-family, Darod, to help eliminate the USC (Lewis 2008). Although Barre’s plan was successful on some levels, it failed to suppress organized opposition, especially in the north. Barre ordered the slaughter of livestock herds, poisoning of wells, and bombing of urban areas (Hooglund 1993). By May of 1988, Hargeysa (Somalia's second largest city) and Burao (a provincial capital) were completely destroyed (Samatar 1993). The following year, the Hawiye-based USC joined the SSDF and Isaaq in rebelling against the regime. In defense, Barre ordered his elite force, the Red Berets, to massacre civilians in Mogadishu in hopes that his adversaries would fall in line (Samatar 1993). The USC responded by initiating covert operations against the regime. In Dec. 1990, USC fighters engaged in a four week battle with Barre's militia in the streets of Mogadishu, eventually defeating them in January of 1991 (Hooglund 1993).

At the same time, leaders representing all Somali clan-families united in the formation of the Council for National Reconstruction and Salvation. One hundred and fourteen prominent council members signed a declaration, known as the Mogadishu Manifesto, calling for Barre's resignation and the appointment of a transitional government (Hooglund 1993). Barre deemed the manifesto destructive and sentenced 45 of the manifesto's signers to death. Under extreme opposition, Barre reversed his decision ordering the release of the men less than a month later (Samatar 1993). Lacking support from a functional military, Barre, now in his 70s, conceded control of Somalia. On January 27, 1991, the authoritarian regime was effectively over (Metz 1993).

After the Abgal and Habar Gidir defeated Barre, the former clan took command of Mogadishu while the latter clan, under the leadership of Army commander General Mahammad Faarah Aidid, continued to pursue Barre. While Aidid was directing offensive attacks against Barre's dwindling army, the Abgal remained in Mogadishu establishing an interim government based around the appointment of Ali Mahdi Mahammad (Hawiye clan-family) as president (Lewis 2008; Metz 1993). Many opposition groups, particularly the SNM, were displeased that they were not consulted regarding the presidency or the direction of the country. Battles erupted throughout Somali with clans trying to 'jockey' for political control. The SNM in the north refused to unite with the USC as one political body resulting in the country being divided into two transitional governments. On May 18, 1991, the SNM severed ties with the USC forming the autonomous, self-governing province of Somaliland which still exists today (Metz 1993).

Dissention in the ranks also occurred among the USC itself. General Aidid strongly criticized the Abgal for not consulting with the Habar Gidir in this matter, especially considering both clans are Hawiye and they fought together to end Barre's reign (Lewis 2008). Aidid decided to split for the main USC group to form his own USC faction (Metz 1993). Aidid's forces challenged President Mahammad's army in the winter of 1991 for control of Mogadishu, and by extension, the country (Hooglund 1993). Fighters loyal to each side clashed in the streets of Mogadishu and by the end of the year, Aidid succeeded in pushing Mahammad into northern Mogadishu, while he took control of southern Mogadishu which included the port and international airport (Hooglund 1993). By September 1991, the political system was destroyed along with civil institutions and services, such as education and health care (Metz 1993). The disorganization caused by the war resulted in a significant downturn in economic revenue, particularly in the south. Consequently, Aidid and Mahammad continued to use force to maintain control of and access to the limited resources still available. They effectively became the foremost ‘warlords’ in southern Somalia (Metz 1993).

2.7 Post-Regime

In addition to relentless violence in the capital city, central and southern Somalia also faced one of the worst droughts on record (Metz 1993). The UN reported that over half of the Somali population was in danger of death by starvation (UN DPI 1997). The Center for Disease Control (CDC 1992) found that in the city of Baidoa, at least 40% of the population died between Aug. and Nov. of 1992 from severe oedema, measles, and diarrheal diseases. Further, nearly 75% of children under the age of 5 died during this period. The famine was so devastating that the Western media deemed Baidoa the “City of Death” (Abdullahi 2001:41). By September of 1992, nearly 25% of children under the age of 5 in southern Somalia had died (Metz 1993). An international effort to supply starving Somalis with food and basic needs began immediately (Lewis 2008; Metz 1993).

These efforts were thwarted by General Aidid who seized shipments entering Mogadishu’s port on the grounds that the supplies would aid his enemies in their fight (Hooglund 1993). Accounts indicated that Aidid blocked up to 80% of food shipments from getting to the people (Hooglund 1993). In March of 1992, a ceasefire was established between Aidid and Mahammad and in April of 1992 the UN sent aid workers to monitor the ceasefire (Lewis 2008). Having little impact, the UN deployed 37,000 troops (of which 26,000 were Americans) in Dec. 1992 under the code name Operation Restore Hope to secure ports and roads to assist in getting food to the needy (Lewis 2008). Disapproving of the conditions established by the international community, Aidid and other warlords began aggressively engaging UN forces in the streets of Mogadishu (Lewis 2008). Aidid's militia was successful in managing UN forces and in 1993, President Clinton ordered all troops withdrawn by March 1994 (Lewis 2008). Following the failed operation, Somalis looted everything left behind. Profits from the sale of the goods were used to fund the then hopeful new warlords (Lewis 2008). Over the next 14 years, Somalis tried to establish a functioning government which would put an end to warring factions and improve the basic needs of the country. As of today, all attempts have failed and consequently, Somalia is still in search of peace.

2.8 Population Displacement

Social disruptions caused by the war led to substantial internal and external displacement of people from both rural and urban areas. Large urban centers were inundated with people abandoning failing farms (through drought and plundering) in search of protection and provisions. Prior to 1991, Mogadishu had approximately 500,000 residents, while in 1992 there were more than 2 million (Samatar 1993). Those unable to relocate to urban areas were forced to take refuge in make-shift camps. In September of 1992, more than 600,000 'visible' Somalis were living in refugee camps (UNDP 2001). An additional 1 million 'invisible' people (those living with kinfolk rather than in camps) were displaced (UNDP 2001). Even though Somalis flocked to Mogadishu during the early stages of the war, they quickly fled due to on-going conflict. Camps were established in the hinterlands around Mogadishu, particularly in the Afgooye area (UNHCR 2009b). Since May 2009, nearly 250,000 people have left Mogadishu due to violence (UNHCR 2009b). Currently, there are more than 1.2 million Somalis (approximately 14% of the population) who are internally displaced (UNHCR 2009a).

Somali refugees also emigrated to neighboring countries such as Kenya, Ethiopia, Yemen, Oman, and Djibouti to escape war and famine (USCRI 2009). In 1992, the UN estimated that 1 million of the 7.5 million Somalis were refugees located throughout Kenya, Ethiopia, Western Europe, North America, and Australasia (Valentine et al. 2009). In Africa, Ethiopia experienced the greatest influx of Somalis during the 1990s. Because the Ogaden region was dominated by traditional Somalis, many refugees had family/friends they could turn to for support. Kenya was also a safe-haven for Somalis throughout the 1990s and 2000s though their experiences were quite different. Many refugees entered through unofficial routes challenging security along the Somalia-Kenyan border. In response, the Kenyan government focused on managing the number of 'illegal' refugees by requiring that all Somalis over 18 years of age 'prove' their legal right to be in the country. Those that could not (e.g. recent refugees) where repatriated (UNHCR 2004). Further, reports of discrimination and violence against Somalis were a regular occurrence. In the face of these obstacles, Somalis continued to seek refuge in the country (UNHCR 2004).

Due to the overwhelming influx during the 2000s (Table 2.1), Kenya ceased its legal residency requirements and established 3 refugee camps around the city of Dadaab in the northeast region. Dadaab currently has the world's largest concentration of Somali refugees with nearly 280,000 occupants and 6,400 more arriving each month (UNHCR 2009b). In December of 2009, Kenya officially closed its borders to Somali refugees to relieve overcrowding in Dadaab and other camps (Mbatiah 2009).

	Country			
Year	Kenya	Ethiopia	Yemen	Djibouti
1993	219,049	228,139	52,400	17,682
1994	206,268	269,739	45,350	20,602
1995	172,164	305,351	49,516	21,321
1996	171,347	287,761	43,871	23,010
1997	174,119	249,235	37,439	21,546
1998	164,657	195,345	57,426	21,615
1999	141,088	180,862	55,186	21,648
2000	137,376	121,096	56,524	21,698
2001	144,349	67,129	67,485	21,712
2002	155,767	37,532	80,763	20,251
2003	154,272	28,276	59,246	25,474
2004	153,627	16,470	63,511	17,331
2005	150,459	15,901	78,582	9,828
2006	165,900	15,900	78,600	nd
2007	188,500	66,600	91,600	nd
2008	196,200	111,600	110,600	nd
Total	2,695,142	2,196,936	1,028,099	263,718

nd = no data

Table 2.1 Number of Somali Immigrants in each Country by Year

Since the mid-1990s, the United Nations High Commission on Refugees has resettled Somalis from these camps throughout the world including the United States, Canada, Norway, Netherlands, Denmark, Sweden, Great Britain, and Australia, among others (USDS 2009). Somali refugees were initially relocated in the United Kingdom because of the connection established between the two countries during the colonial period (Valentine et al. 2009). The 2001 census indicated a population of 44,000 Somalis, but later reports estimated between 95,000 and 250,000 (Lewis 2008). These numbers likely are underestimated due to issues of collecting data on often transitory refugees. Warfa et al. (2006) found that Somalis living in London move an average of 4 times before establishing permanent residence. The exact number of Somalis in the UK is currently unknown.

In North America, Somalis first resettled in Canada and then the Unites States. Toronto, Ontario experienced a steady increase in Somalis throughout the 1990s (Berns-McGown 2007; Horst 2007). Prior to 1991, very few Somalis resided in Canada, while after that, they became the largest African refugee group in the country (Danso 2001). Substantial populations of Somali refugees have also relocated to the United States (Table 2.2). Before the onset of the civil war, only a nominal number of Somalis entered the country (U.S. Department of Homeland Security 2000). Subsequently, tens of thousands have migrated to the region as civil war and drought forced many to flee there deteriorating country. Somalis accounted for approximately 7.1% of all refugees and 42.8% of all African refugees who entered the U.S. between 1992 and 2009 (U.S. Department of Homeland Security 2000, 2009). Several urban centers were involved in the resettlement project including Columbus, OH, Minneapolis, MN, Washington, D.C., and Atlanta, GA (Lewis 2008).

Since 1991, Minnesota has been the focal point of Somali life. According to the 2000 U.S. census, over 14,000 Somalis resided in Minnesota, which was approximately 30% of the Somali population in the U.S. (Goza 2007). This region was advantageous because of its good employment opportunities and refugee service agencies (Goza 2007). Refugees found similar advantages in Columbus, OH (Somali Community Association

2009). However, throughout the latter half of the 2000s, job opportunities shifted from Minneapolis to Columbus resulting in a corresponding population increase in central Ohio (Somali Community Association 2009). Current estimates indicate Somali populations of 60,000 and 50,000, respectively (Somali Community Association 2009). It is reported that if the availability of unskilled job opportunities continues in Columbus, the population will surpass that in Minneapolis by the end of 2010 (Somali Community Association 2009). Further, because of the close connection between Columbus and Toronto, families have been relocating to the former over the past several years (Goza 2007). The 2010 U.S. census will be valuable in determining the distribution of Somalis throughout the country.

Year	Refugees	Immigrants
1990	25	277
1991	192	458
1992	1,570	500
1993	2,753	1,088
1994	3,555	1,737
1995	2,506	3,487
1996	6,436	2,170
1997	4,974	4,005
1998	2,951	2,629
1999	4,320	1,690
2000	6,026	2,393
2001	4,951	3,007
2002	237	4,535
2003	1,994	2,444
2004	13,331	3,929
2005	10,405	5,829
2006	10,357	9,462
2007	6,969	6,251
2008	2,523	10,745
2009	4,189	n.d.
Total	**90,264**	**67,383**

n.d. = no data

Table 2.2 Number of Somalis entering the U.S. by Year
Source: U.S. Department of Homeland Security, 2000 and 2009

Chapter 3: Cultural Context

3.1 Demographics

The number of Somalis living within the internationally accepted geopolitical boundaries of Somalia is not known because there has been no official census since 1975. This resulted in nearly 35 years of undocumented population change (Lewis 2008). Estimates based on current growth rates and the 1975 data, suggest a total population of between 8.7 and 9.5 million (Amnesty International 2009; CIA 2008; WHO 2009 Review).

Somali populations stretch southward from the Awash valley in Ethiopia to just south of the Tana River in northern Kenya (Lewis 2008). The majority of Somalis reside along the banks of the Webi Jubba and Webi Shabelle, although large populations are also found in several urban areas, including Hargeysa, Burao, and the Berbera in the north and Mogadishu, Kismaayo, Oddiur, Baidoa, and Hobyo in the south. In 2008, roughly 37% of the Somali population resided in these urban centers (CIA 2008; WHO 2009). The remainder of Somalia is sparsely populated, punctuated by uninhabited regions (CIA 2008).

Scholars often describe Somalia as one of the most linguistically and religiously (Islam) homogeneous regions in the world (Lewis 2008; Samatar 1993). Approximately 95% of inhabitants speak a dialect of Somali and are followers of the Islamic faith

(Samatar 1993). This contention, however, is misleading in that it diminishes the role of non-Somalis in the historic and cultural contexts of past and present day Somalia. Minority Rights Group International (2009) reports that one in five Somalis is of minority status.

The largest minority is the Sab. The Sab consist of five linguistico-ethnic groups including Maay (the largest), Jiido, Dabare, Tunni, and Garre. The latter four are often referred to as Digil, while the Maay are known as Mirifle (Abdullahi 2001) or Rahanweyn (Lewis 2008). The Sab are permanent cultivators who reside in areas surrounding the Webi Jubba and Shabelle. Unlike other Somalis, Sab do not trace their ancestry to the apical ancestor, Samaal. Rather, they claim descent from a mixture of Somali, Oromo (or Galla), and pre-Cushitic Bantu peoples (Abdullahi 2001). Further, it is common for Sab to accept ‘clients’ (e.g. freed slaves) as members of society, thus creating multi-ethnic communities (Samatar 1993). A ‘client’ is defined as a group of people who seek support (in protection, subsistence, etc.) from another group, usually of different origin, in exchange for services (Lewis 1969). Historically, Somalis do not consider Sab their equals. Social inequalities are still pervasive ranging from prohibition of intermarriages to food taboos involving the consumption of meals prepared by Sab (Minority Rights Group International 2009; Samatar 1993).

Alongside the Sab live sparsely scattered groups of Bantu peoples known as Wagosha or Gosha (“people of the marshes”) (Abdullahi 2001). Gosha are remnant populations of indigenous Bantu who resided in southern Somalia prior to the arrival of Somalis. As with the Sab, Gosha are cultivators who are said to be the only peoples in Somalia who know how to plant and grow palm trees. In recent years, some Gosha have migrated to urban centers to work as carpenters, mechanics, plumbers, electricians, and masons (Abdullahi 2001).

In the Benadir region of Somalia (coastal lands from Mogadishu southward to the Kenyan border) live the Benadiri. Research suggests that Benadiri are descended from Bantu, Persian and Arab immigrants, and Somali peoples (Abdullahi 2001). Also residing in southeastern Somalia are the Barawani (also known as Amarani) and Bajuni, both of whom are Swahili speaking peoples (Abdullahi 2001). The Barawani live primarily in the city of Barawe, while the Bajuni live on the island of Bajuni where they subsist as seafarers, fishermen, and merchants (Abdullahi 2001; Samatar 1993). Both groups are believed to have fled from Arabia as descendants of an Israelite group (Lewis 1969). They remain isolated from other Somalis because of cultural, geographical, and linguistic (Swahili) differences (Lewis 1969; Samatar 1993).

In central Somalia live the Eyle who are hunter/gatherers believed to be native inhabitants of Somalia. They were marginalized when Bantu peoples moved into the area from the south and the Oromo (Galla) and Somalis encroached from the north. The Eyle, literally “dog owners”, use dogs for protection and hunting (Abdullahi 2001:11). This stands in strict opposition to Somali beliefs that dogs are filthy animals that should be avoided at all costs and that hunting should not be undertaken for any reason. Because Eyle are skilled in killing and processing animals, they often take jobs as butchers in urban centers (Abdullahi 2001).

The Midgaan, Tumaal, and Yibir constitute the remaining minority groups. Somalis refer to these peoples as *sab* (not to be confused with Sab) denoting a low-caste group. Midgaan are believed to have extraordinary spiritual abilities, similar to that of a shaman. Most important among their jobs is performing circumcisions. The smallest *sab* group, the Yibir (~5%), are magicians of whom requests are made for newborn amulets, the blessing of a Somali wedding, or predictions for the future. Most *sab* serve as 'clients' to other Somali groups (Samatar 1993).

Although there are numerous minority groups, Somalis themselves contend that all peoples in Somalia and the Ogaden region of Ethiopia, no matter their origin or status, are to be identified as Somali (Omar per. comm. 2009).

3.2 Social and Political Structures

Somali social structure is based on patrilineal descent from the eponymous spirit, Samaal, through the apical worldly ancestor, the Prophet Mohammed (Metz 1993). Genealogical trees are recorded in the names given to male children. Each boy is given a first name of the parent's choosing, but his surname is the father's first name. When the boy has a son, the child will take his father's first name as his surname, his father's last name as his middle name and be given a new first name (Lewis 1962). As such, an individual's name represents three generations in the family tree. If a boy knows his grandfather's full name, he can account for 9 generations. Most Somalis can follow their ancestry back many generations; it is actually required that all Somali children be able to trace their ancestry as far back as is known. Some Somalis argue that they can recall every agnatic relationship in their lineage back to Mohammed (Omar per. comm. 2008).

Because the Somali 'Nation' is too large to be politically viable, a segmented lineage system is utilized whereby the Nation is divided into descending sub-lineages, including: Clan-family, Clan, Tribal-family, Confederacy, Sub-confederacy, and Tribe

(Lewis 1969). An example of a Somali genealogy, beginning with the apical ancestor Mohammed, is presented in Figure 2. Somalia has six major clan-families including Dir (northwest), Darod (northeast), Isaaq (north-central), Hawiye (central and southern), Digil (southern riverine area), and Rahanwein (southern riverine area) (Lewis 2008) – see Figure 2. The former four groups are primarily pastoralists who represent approximately 70% of the population. The latter two clan-families are agriculturalists who reside in southern Somalia between the Jubba and Shebelle. They represent roughly 20% of the population (Metz 1993). The remaining 10% is composed of the various minority groups previously described. Clan-families are composed of many clans of various sizes ranging from 20,000 to 130,000 (Lewis 1994). Clans are numerous in Somalia because the "all-embracing Somali clan logic…assumes that all collections of people are 'clans'" (Lewis 2008:8). Each clan has a single formal political office held by a sultan. Even though he (sultans are never women) makes decisions on germane issues, his position is more ceremonial than functional (Lewis 1969; Samatar 1993). Major decisions are often left to men of high prestige, such as proven warriors and men of religion (*wadaddo*) (Ofcansky 1993). Clan boundaries are relatively flexible due to traditional lifestyles as nomadic pastoralists. Territory is never officially owned by any particular group. Grazing is seen as a gift of God to whom all men are equal. However, tradition often affords groups occupational rights over grazing lands during certain times of the year. Water-wells, on the other hand, may be privately owned. Wells are commonly used to 'strong-arm' land for a particular group (Lewis 1994:23).

Clans are sub-divided into primary lineages whose genealogical depth is 12-14 generations. These lineages are further divided into secondary and tertiary lineages based on agnatic ancestry (Samatar 1993). Although this system allows descent to be clear and unequivocal, individual lineages themselves hold no political or social standing. Rather, socio-political rights and obligations within and between sub-lineages are governed by contractual agreements which are entered into by lineal and collateral agnatic kin (Lewis 1962). Because these contracts are based on patrilineal relations, any and all ancestors are potentially an “axis of political division and unity” (Lewis 1994:22). The smallest and most significant contracted political and jural unit is the dia-paying group. These groups are composed of men, perhaps of separate yet related lineages, who share a common ancestor within the previous 4-8 generations. Although dia-paying groups are largely based on kinship, individuals may bond for other reasons such as protection (Lewis 1962). Membership does not automatically entail certain rights and obligations (Samatar 1993). Rather, men gain social and political solidarity by explicit contract (Lewis 1961, 1962). The socio-political strength of a dia-paying group is traditionally determined by the number of warriors in the faction (Ofcansky 1993).

The primary role of the dia-paying group is social control and the resolution of inter-group conflicted. Members of a dia-paying group are equally responsible for any actions taken by or against any member of another dia-paying group. Thus, if a person commits murder, all members are viewed as having committed the crime. Similarly, if a member is murdered, all members consider the transgression a personal affront, even if the deceased is only distantly related (Lewis 1994). Torts are divided into three groups: homicide, physical injury, and moral injury (e.g. offenses against women, entering a man’s house uninvited, theft, etc.). In the case of homicide, the principle of “equivalence of blood” (a life for a life) is applied (Lewis 1969). Agnatic kin of the dead are charged with avenging the death. This may take the form of retaliatory murder or financial compensation. In the event that revenge will create added stress to the grieving family, livestock may be requested as 'blood money'. The most important and valuable of livestock is the camel due to their hardiness in extreme conditions (Laitin 1993). The death of a man may be resolved by payment of 100 camels, while 50 camels would be appropriate compensation for the death of a woman (Lewis 1994). Members of the offending dia-paying group are equally responsible for amassing the camels through donation. Conversely, the dia-paying group of the victim divides the camels equally among all of the members, not just the deceased's family (Lewis 1994).

All dia-paying group members are obligated to make retribution to a wronged party and therefore, conflicts are rare, aiding in the maintenance of social order. That is not to say that dia-paying groups avoid conflict at all costs. Rather, a group may collectively agree that blood compensation for a crime is worth the financial burden. Decisions regarding these matters are overseen by a council of elders (*shir*) which entertains arguments from the adult men of the group (Lewis 1994). The opinions of older individuals and of those from deeper lineages are often given more weight (Samatar 1993). The council ultimately rules on the viability and cost of the proposed offense. If the proposal is opposed, the group will re-organize and try to pass another proposal or the matter will be dropped all together. In the event that an individual decides to carry out the crime in the face of opposition from the council, he will likely not be supported militarily or financially by the group (although he may be by his family) (Lewis 1969).

The dia-paying group is not the only political entity that may be enacted in Somali culture; although it is the most important in everyday life. Dia-paying groups within a clan may unite to form larger political units when necessary. Clans may also unite if the situation requires substantial military and economic power. As with the dia-paying group, these 'mega-groups' are bound to one another through contractual agreements which state the obligations of each faction (Lewis 1962). Although these contracts are typically entered into by agnatic kin, it may be necessary for two unrelated or distantly related groups to ally. In this case, the contract supersedes any genealogical relationships that may exist (Lewis 1994).

Because alliances are occasionally made between unrelated lineages, the genealogical position of a group is not necessarily consistent with the group's political status. Several lineages may be equal in genealogical terms, but politically divergent due to the size and speed at which their family increases (Lewis 1961). Somali culture separates lineages into long and short branches. As the names imply, long branches are those which consist of many generations, while short branches have relatively fewer generations. Since long branches have greater genealogical 'depth' than short branches, they are accorded more power and prestige (Lewis 1962). Pastoralists in the north have deep, organized genealogies because of the lack of influence from neighboring populations. The south, on the other hand, has more "free-standing 'descent groups' without any lineage based internal structure"; a likely result of the development of composite populations (peoples of various origins) in the area (Lewis 2008:9). Their loose organization does not support a traditional military which makes them vulnerable to armed predatory groups (Lewis 2008).

It is important to note that genealogical depth does not necessarily mean time depth. For example, group X may increase by three generations in the same time it takes group Y to establish 5 generations. Further, group X may only have 15 members in those 3 generations, while group Y may have 50 members. If then, a long and short branch form an alliance, the short branch will inherit greater socio-political power than its genealogy would dictate under normal circumstances. Once the alliance is disbanded, however, the short branch loses this advantage (Lewis 1962).

3.3 Economy

Describing 'Somalia's economy' is a challenging task since there is not, and has never been, a national economic system. Internal economic relations have traditionally been based on socio-political 'agreements' between related clans and clan-families. It has only been since the mid-20th century that attempts been made to unite all Somalis under one national polity (Lewis 2008). Somalia's domestic strategies are divided along multiple lines. First, northern and southern regions of Somalia have considerably different economic systems. Second, the economies in both regions are composed of what has been defined as "official" and "unofficial" trade organizations (Little 2003:8). An official economy refers to government regulated values and exchanges, whereas an unofficial economy is based on "mutual trust" agreements (Little 2003:9). According to Little (2003), in the absence of an official economy, an unofficial economy will take its place. The economic situation in Somalia is further complicated by the disruption in economic stability as a result of civil unrest beginning in the late 1980s. Because of the complicated nature of Somalia's economy(s), it is not possible, nor justifiable, to engage in an exhaustive treatment of these issues in the context of this thesis. The following discussion, therefore, will focus first on the domestic system and second on the international system.

Although Somalia is relatively homogeneous linguistically and religiously, there are regional differences in socio-political-economic organizations. Little (2003) argues that too often generalizations are made about Somalia's economy with regional differences minimized or overlooked all together. Domestically, northern and southern Somalis have engaged in all but mutually exclusive economic strategies. For example, the northern economy is based primarily on livestock, whereas the south relies more on crop production (Lewis 2008). Further, Somalis participate in three forms of subsistence including, nomadic pastoralism, semi-nomadic pastoralism, and agriculture (Metz 1993). As such, it would only be fitting to describe the economies of northern and southern Somalia separately where possible.

One caveat regarding the subsistence terms used herein must be discussed. In a strict sense, the term 'agriculture' refers to both crop and livestock production. However, since there is an emphasis on both resources throughout this thesis, it would be prudent to delineate them into clearly defined terms. Thus, the term 'pastoralism' will refer to animal husbandry and the terms 'agriculture' and 'cultivation' will refer only to crop production. The latter two terms may be used interchangeably unless otherwise indicated.

Generally speaking, Somalia's domestic economy is based on nomadic pastoralism, agriculture, forestry, and fishing (Metz 1993). Approximately 60% of Somalis are nomadic pastoralists, 20-25% are cultivators, and the remaining 15-20% are wage laborers and government employees (Metz 1993; Samatar 1993). Nomadic pastoralists live predominately in northern Somalia where the physical environment is not optimal for agriculture; less perhaps the minimal dry land farming practiced along the western plateau. The north may be referred to as ‘camel country’ since nearly 96% of the nation’s herds are located in the region (Little 2003). Camels are the most valuable resource in the north (less horses which are extremely rare) since they are well suited to environments of food and water scarcity (Laitin 1993). Camels are able to subsist up to 40 days without water, while cattle, goats, and sheep require water nearly everyday (Aidid 1994; Lewis 2008). Further, camels are capable of producing sufficient quantities of milk even under tough conditions; in similar situations, cattle will tend to ‘dry up’ (Little 2003). Camels are so valuable, in fact, that a classic northern Somali saying states that “a camel man is a man, a goat man is half a man, and a cattle man is no man at all” (Abdullahi 1990:72). This saying clearly illustrates the distain that northern pastoralists have for the economic strategies of the south (i.e. agriculture, cattle husbandry, etc.).

Even though Somalis in the south do not rely on camels, they too view camels as a sign of wealth and success. Camel owners are accorded high status, making their input on local community issues and regional disputes more influential. Camels are the primary cause of raiding between clans. Raids are common in Somalia as stealing camels is not illegal and is often a source of pride and honor (Mansur 1995). In addition to providing meat, milk, and transportation, camels serve as the medium of exchange for payment of ‘blood money’ and for the obligatory brideswealth accompanying marriage (Lewis 2008; Mubarak 2006).

Unlike elsewhere in Somali, the economy of the south relies on both livestock and agriculture. Regarding the latter, only 13% of land in Somalia is considered arable and therefore, wide-spread agriculture is not feasible. (Aidid and Ruhela 1994; Mubarak

2006). The floodplains between the Shabelle and Jubba are the most fertile giving it the title of Somalia's "breadbasket" (Mubarak 2006:143). Traditional food crops include sorghum, beans, corn, sesame seeds, rice, sugarcane, manioc, papaya, and bananas (CIA 2009). Several non-food crops are also grown including cotton, tobacco, frankincense, and myrrh (CIA 2009). Even though agriculture provides subsistence to approximately 65% of the Somali population, it is an inherently unstable practice. Droughts are very common in the southern region occurring every 4 to 5 years (Mubarak 2006). The lack of rainfall during these periods results in the absence of the three seasonal floods – Webi Jubba in April and June; Webi Shabelle in June and September – which are the lifeline of the southern economy (Lewis 2002).

In addition to agriculture, semi-nomadic strategies are also practiced in southern Somalia. This region is often referred to as "cattle country" because the majority of the nation's herds live in this area (Little 2003:36). Camels, goats and sheep are also raised, but their overall proportions are extremely low. For example, in recent years only 4% of camel herds, 1% of goat herds, and 0.5% of sheep flocks resided in this area (Little 2003).

Somalia's international economy is based on the exportation of agricultural resources. Livestock account for 40-50% of Somalia's GDP (CIA 2009) and approximately 65% of their export earnings (CIA 2009). Goats, sheep, and to a lesser degree camels and cattle, are exported to the United Arab Emirates, Yemen, Saudi Arabia, and Oman, among others (CIA 2009; Lewis 2008). The proportion of a herd that is sold at any given time varies depending on herd size and economic demand. Under favorable conditions, as much as 30% of a flock of sheep or goats will be sold per exchange. The proportion of camels and cattle sold is much less, at roughly 10% and 5%, respectively (Lewis 2008). In the early 2000s, Somalia accounted for nearly 60% of all livestock exports from the African continent (Little 2003). This was greatly reduced in the mid-2000s when Saudi Arabia refused to import Somali livestock in an effort to hinder the spread of rinderpest, an animal derived viral disease.

The effects of this ban are not known. However, a similar ban enacted in 1998 (to minimize the spread of Rift Valley Fever) may illustrate the importance of livestock exports to economic stability. In 1997, Somalia exported more than 2.2 million animals to Saudi Arabia, their principle market. During the ban (March 1998 – Oct. 1998), the sell of livestock all but ceased to exist, resulting in a 45% decrease in state revenues (Little 2003). Whether the same occurred in the most recent ban is difficult to determine. However, it is clear that livestock exports are a keystone of Somalia's economy, particularly in the north. In addition to being exported "on the hoof", Somalis export meat, hides, skins, and milk (Lewis 2008:57). In 2007, camel milk, sheep milk, goat milk, and cow milk represented the 1st, 3rd, 4th, and 5th largest exports, respectively (FAO 2009).

Crop exports account for 50-55% of the GDP (Mubarak 2006). In 2007, sugarcane and fresh fruits yielded the greatest harvests at 215,000 and 135,000 metric tons (MT), respectively (FAO 2009). Although high yielding, these crops have lower market values than less productive crops. For example, the sesame seed harvest in 2007 yielded only 30,000 MT, but had a market value 6.0 and 2.5 times greater than sugarcane and maize, respectively (FAO 2009).

Agricultural production has decreased over the past few years due to persistent drought (U.S. Dept. of State 2009). These conditions have greatly impacted the domestic and international economies. The current gross national product (GNP) is only $600.00 (U.S.) per capita, making Somalia the 225th ranked economy in the world. Gross national income (GNI) is also poor with a per capita income of $140 (U.S.) (CIA 2009). The proportion of people in extreme poverty (less than 1 dollar U.S./day) and general poverty (less than 2 dollars U.S./day) is 43.2% and 73.4%, respectively (NRC 2008). Further, Somalia's export/import ratio is -0.62 indicating that substantially more is imported than exported (CIA 2009).

Since the international economy is not supported by exports, Somalia is reliant on two economic sources: international aid and remittances (Lewis 2008). Many countries have aided Somalia since the civil war including the United States, European Union, Canada, Denmark, France, Germany, Italy, Japan, Netherlands, Norway, Sweden, Switzerland, and United Kingdom (USAID 2005). The U.S. alone will contribute over 30 million dollars in assistance in 2010 (USAID 2010). Much of the foreign aid, however, has failed to reach the people. As of March 2009, roughly 42% of the population was still in need of "emergency livelihood and life-saving assistance" (Holleman and Moloney 2009:1).

Although foreign aid from other countries is necessary, the "major inflow of 'aid' has come from Somalis themselves" (Kulaksiz and Purdekova 2006:15). Remittances, monies and goods sent by friends and family who emigrated to other countries, have become a primary source of economic revenue (Lewis 2008). Approximately 1 billion dollars (U.S.) is remitted annually, which accounts for roughly 70% of Somalia's gross national product (Kulaksiz and Purdekova 2006; Lewis 2008). A remittance economy exists in the absence of a formal banking sector through private industry (Kulaksiz and Purdekova 2006; Lewis 2008). Private firms known as *Hawala* give Somalis access to monies for consumption and investment, particularly in education and healthcare (Lewis 2008). From a macro-economic perspective, remittances are valuable in stimulating economies. Reports on Mexican and Ghanan remittances indicate that for every dollar remitted, the GNP increases at least two fold that amount (Kulaksiz and Purdekova 2006).

3.4 Religion

Proscription to religious doctrine is pervasive in all aspects of Somali culture. The majority of people (~95%) are Sunni (as apposed to Shia) Muslims, with less than 1% being Christian (Samatar 1993). Christianity is strictly opposed by Somali Muslims and therefore, the presence of Somali Christians is unexpected. Since the end of the 19th century, Somalia has gone through several periods of colonization by Christian based countries, such as Ethiopia, France, Britain and Italy (Lewis 2008). Of particular importance were the long standing conflicts between Ethiopia and Somalia. Religious strife within the Ogaden region resulted in the death of numerous Somalis which left many children without family. Having nowhere to go, these orphans were often taken-in by Catholic priests who schooled them in Christian theology. Subsequent generations were raised Christian even though they lived in an Islamic culture (Abdullahi 2001).

In contrast to the Islamic ideal that there should be no distinction between secular and religious aspects of life, Somalis believe that warriors and wadad (religious leaders;

also known as Sheikhs) have spiritual powers not seen in others (Samatar 1993). The development of Islam in Somalia was based on Sufism, which is the understanding that people may gain greater access to Allah through spiritual means. Sufis (also known as Dervishes) achieve a closer connection with Allah by escaping their physical reality through self-denial (Samatar 1993). For example, during the month of Ramadan, Somalis abstain from eating or drinking during the period between sunrise and sunset. It is believed that this act allows one to experience the pain of those who are starving. At the conclusion of Ramadan, Somalis are required to donate money, food, etc. to needy people given they have the means. Somalis have faith that self-denial brings them closer to Allah (Omar per. comm. 2009).

Although Somalis believe Allah to be the ultimate ruler of the universe, they attribute more immediate issues to worldly or mortal spirits (Lewis 2008). In pre-Islamic times, 'priests' were capable of 'helping and hurting' people through spiritual intervention. They 'helped' by making amulets and charms which protect people from spiritual possession, while they 'inflicted' harm through the use of sorcery (Abdullahi 2001). Many Somalis believe that illnesses such as coughing, vomiting, and loss of consciousness are the result of sorcery. Further, someone who commits an anti-social act is believed to be under the control of supernatural powers (Abdullahi 2001). In addition to exosomatic spirits (*zars*), which mostly affect women, intrasomatic spirits (*gelid*) also exist within everyone. If a person is harmed by another, his/her gelid may attach the offender even if the physical person refrains from confrontation (Samatar 1993). While these beliefs are rooted in pre-Islamic ideologies, they are still retained in Somali culture as a form of psychotherapy (Abdullahi 2001).

3.5 Family-life

Somali's family- and community-life are based on traditional pastoral customs as most clans formed within this context. In southern Somalia, many people live in relatively permanent villages due to the constraints placed upon them by their agricultural duties. There are also semi-nomadic groups in the region which move their animals (primarily cattle) to grazing lands during the wet seasons. Residency in the north is substantially different in that there is little permanency, relying instead on the continual movement of their herds. There are two "herding units" in the north including nomadic hamlets and camel camps (Lewis 1994:23). The hamlets consist of several nuclear families – typically 3, but may get as large as 5 or 6 families – whose husbands are close agnatic kin. Affinals are also known to live in the hamlets, although their stay is often ephemeral. The population of a hamlet fluctuates from season to season and year to year making this an inherently unstable organization. Hamlets are composed of portable tents – made of a light wood frame with straw mats and/or hides for the covering – located within a circular fence of thorn bushes for safety (Lewis 1994).

Each family owns a flock of sheep, goats, burden camels, and a few milch camels. Goats and sheep are grazed outside the hamlet during the day and caged in thorny brush pens at night. Traditionally, the wife and small children look after the sheep, goats, and burden camels, while the husband takes care of the milch camels. One woman can manage 150 head of sheep and goats at one time. If a man amasses more animals than one woman can handle, he will likely take another wife (Lewis 1994) – Islamic law allows men to marry up to 4 wives given he can support them emotionally and financially (Abdullahi 2001). Women are responsible for setting-up and tearing-down the portable tents and animal pens when the hamlet is on the move. She uses the burden camels to transport the family's possessions (Lewis 1969).

The second herding unit is the camel camp. Because camels are capable of surviving for long periods without water (40 days), they are often grazed at considerable distances from the hamlets, especially during dry seasons (Aidid and Ruhela 1994; Samatar 1993). These camps are constructed similarly to the hamlets with pens and tents inside a thorn brush fence. Camel husbandry is the responsibility of unmarried men/boys who are often sent to the camps when they are as young as 7-8 years of age. Unlike hamlets, camel camps are based exclusively on agnatic kin; affinal kin are not allowed. During the wet seasons, the men return with their camels and help maintain the hamlet. They are also responsible for delivering animal by-products to commercial centers for exportation (Lewis 1969). Although hamlets and camel camps usually migrate together, they are in essence independent of one another. One group may break away at any time if better pastures are found in another direction (Lewis 1994).

In Somali culture, the primary purposes of marriage are creating alliances and bearing children (Abdullahi 2001, Lewis 2008). Marriage customs center on the practice of polygyny. The number of wives per family varies with the man's age and wealth. The majority of Somali pastoralists and Sab are reported to have at least two wives at one time, while the older and more wealthy men report having four (Lewis 2008). The first wife and her children form the "Great-house" (Lewis 1994:30). As the senior wife, she has the authority to control issues regarding the entire polygynous family. In contrast, even though all wives are to be treated equally, it is not uncommon for the man to be more attracted to the youngest wife than to the senior wife. This system breeds inherent jealousy and friction between the women involved (Lewis 2008). Among pastoralists, tension is minimized by creating separate socio-economic units composed of a wife and her children who raise small groups of goats and sheep. In agricultural regions, a man divides his land equally between the wives. If he has little land, the women are forced to work the fields together, although the crop is still split evenly (Lewis 2008). While this process helps relieve marital strain, the primary function is ultimately economic.

Until men and women are married, they are considered children of their parent's home. For men, this indicates they have not progressed past the stage of boyhood. Men are prohibited from joining and participating in exclusive clubs which deliberate on community affairs. Unmarried women are similarly denied access to sacred events, such as wedding showers and spiritual rituals (Abdullahi 2001). Marriage is traditionally arranged, particularly among pastoralists, to ensure a productive alliance between families now and/or in the future depending on the age of the children. In some cases, a young girl may be promised to a young boy far before the marriage is to take place. Marriage is exogamous in Somali culture in that the parties must marry outside their primary lineage (Lewis 1994). Cultivators also have arranged marriages, but it is far less strict due to the weaker lineage system (Lewis 2008). To ensure the continual existence of alliances, Somalis practice the levirate and sororate. That is, if a husband dies, the wife may marry one of her deceased husband's brothers, while a widower may marry his deceased wife's sisters. In the case where a husband has no brothers or a wife has no sisters, another relative may fill the position (Lewis 2008).

In addition to alliances, marriage is an important family institution in that it legitimizes the births of many children, especially male heirs (Lewis 2008). The Somali practice of polygyny allows a man to extend his already large lineage adding strength and honor to his father's ancestral line. Elders may have as many as 100 or more descendants (Lewis 2008). Further, deeper lineages (substantial membership size) are accorded greater political power than short lineages. As such, the bearing of many children (particularly males) serves to carry on the family's genealogical and political power (Lewis 1962). Somalia currently has the 4th highest total fertility rate in the world at 6.52 (WHO 2009)

Somalis value the purity of women prior to marriage, so it is necessary that she is 'clean' and of virginal status before a man will marry her. The preservation of virginity is accomplished through female circumcision (Aidid and Ruhela 1994; Lewis 1994). The two primary forms of circumcision practiced by Somalis are infibulation and sunna (Abdullahi 2001). The former is the most severe, entailing the removal of the clitoris and labia minora with the subsequent sewing together of the labia majora so that only a small opening remains for the passage of bodily fluids (Abdullahi 2001). This form was highly favored at one point throughout Somalia, but its popularity has decreased, particularly in urban areas. However, infibulation is still preferred among Somali pastoralists. The second form, sunna, is far less involved with the removal of only the clitoral prepuce and part of the clitoris (Abdullahi 2001). The removal of the clitoris is viewed as a means to limit female sexual desires. As the clitoris is the pleasure center for self-enjoyment among women, it is argued that if a woman is allowed to 'stimulate' herself, she will become sexually aroused to the point of emotional temptation for intercourse (Hicks 1996). If this were to occur, she will likely be relegated to spinsterhood because most men will not marry a woman who is no longer a virgin (Aidid and Ruhela 1994).

Recently however, men aged 15 to 26 reported that female circumcision is not a prerequisite to marriage (Landinfo 2008).

It is commonly held that female circumcision is prescribed in the Quran which makes the practice religious rather than secular. This promotes its continuance as it is the ‘will’ of Allah that women be ‘prepared’ for marriage (Landinfo 2008). Contrary to these beliefs, circumcision is not discussed anywhere in the Quran; thus it has no religious affiliation (Abusharaf 1998). Somali society itself also encourages the practice because it is viewed as an essential and important aspect of life (Abdullahi 2001). Mothers and grandmothers perpetuate the practice because of a “firm belief in the physical and moral benefits of the operation as it is the only guarantee for marriage and consequent economic and social security” (Duleh 1983:67). Mothers are often under extreme pressure from other mothers, as well as men, to have their daughters circumcised. If the mother opposes the practice, she will likely opt for the ‘sunna’ form (Landinfo 2008). In rural areas, ~90% of rural and nomadic women want female circumcision to continue as an established cultural institution (Landinfo 2008). They believe that circumcision is done for many reasons including religion, abstinence prior to marriage, and the promotion of beauty. Women in urban areas were less likely to desire the practice for their daughters (Landinfo 2008).

Nearly 98% of Somali girls have experienced some form of circumcision with more than 80% being infibulated (Landinfo 2008; Vangen et al. 2002). Circumcisions are performed by Midgan women who use a *mandil* (special surgical knife) to perform the operation (Aidid and Ruhela 1994). Girls are traditionally circumcised between 5 and 8 years of age (Abdullahi 2001; Aidid and Ruhela 1994). However, among some nomadic groups, girls may be as old as 14 or 15 years (Aidid and Ruhela 1994). In the case of the sunna form, very little changes for the girl in that only her ‘pleasure’ has been taken away. This is not so for those who are infibulated. Since the labia are sewn closed, sexual intercourse is difficult and painful. To consummate the marriage, the husband must use ‘force’ and it is not uncommon for penetration to be unsuccessful. If he is unable after several days, the labia will be cut open either by the husband or by her mother (Aidid and Ruhela 1994). A similar procedure takes place during the birthing process but to a much greater extent. Giving birth requires the entire infibulation be reversed for safe delivery, after which re-infibulation may take place (Chalmers and Hashi 2000).

Although a wife becomes part of her husband’s lineage upon marriage, allegiance to her maiden family remains strong. According to Christine Ahmed (1995), women are mothers and sisters first and wives second. In the event a husband mistreats his wife, her brother(s) or other male relatives will use all means to rectify the situation. In the event of divorce, the woman takes everything she acquired before and during the marriage. She may also receive alimony and *meher* (marriage security) in the amount that was agreed upon before the wedding. The ex-wife also gets custody of the young children and older girls (Abdullahi 2001). She will return to her family and severe all ties to her ex-husband’s family.

Chapter 4: Health and Well-Being: Somalia to the United States

4.1 Health in Somalia

Prior to the fall of the regime in 1991, the Somali Ministry of Health (MOH) developed programs to improve health care in both rural and urban areas. However, because of a lack of resources and infrastructure, their plan was never fully realized (Qayad 2007). Despite this, several positive health care services and facilities were developed between the 1960s and 1980s. First, in 1966, a nursing school was established in Hargeisa and in 1970, a second school was built in Mogadishu (Qayad 2007). In addition, the Faculty of Medicine and Surgery was set-up in the capital city in 1973 (Qayad 2007). These teaching institutions were valuable in increasing the number of qualified medical personnel. At the initiation of the medical school, there were only 96 physicians throughout the country. Five years later, there were 196 (Qayad 2007).

The 1980s also saw advancements in Somalia's healthcare system. First, the Finnish International Development Agency established primary healthcare and tuberculosis treatment centers throughout the country (Qayad 2007). Second, the MOH formed a refugee health unit which was supported by foreign aid including healthcare workers (Qayad 2007). Third, in conjunction with universities in Sweden, the Faculty of

Medicine increased medical science programs designed to advance Somalia's health services (Qayad 2007).

Due to the civil war, the progress in healthcare deteriorated. Collapse of the government meant that most healthcare services and facilities were no longer economically viable. In 1993, only 2% of the national budget was allocated to healthcare, which was one-fourth that required (World Bank 1993). Educational institutions were abandoned halting the influx of trained professionals (Qayad 2007). As of 2009, Somalia had a physician density less than 1 per 10,000 people and a nurse density of 2 per 10,000. In comparison, the United States had a physician density of 26 per 10,000 and a nurse density of 94 per 10,000 (WHO 2009). The low density of medical personnel in Somalia resulted in the closure of many health clinics.

The absence of a formal healthcare system has contributed to Somalia having some of the worst health indicators in the world (WHO 2008). Access to clean drinking water and sanitation is a continual problem. Only 63% of urban residence and 10% of rural residence have sustainable sources of 'improved' drinking water (WHO 2009). Adequate sanitation is also a concern with 51% of urban and 7% of rural residence having continual access (WHO 2009). These living conditions have greatly influenced the spread of disease. Approximately 72% of 'living years' are lost annually due to disease related illness (WHO 2009).

The prevalence of endemic diseases in Somalia and their corresponding values in the U.S. are presented in Table 4.1. Neonatal and infant mortality rates are high at 49 per 1,000 live births and 88 per 1,000 live births, respectively (WHO 2009). One in 12 children will die before their first birthday (WHO 2008). Further, children have a 14.2%

probability of dying before the age of 5 from neonatal complications, diarrhoeal diseases (e.g. cholera, dysentery, etc.), measles, malaria, and pneumonia (WHO 2009).

	Somalia		**U.S.**	
Disease	# Cases	Prevalence*	# Cases	Prevalence*
Cholera	41,643	478.7	7	< 0.01
Leprosy	414	4.8	nd	nd
Malaria	36,773	422.7	nd	nd
Measles	1,149	13.2	30	< 0.01
Pertussis	1,347	15.5	8,739	3
Polio	8	< 0.1	0	0
Neonatal tetanus	31	< 0.4	0	0
Tuberculosis	6,130	352	4,864	3

* per 100,000 people

Table 4.1 Prevalence of Endemic Diseases in Somalia and the U.S.

Diarrhoeal diseases are of paramount concern because of their prevalence and ease of prevention. Diarrhea depletes the body of essential fluid thus requiring the consumption of large quantities of water. In areas where water is contaminated, the issue is compounded (WHO 2009). Consequently, nearly 1 in 5 Somali children die from the lack of clean drinking water and poor sanitation before their 5th birthday (WHO 2009). These poor conditions have contributed to life expectancies for males and females of 50.0 and 55.0 years, respectively (WHO 2009).

Cultural practices also contribute to the medical issues experienced by Somali mothers and their children. Several risk factors for poor health include number of antenatal visits, circumcision, low birth weight (LBW), and infant feeding practices, among others (WHO 2009). Antenatal visits are necessary for identifying intrauterine growth restriction (IUGR) and below average development, both of which may put the child at risk for ante- and post-natal complications. Antenatal visits by Somali mothers are rare. Roughly 1 in 4 mothers (26%) make at least one antenatal visit, while only 6% visit the doctor more than 3 times. Essen et al. (2002) reported that Somali women in Sweden often avoid or wait too long for antenatal care. This is partly explained by these women's preference for children who are small-for-gestational age (SGA) or of LBW. It is believed that if doctors discover IUGR, they will 'force' mothers to increase the child's size (Essen et al. 2002).

To some extent, the desire for SGA or LBW children stems from fears of complications arising from circumcision. Modifications to the vagina are associated with fetal distress, secondary arrest, prolonged second stage of labor, and death of the mother and/or infant (Essen et al. 2002). In 2005 (the most recent data available), the maternal mortality rate in Somalia was 1,400 per 100,000 live births (WHO 2009). By comparison, the U.S. had a maternal mortality rate of only 11 per 100,000 live births (WHO 2009). Caesarean Section is often used to minimize death due to birthing complications. In the U.S., approximately 30% of all births are by C-section (WHO 2009). In Somalia, on the other hand, C-Sections are extremely rare in urban areas and absent all together in rural areas (WHO 2009). The conception is that "Caesarean Section causes death, rather than viewing the procedure as an attempt to avoid a fatal outcome" (Essen et al. 2002:681).

Further, Somali women have reported that C-sections limit the number of children that can be delivered, increase inter-birth spacing, and restricts women's ability to take care of the house and children (Beine et al. 1995). Consequently, mothers may avoid C-Sections by reducing the size of the baby by underutilizing prenatal services and decreasing dietary intake (Beine et al. 1995; Essen et al. 2002). Connections between fears of C-sections, decisions made by the mothers, and negative health outcomes are graphically display in Figure 4.1. SGA and LBW children often have health issues, such as high rates of hypertension, coronary heart disease, asthma, diabetes and reduced Apgar scores (Roche and Sun 2003; Vangen et al. 2002). SGA and LBW may also lead to higher rates of neonatal/infant mortality (McIntyre et al. 1999; Roche and Sun 2003).

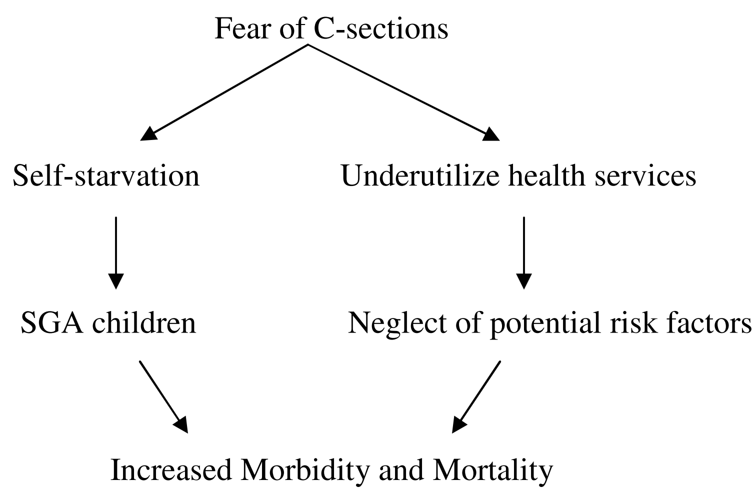

Figure 4.1 Relationships between Fear of C-section and Negative Health Outcomes
Adapted from Essen et al. 2002

Infant feeding practices are also a health concern. In rural areas, the majority (>90%) of children are breastfed for longer than 12 months (Ezepue 2001; Ibrahim et al.

1992; Nur and Darnton-Hill 1985). This is substantially lower in urban areas, where less than 10% of children are breastfed for more than 10 months (Nur and Darnton-Hill 1985). Although breastfeeding is common, *exclusive* breastfeeding is rare, even among neonates (Ibrahim et al. 1992). Only 9.1% of children are exclusively breastfed for 6 months (WHO 2009). The early introduction of non-breastmilk leads to reduced physical growth and motor development, increased infant obesity, and increased morbidity (e.g. intestinal and respiratory infections) (Hop et al. 2000; Kalanda et al. 2006; Mamabolo et al. 2004).

Between 49% and 90% of children are given some form of food other than breast milk for their first meal (Ibrahim et al. 1992; Nur and Darnton-Hill 1985). Primary foods include cow's milk, water with sugar, ghee (clarified butter), honey, and oil (Abdullahi 2001; Ibrahim et al. 1992; Nur and Darnton-Hill 1985). Liquid supplementation often continues following the first feeding. Semi-solid foods such as rice, maize, oat porridge, and fruits are also introduced early. At least 65% of children are fed semi-solid foods under the age of 4 months (Ezepue 2001). Protein-rich foods like beans and meat are not typically given to children under 12 months of age on a daily basis. Fruits and vegetables are also limited during this developmental period (Ibrahim et al. 1992).

4.2 Somalia compared to the United States

Comparisons of key health indicators between Somalia and the U.S. are presented in Table 4.2. These data suggests the health conditions in the U.S. are more advantageous than those in Somalia. Higher life expectancies in the U.S. illustrate this point. On average, both American men and women live approximately 26 years longer than

Somalis (WHO 2009). Based on data from 224 countries, the U.S. ranks 49th for life expectancy, while Somalia ranks 211th (CIA 2009). Disease environments in the U.S. also appear less costly, in that mortality due to communicable diseases is 63% lower than in Somalia (WHO 2009). Neonatal (birth to 28 days) and infant (29 days to 1 year) mortality also support these observations. In Somalia, 4.9% of neonates and 8.8% of infants die, compared to only 0.4% of neonates and 0.6% of infants in the U.S. (WHO 2009). This discrepancy may be explained, at least partly, by the conditions surrounding delivery. The number of live births attended by skilled professionals is roughly 100% and 33% for the U.S. and Somalia, respectively. Health disparities may also be observed in children's growth. Somali children under the age of 5 are 10 times more likely to be stunted and 25 times more like to be underweight than American children (WHO 2009).

The presence of safe water supplies and sanitation are also positive contributors to better health in the U.S. Virtually all urban residences and 94% of rural residences in the U.S. have access to improved drinking water. These figures are 37% and 84% higher than rural and urban Somalia, respectively. Improved sanitation is also more accessible in the U.S. where it is offered to nearly all urban and rural residence. In contrast, it is offered to only 52% of urban and 8% of rural residence in Somalia (WHO Review 2009).

National expenditures may also indicate health disparities. Per capita expenditures in the U.S. are over $6,000.00 ($US) yearly, while only $8.00 ($US) per capita is allocated to health care in Somalia (WHO 2009). Further, total expenditures, as a percentage of the GDP, were 12.7% higher in the U.S. (WHO 2009). Compared to data from 187 countries, Somali ranks 175th and 179th for per capita expenditures and percentage of GDP, respectively (WHO 2009). All of these data support the contention that environmental conditions in the U.S. are more conducive to positive health outcomes.

Indicator	Somalia	U.S.
Life expectancy at birth (years) males	50.0	76.0
Life expectancy at birth (years) females	55.0	81.0
Probability of dying (per 1 000 population) between 15 and 60 years	381.0	108.0
Probability of dying (per 1 000 live births) under five years of age	142.0	8.0
Infant mortality rate (per 1 000 live births)	88.0	6.0
Neonatal mortality rate (per 1 000 live births)	49.0	4.0
Maternal mortality ratio (per 100 000 live births)	1400.0 (a)	11.0
Years of life lost to communicable diseases (%)	72.0 (b)	9.0
Years of life lost to non-communicable diseases (%)	16.0 (b)	73.0
Deaths among children under five years of age: neonatal causes (%)	17.3 (b)	50.4
Deaths among children under five years due to diarrhoeal diseases (%)	19.1 (b)	0.1
Deaths among children under five years of age due to measles (%)	12.5 (b)	0.0
Deaths among children under five years of age due to malaria (%)	2.6 (b)	0.0
Births by Caesarean section (%)	0.0	30.1
Population with improved drinking water sources (%) urban	63 (d)	100.0
Population with improved drinking water sources (%) rural	10 (d)	94.0
Population with sustainable access to improved sanitation (%) urban	51 (d)	100.0
Population with sustainable access to improved sanitation (%) rural	7 (d)	99.0
Antenatal care coverage (at least 1 visit) (%)	26 (c)	nd
Antenatal care coverage (at least 4 visits) (%)	6 (c)	nd
Births attended by skilled health personnel (%)	33 (c)	99.0
Exclusively breastfed for 6 months (%)	9.1 (c)	11.9
Low birth weight, newborns (%)	11 (e)	8.0
Overweight for age (%)	4.7 (f)	8.0
Children under five years of age stunted for age (%)	42.1 (f)	3.9 (f)
Children under five years of age underweight for age (%)	32.8 (f)	1.3 (f)
Individuals >15 years of age that are obese (%)	Nd	32.2
Total fertility rate (per woman)	6.5 (g)	2.1
a. 2005 data b. 2004 data c. 2000-2008 data g. 2009 data d. 2006 data e. 2000-2006 data f. 2000-2007 data		

Table 4.2 Health Indicators between Somalia and the U.S.
Source: WHO 2009

4.3 Somali Refugees in the U.S.

Little is known about the health of Somali refugees. Only two studies have explored this issue in the U.S. The Somali Health Survey was conducted in 2004 by the Minnesota Department of Health to assess conditions experienced by Somalis, particularly cardiovascular disease, diabetes, immunizations, cancer, and infant health (Herrel and Leinberger 2004). Both men and women were found to have high rates of diabetes, heart disease, high cholesterol, and high blood pressure. Further, only 18% of participants met the recommendations for moderate physical activity and less than 5% met the recommendations for fruit and vegetable consumption. On a positive note, 85% of women reported attending at least one prenatal appointment. Nearly 75% of these women attended at least 5 prenatal appointments (Herrel and Leinberger 2004). A major limitation of this study, however, is that all participants were adults born and reared (at least partially) in another country. Thus, the various medical conditions suffered by these peoples may be the result of conditions experienced elsewhere.

The second study was conducted in 2005 by the same group to examine Somali breastfeeding practices (Werner 2005). The duration of breastfeeding among Somali mothers was considered sufficient based on WHO standards. However, exclusive breastfeeding was not common. Roughly 40% of mothers report supplementing their children's diet during the first 3 days post-partum (Werner 2005). Primary supplements were plain water, infant formula, and milk from other animals (e.g. cow and goat). Mothers explained that dietary supplementation before 6 months of age was due to 1) lack of knowledge, 2) medical barriers (i.e. pain), 3) child refusal of the nipple, and 4) lack of time (Werner 2005). These results demonstrate that Somali women continue to practice traditional childrearing customs even in the United States. Similar findings are reported for Somali women in Australia (Burns 2004), Norway (Vangen et al. 2002), Sweden (Essen et al. 2000), and Great Britain (Maxwell et al. 2006).

Reasons for retaining traditional practices in more developed countries were explored (Burns 2004; Carroll et al. 2007; Essen et al. 2000; Herrel and Leinberger 2004). In general, Somali women reported being nervous about using the health care system of the host country because of miscommunication due to language barriers. Women were often offered the assistance of translators with who they did not know. Thus, they felt uncomfortable describing personal issues. Translators were also viewed as ineffective because they were not conveying the information accurately to medical personnel. (Herrel and Leinberger 2004). Given the lack of effective communication, Somali women reported being confused and even frightened by the medical traditions practiced in the U.S. and other countries. For example, women in the United States (Herrel and Leinberger 2004), Norway (Vangen et al. 2002), and Sweden (Essen et al. 2000) expressed a strong fear of birth by Caesarean Section because they did not understand why surgery was necessary. Regarding nutrition, Somali women in the U.S. (Carroll et al. 2007), Australia (Burns 2004), and Great Britain (Maxwell et al. 2006) were concerned about the quality of food in these countries. In particular, they were uncertain about the nutritional content and value of pre-packaged foods (Carroll et al. 2007). Maxwell et al. (2006) reported that Somalis view foods imported from Somalia (e.g. camel’s milk and meat, ghee, and flour) to be superior to similar products in more developed countries.

4.4 Research Hypotheses

It is apparent that environmental conditions in the U.S. promote better health and well-being than those in Somalia. Whether this has an impact on Somali immigrants is unknown. Thus, the following hypotheses will be tested to examine this issue:

Hypothesis 1**:** Somali children born and reared in the United States will show significantly ($P< 0.05$) greater height-for-age, weight-for-age, and BMI than age-matched children from Somalia.

> Height, weight, BMI, and body fat are often used to assess the nutritional and health status of children. Since height increases over time, it can be used as an indicator of historical health conditions experienced by children. Weight, BMI, and body fat, on the other hand, fluctuate over time and may be interpreted as changes in the recent health environment (Bogin and Loucky 1997). Because the United States provides a more positive health environment, it is hypothesized that Somali children born in the U.S. will have significantly greater height, weight, BMI, and body fat than those born in Somalia. Previous research supports this contention. Studies show that children born to immigrants in the United States achieve greater growth than age-mates in their parent's country of origin (Boas 1912; Bogin 1999; Fishberg 1905; Goldstein 1943; Greulich 1957; Lasker 1952; Shapiro 1939). Primary reasons explaining these outcomes are better nutrition, clean drinking water, and reduced disease prevalence (Bogin 1999). Thus, the 'improved' conditions found in the United States will result in greater growth of U.S. born Somali children when compared to those born in East Africa.

***Hypothesis 2*:** Somali children born and reared in the United States will show significantly (P< 0.05) lower height-for-age, but greater weight-for-age, BMI, and body fat than the NCHS reference standards.

Associations between mothers who have experienced nutritional deprivation in early life and having overweight children have been observed (Zottarelli et al. 2007). Mothers who experience malnutrition during their growth period likely have children whose metabolic pathways have been 'programmed' to protect them from starvation by increasing fat reserves (Sawaya et al. 2004). This idea is referred to as the 'Intergenerational Influences Hypothesis' (Varela-Silva et al. 2009). If these children subsequently experience environments of sufficient dietary consumption, they are apt to store much of the energy and become overweight (Smith et al. 2002). Height-for-age, on the other hand, is negatively impacted by this energy retention. Spurr and Reina (1988) reported that increased energy intake will likely be stored for future use rather than being directed toward proper growth. Therefore, increased dietary quantity may increase fat mass but not height.

Studies by Popkin et al. (1996) and Varela-Silva et al. (2009) support these contentions. Among Hispanic- and Maya-Americans, they found that children were both overweight and under-sized. For example, among first-generation Maya-American children, nearly 50% were overweight and 42% were obese (Bogin and Loucky 1997). Further, over 21% were considered stunted

(Varela-Silva et al. 2009). These findings illustrate the continual and long-term effects of intergenerational influences.

Since Somali mothers in the U.S. were born and reared in arguably disadvantageous environments, it is hypothesized that their children will exhibit greater fat deposition and lower height than NCHS standards.

Hypothesis 3: Somali mothers in the United States who retain traditional cultural customs regarding pre- and post-natal care (e.g. birth size and breastfeeding) will have children who show significantly ($P< 0.05$) lower birth weight, height-for-age, weight-for-age, BMI, and body fat than mothers who do not retain these customs.

Somali mothers traditionally practice cultural customs not recommended by the WHO, including intentional low birth weight (LBW) and early supplementation to breastfeeding. Research on Somali immigrants in the U.S. indicate that these practices are continued by some women because of tradition and the lack of knowledge regarding medical and dietary practices (Herrel and Leinberger 2004; Werner 2005). Regarding birth weight, LBW children remain significantly shorter and lighter than control subjects throughout their first decade of life (Dewey et al. 2005; Peng 2005; van der Mei et al. 2000). Further, in comparison to preterm children, LBW children experience substantially lower levels of catch-up growth through adolescence (Dewey et al. 2005).

Concerning breastfeeding, the World Health Organization (WHO) recommends that children be exclusively breastfed for the first 6 months of life (Butte et al.

2003). Premature introduction of supplemental foods often results in reduced height-for-age and weight-for-age (Hop et al. 2000; Mamabolo et al. 2004). The degree of acculturation may affect these practices. Gibson et al. (2005) found that less acculturated mothers had higher rates of breastfeeding initiation and duration than more acculturated mothers. However, less acculturated mothers were more likely to prematurely introduce non-breastmilk in the diet (Gibson et al. 2005; Scribner and Dwyer 1989). Thus, mothers who do not practice traditional customs will have children who have significantly ($p< 0.05$) greater height-for-age, weight-for-age, BMI, and body fat than children of more traditional mothers.

Hypothesis 4: Family size will show a significant ($P< 0.05$) negative correlation with height-for-age, weight-for-age, BMI, and body fat.

The "economic model of parental investment" contends that parents benefit from having children who are healthy throughout their lives and therefore, may dedicate most of their resources to childcare (Smith et al. 2002:996). However, as family size increases, the amount of resources available for each child diminishes, possibly resulting in poorer health. This situation is more evident in low socio-economic status (SES) families who have relatively little resources at their disposal (Smith et al. 2002). Somali families tend to be highly variable in size with an average fertility rate of 6.5 (CIA 2009). As such, it is hypothesized that children of larger families will have significantly ($p < 0.05$) lower height-for-age, weight-for-age, BMI and body fat than those of smaller families due to individual resource acquisition.

Chapter 5: Materials and Methods

5.1 Biocultural approach

Population health is the result of interactions between biological and socio-cultural factors (Crews and Bogin 2010). The inter-marriage of these factors requires the inclusion of both simultaneously through the use of a research design informed by a wide range of variables, methods, and theories. Since health is influenced by a myriad of factors related to current and past environments (Crews and Bogin 2010), the biocultural approach is necessary in developing a holistic understanding. The variables included in a research design depend on indicators of health, identifying factors which limit or promote health, and population specific environmental conditions.

The biocultural approach was useful in this research because children's health is influenced by many factors, particularly those related to nutrition and disease (Crews and Bogin 2010). These factors are ultimately shaped by variables such as household income and size, mother's age and education, immigration history, and pre- and post-natal childcare practices. Explaining variation in health status depends on determining the environmental stressors affecting health and how mothers and their children adapt culturally and biologically.

5.2 Project design

This project was design to investigate the effects of environmental change on the health of Somali children born in the U.S. It is contended that U.S.-born Somali children are healthier than their age-mates from Somalia. Further, acculturation levels will be positively correlated to health of the children. Several methods were used to address the validity of this argument. Health and well-being of children were determined through the analysis of anthropometric variation. Height, weight, and body fat are often used to assess health and nutritional status. Because height-for-age increases over time, it serves as an indicator of lifetime environmental conditions. Conversely, weight-for-age and body fat vary over time, reflecting more recent conditions (Bogin 1999).

Situating anthropometric data in larger contexts is important in understanding the multi-dimensional nature of short- and long-term adaptations during life. Environments experienced by children are predominantly the result of conditions constructed by mothers. Childcare practices, income, maternal exposure, and household composition, among others, contribute to the well-being of children (Bogin 1999). Identifying demographic and socio-economic variables which may impact health was accomplished by the use of formal interviews with the mothers.

5.3 Research population

Health of U.S.-born Somali children was investigated within the Somali community in Columbus, Ohio. Columbus is the largest city in Ohio with a population of approximately 755,000 (City of Columbus 2009). Columbus has a per capita income of just over $37,000 and a cost of living 18.5% lower than the national average. The unemployment rate is also lower than the national average (9.7%) at 8.6% (City of Columbus 2009). Conversely, Columbus has a disproportionately high level of crime as measured by the Crime Rate Index (City-Data 2008). Columbus' index score of 621.6 is roughly 300 points higher than the national average (City-Data 2008).

Since the mid-1990s, Columbus has served as one of the primary urban centers for Somalis (Somali Community Association 2007). Because an official census on this community is not available, population size was estimated by the Somali Community Association of Ohio to be approximately 30,000 in the greater Columbus area (Omar per. comm.. 2009). This population was selected for several reasons. First, the population is relatively homogeneous in regards to region of origin and cultural characteristics (Omar per. □omm... 2009). Homogeneity is beneficial because it aids in minimizing potential confounding factors related to cultural diversity (Bogin 2002). The majority of Somalis in Columbus are members of the Darod clan-family who are traditionally pastoralists (Omar per. comm. 2009). Second, because Somalis have been arriving in Columbus for the past two decades, the degree of acculturation among mothers may vary considerably, which will be valuable in assessing changing cultural influences on health. Finally, because of the lack of research involving this population, collecting data on these children will inform future comparisons between previously studied populations (i.e. Minneapolis, MN) and others throughout the U.S. and around the world (substantial populations are located in England, the Netherlands, Scandinavia, and Australia, among others).

5.4 Sampling

Little is known about the demographic profile of this population due to a lack of census data. I estimated the number and composition of children in the community by using several lines of evidence. School enrollment records indicate that there are roughly 3,500 children (K-12) within the greater Columbus area who speak Somali as their primary language at home (Ohio Department of Education per. comm. 2008). For pre-school children, a demographic estimate was derived from birth records. The Ohio Department of Health, Center for Vital Statistics (per. comm. 2007) reported that approximately 530 children were born to Somali parents in the greater Columbus area in 2006. According to this figure, it was estimated that approximately 2,500 children under the age of 6 reside in Columbus, assuming a constant birth rate. Estimates derived for the Somali population in Minneapolis (Dept. of Health Statistics per. comm. 2007) indicate a similar figure which lends support to the calculations made here. Based on these derived figures, there are approximately 6,000 Somali children in Columbus who are younger than 18 years of age. However, because the present research is concerned only with Somali children born in the United States, it was conservatively estimated that 3,000 individuals are in the target population.

An opportunistic sample of Somali children was examined. This method was most appropriate because the exact demographic profile is unknown and therefore, a more structured approach (i.e. random sampling) would not be productive. Because of transportation/logistic issues, most families were unable to meet at a central research location, such as a community center. Consequently, it was necessary to visit the families at their homes. This also served to help them feel more comfortable during the process.

Cross-sectional data were collected. While a longitudinal approach may be more informative in some regards, issues of privacy precluded such an approach. Somalis in this region tend to be cautious about the intents of non-Somalis (Omar per. comm. 2009). Consequently, recording information beyond the required family ID number would be an invasion of their privacy and grounds for refusing participation. The Office of Responsible Research Practices at The Ohio State University concurs with this assessment.

As a member of the Board of Directors for the Somali Community Association of Ohio, I have wide ties to demographically diverse sectors of the community and thus, economic and social biases may be minimized. Potential participant families were identified through my interactions with women at the local community center and other locations in the region. The following criteria were used in the selection process: 1) the mother must have been born and reared in Somalia, 2) she must have lived in the U.S. for at least 1 year, 3) at least one child must be born in the U.S. and 4) all U.S.-born children must be between 6 months and 10 years of age. Participating mothers were subsequently asked to recommend other families who meet the criteria. To limit bias toward more economically disadvantaged members of the community, compensation was not offered. A total sample of 412 children and 165 mothers were examined. Sample characteristics are reported in Chapter 6.

5.5 IRB procedures

Since many mothers speak limited English, a female Somali interpreter was hired to aid in the selection and interview processes. Having a female interpreter is necessary given women are discouraged from speaking with men, especially unfamiliar men, in the absence of a male relative (Omar per. comm. 2009). Further, some mothers may feel more at ease discussing private issues (e.g. breastfeeding practices) with another woman. My interpreter was chosen because she is well respected in the community and is sensitive to the issue of participant confidentiality. A female field assistant was also retained to aid me in data collection. Both women completed the required Collaborative Institutional Training Initiative (CITI) ethics training.

After potential Somali families were identified, they were given a flyer (in both English and Somali) which outlined the research goals, purpose, design, and requirements. Families were given the opportunity to ask questions or to raise concerns before they decided whether to join the project. They were encouraged to discuss the research with their families before making a decision. Participants were reminded of the necessary time commitment and asked if they had any questions regarding their involvement. Verbal rather than written consent was obtained through the use of an IRB approved script to ensure confidentiality. Families were informed that their participation was voluntary and they could quit the project at anytime without penalty.

5.6 Health assessment

Health was assessed using anthropometric variables. Measurements were taken with the aid of a research assistant following methods outlined by Frisancho (1990). All measurements were taken on the left side of the body. If a measurement was unable to be taken on the left side (e.g. arm was in a cast), the corresponding measurement was not taken on the right side due to issues of asymmetry. Auerbach and Ruff (2006) found that bilateral asymmetry of human appendages is quite common with a bias in size toward the right side in the upper limbs and toward the left side in the lower limbs. Measuring instruments were cleaned after the assessment of each family with antibacterial wipes.

Frame Size*: height, leg length, arm length, upper-arm index, biacromial breadth, and biilliac breadth*

These measures are widely used because they are sensitive indicators of environmental conditions throughout life (Frisancho 1990). Height was measured using a portable stadiometer (Seca® model 214 Mobile Stadiometer®, Hanover, MD). Children older than 2 years of age were measured without shoes in the standing position with their head, heels, buttocks, and shoulders touching the vertical arm. Children younger than 2 years of age were measured in the recumbent position using a portable infantometer (Seca® model 416 Mobile Infantometer®, Hanover, MD). This measurement required the coordinated efforts of two people. My field assistant held the child's head against the head board, while I extended the child's legs and placed the feet firmly on the foot board. Each measurement was taken twice and recorded to the nearest millimeter.

Height incorporates multiple body components and each may vary in response to external stressors. Compared to torso size, leg length is particularly sensitive to changes in environmental conditions (Bogin and Varela-Silva 2010). Thus, changes in height are more likely to be the result of changes in leg length rather than torso length (Bogin and Varela-Silva 2010). Sitting height is used to determine leg length relative to overall height. For children younger than 3 years of age, sitting height (or crown-rump length) was measured in the recumbent position using a portable infantometer (Perspective

Enterprises®, Model PE-RILB-STND®, Portage, MI). The child's legs were held perpendicular to the infantometer, while the foot board was pressed firmly against their rump. For children older than 3 years of age, sitting height was measured using a lightweight anthropometer (GPM® #101, Siber & Hegner, Zurich, Switzerland) as the child sat on a portable table. My field assistant ensured proper positioning of the child by pushing up gently on the mastoid processes. Measurements were recorded to the nearest millimeter. Relative leg length was determined by calculating the sitting height index or Cormic index (CI). The CI identifies the proportion of height that is attributed to leg length (Padez et al. 2009). An increase in the CI means that leg length is contributing less to height than is torso length (Padez et al. 2009). Because leg length increases at a faster rate than torso length during childhood, the CI should decrease with age (Padez et al. 2009; Stinson 2009). The CI is derived using the following formula: sitting height (cm) – stature (cm) * 100. A lower sitting height index indicates relatively longer legs, while a higher sitting height index indicates relatively shorter legs.

Arm length is also a useful measure of past environmental conditions. Arm length is strongly correlated with height and therefore, serves as an alternate measure of nutritional status (Mitchell and Lipschitz 1982). Arm length was measured using a lightweight anthropometer (GPM® #101, Siber & Hegner, Zurich, Switzerland) from the most lateral aspect of the acromial process to the most distal point on the longest finger. The contribution of the upper-arm relative to overall arm length is also a useful measure. Upper-arm length was measured from the acromial process to the most distal point of the olecronan process while the arm was held parallel to the torso and the elbow was bent at a 90° angle. These measurements were recorded to the nearest millimeter. Relative upper-arm length was calculated using the following formula: upper-arm length (cm) – arm length (cm) * 100. A lower upper-arm index indicates that the humerus contributes less to the overall length of the arm than a higher upper-arm index.

Bi-acromial and bi-iliac breadths were used to assess torso size. Bi-acromial breadth was measured using an anthropometer (GPM® #101, Siber & Hegner, Zurich, Switzerland) from the most lateral points of the acromial processes. These points were identified by palpating the shoulder area. Bi-iliac breath was measured with the same instrument from the most lateral points on the iliac crests. These points were also determined by palpation. All measurements were recorded in mm.

<u>Body Composition</u>*: weight, body mass index (BMI), triceps skinfold, upper arm circumference, calf circumference*

Unlike frame size, measures of body composition indicate recent environmental conditions. Improvements in nutritional status are often accompanied by increases in relative body fat. Thus, these measurements are useful in determining short-term changes in environmental stressors. Children less than 2 years of age were weighed to the nearest 10 grams on a portable pan scale (Seca® model 354 All-purpose Baby Scale®, Hanover, MD). Children over the age of 2 were weighed to the nearest 100 grams on a digital floor scale (Taylor® Ultra Lightweight Scale®, model #7324W, Oak Brook, IL) placed on a firm, flat surface. Participants were weighed without shoes and wearing light clothing.

BMI is used to assess overall body fat. BMI is calculated as weight (kg)/height (m)^2, which identifies those who are underweight, normal, overweight, and obese (Bogin 1999). BMI values used to determine the weight status categories are presented in Table

5.1. As indicated, percentiles are used for assessing body composition in children, while absolute BMI figures are used for adults (CDC 2009a).

	Children	Adults
Underweight	< 5th Percentile	< 18.5 kg/m2
Normal	5th - 85th Percentile	18.5 - 24.9 kg/m2
Overweight	> 85th Percentile	25.0 - 29.9 kg/m2
Obese	> 95th Percentile	$\geq$ 30 kg/m2

Table 5.1 BMI Measures used to Assess Weight Status

Triceps skinfold thickness measures the amount of stored energy resulting from the intake of greater quantities of nutrients than is necessary. This measurement was taken at the mid-point of the arm between the acromial and olecranon processes. The mid-point was marked with a cosmetic grease pen. A Lange® caliper was used to make three consecutive measurements to ensure accuracy. Measurements were then averaged to reduce the effects of intra-observer error (Frisancho 1990). Upper-arm circumference was taken at the same time. A flexible fiberglass tape was place around the arm at the mid-point previously marked. Triceps skinfold (TS) and arm circumference (AC) where used to determine the upper-arm muscle area (UMA) which indicates the availability and utilization of nutrients (Frisancho 1990). UMA was calculated as follows:

$$\text{UMA} = \frac{[\,\text{AC} - (\text{TS}\,\pi)\,]^2}{4\,\pi} \quad (\text{ in cm}^2)$$

The arm fat index (AFI) which identifies the % of fat in the upper arm was also calculated. The equation is as follows:

$$\text{Total Upper-arm Area (TUA)} = \frac{AC^2}{4\pi}$$

$$\text{Upper-arm Fat Area (UFA)} = \text{TUA} - \text{UMA}$$

$$\text{AFI} = \frac{\text{UFA}}{\text{TUA}} \times 100 \quad \text{(as a \%)}$$

Calf circumference was measured with a flexible fiberglass tape at the widest point. All measurements were recorded to the nearest millimeter.

5.7 Comparative Populations

Assessing the health of the Somali population in the U.S. requires the use of comparative samples. Growth of children in Somalia has been examined and reported by three studies conducted over the past 40 years. The first was completed in 1971 by the Somali Ministry of Health (Abbas 1972). Recumbent length/height, weight, and upper-arm circumference were reported for 845 healthy children (434 boys and 411 girls) aged 6 to 72 months who lived in Mogadishu (Abbas 1972). The second study, conducted in 1975 by international researchers, expanded the first study by obtaining measurements on children older than 72 months living in Mogadishu (Gallo and Mestriner 1980). Recumbent length/height, weight, arm circumference, and calf circumference were measured for 1,270 children (679 boys and 591 girls) aged 6-18 years who were of “elite” nutritional status (Gallo and Mestriner 1980:558).

In 2006, UNICEF conducted a Multiple Indicator Cluster Survey (MICS) to monitor the health and well-being of Somali women and children following a decade and a half of civil war. The survey included measures of child mortality, nutrition, water quality, and access to adequate sanitation, among others (UNICEF 2006). Unlike the previous two studies, the MICS was a nationally representative survey. Anthropometric and socio-economic data were collected on 6,764 women 15 to 49 years of age and 6,305 mothers who had children less than five years of age (UNICEF 2006).

Regarding U.S. standards, the National Center for Health Statistics (NCHS) has conducted the National Health and Nutrition Examination Survey (NHANES) as a representative study designed to assess the health and nutritional status of children and adults in the U.S. From the early 1960s to the late 1990s, the NHANES was completed periodically, each time focusing on a different population or health topic (CDC 2008). In 1999, the NHANES became an on-going project in which approximately 5,000 people from 15 randomly selected counties in the U.S. are examined each year (CDC 2008). A questionnaire is used to obtain data on socio-economic, demographic, dietary, and other health-related variables. Medical, dental, physiological, and anthropometric data also are collected (CDC 2008). The results of these surveys are used to identify risk factors which inform public policy. In addition, the anthropometric data form the basis of national growth standards (CDC 2008).

Standards for children are widely available in two publications: Kuczmarski et al. 2000 and McDowell et al. 2008. The former reports anthropometric data collected from the National Health Examination Surveys (NHES II and III) and NHANES (Cycles I, II, and III) between 1963 and 1994 (Kuczmarski et al. 2000) (Table 5.2). Anthropometrics reported in 2008 were collected between 2003 and 2006 as part of the on-going NHANES (McDowell et al. 2008) (Table 5.2). Although the 2000 data are commonly used as growth standards, secular trends must be considered a possible confounding issue given the temporal depth. Differences between the two databases for height and weight are illustrated in Figures 5.1 and 5.2. Except for the 10th percentile, the 2008 data show higher values for both measures at almost every age. This suggests that body measures have increased over the past two decades.

Kuczmarski et al. 2000

Survey	Years	N
NHES II	1963-1965	7,500
NHES III	1966-1970	7,500
NHANES I	1971-1975	30,000
NHANES II	1976-1980	25,000
NHANES III	1988-1994	40,000
	Total	110,000

Measures:	Length/height-for-age Weight-for-age Head circumference

McDowell et al. 2008

Survey	Years	N
NHANES	2003-2006	19,500
	Total	19,500

Measures:	Weight-for-age Length/height-for-age BMI-for-age Head circumference Waist circumference Mid-arm circumference Calf circumference Mid-thigh circumference Upper-arm length Upper-leg length Subscapular skinfold Triceps skinfold

Table 5.2 Comparisons of Survey Characteristics between 2000 and 2008 U.S. Standards

Comparing the current Somali data (henceforth referred to as Columbus 2009) with ‘out-of-date’ standards like those from 2000 may lead to inaccurate conclusions about the well-being of the population. For example, if the growth of a population is compared to both standards, the 2000 version will identify fewer children as stunted and more as overweight than would the 2008 data. As an indicator of chronic malnutrition, stunting is used to assess whether medical intervention is necessary. If malnourished children are not recognized as having a serious problem (i.e. not considered stunted), necessary intervention may not be forthcoming. It is important then that chronic issues be identified as early as possible. This is more likely to occur using the 2008 standards. For this reason, analyses presented here are based solely on the 2008 data.

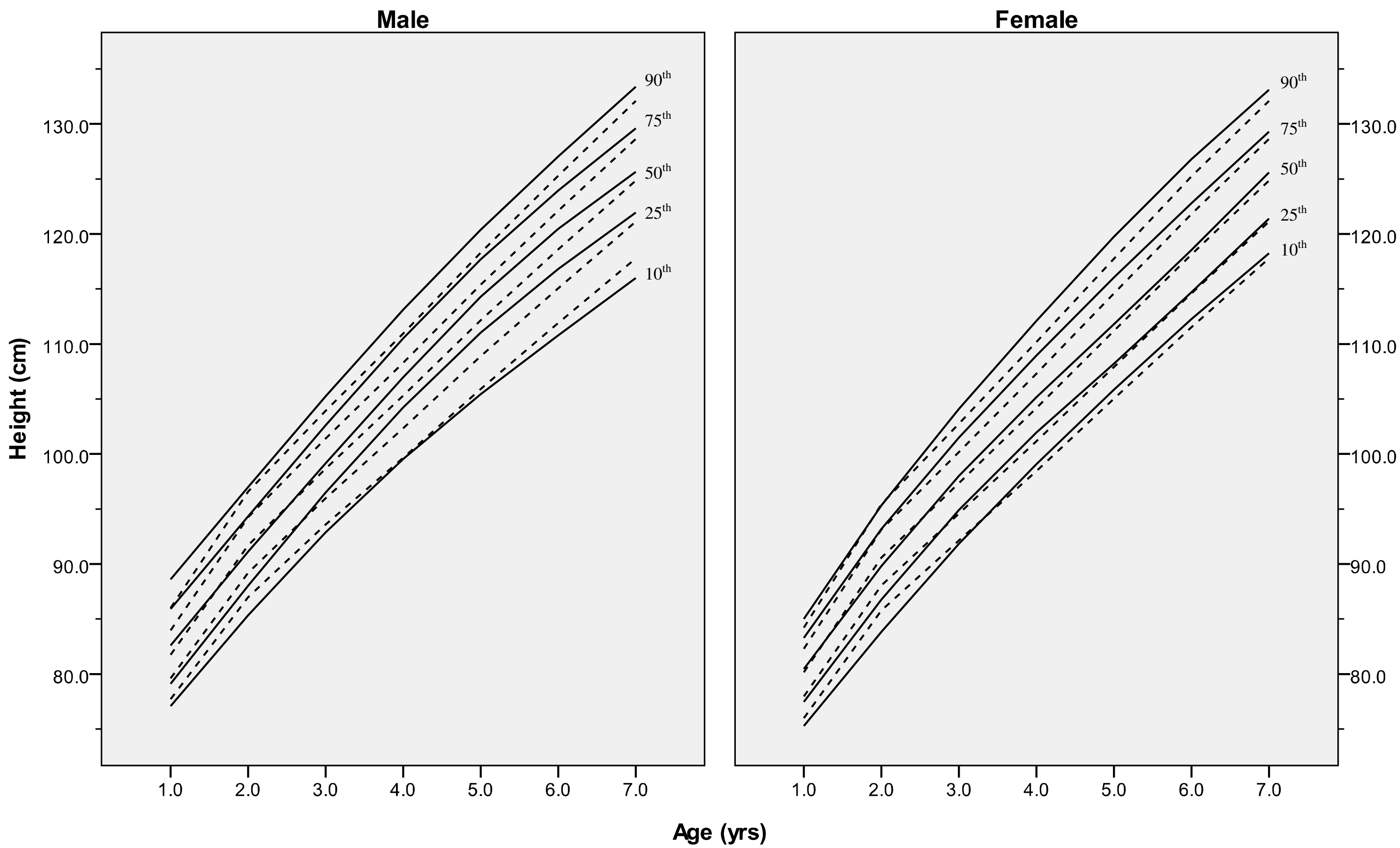

Figure 5.1 Height Comparisons between NCHS 2000 and 2008 U.S. Standards by Age.
Solid line = NCHS 2008, Dashed line = NCHS 2000 percentiles

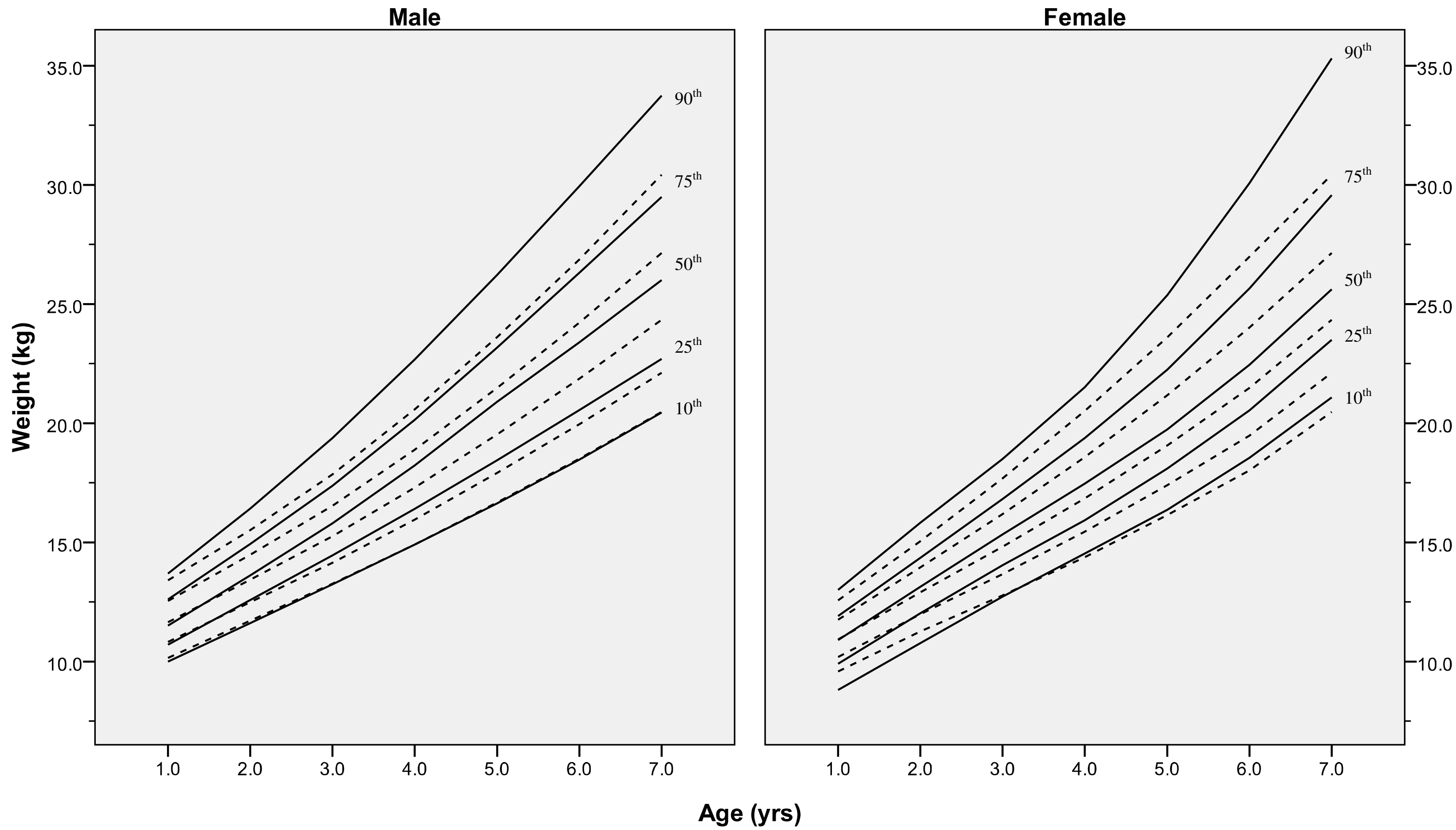

Figure 5.2 Weight Comparisons between NCHS 2000 and 2008 U.S. Standards by Age.
Solid line = NCHS 2008, Dashed line = NCHS 2000 percentiles

5.8 Interviews

Structured interviews were conducted with each mother to address Hypotheses 3 and 4. Because fathers were rarely present (2.4%), they were not included. My interpreter aided me in collecting information when the mother did not speak English or if she was uncomfortable answering questions in the presence of a man. In the case of the latter, my interpreter completed the interview alone. She was qualified to conduct interviews in my absence since I trained her on interview procedures and on the information to be gained through the interview instrument (see Appendix A). The instrument was written in both English and Somali in the event a mother wanted to answer the questions in private. No mother requested this option.

Information obtained was divided into several categories: socioeconomic status (SES), acculturation assessment, pregnancy conditions, and post-natal childcare. The following questions were asked in each category:

SES: age, income, occupation, education, number of children (both foreign- and domestic-born), number of people living in the house, and number of children in the house.

> The 'economic model of parental investment' contends that parents benefit from the survival and success of their children and therefore, will invest all resources to that end (Smith et al. 2002). The amount available to invest, however, is constrained by socio-economic variables. Income is the primary resource influencing investment in offspring (Smith et al. 2002). Higher income allows greater access to health promoting goods/services, such as better dietary

consumables and healthcare. In contrast, low income families have less to invest, jeopardizing the viability of their children and their evolutionary line. Number of kids and people living in the home are important factors influencing potential investments. Large families have fewer resources available per person which ultimately may result in reduced health (Smith et al. 2002). .

Acculturation assessment: age when the mother entered the U.S., years in the U.S., where did the mother live prior to coming to the U.S., English literacy, and language spoken in the home.

The degree of acculturation among mothers is associated with behavioral attitudes toward childcare (Gibson et al. 2005). Among Hispanic women, Gibson et al. (2005) found the length of time in the U.S., English literacy, and the use of English in the home influenced the initiation of breastfeeding. Less time in the U.S., reduced English literacy, and the use of the native tongue corresponded with higher rates of initiation. Sussner et al. (2008) also found that exclusive use of the native language was associated with increased breastfeeding initiation and duration. These studies suggest that the degree of acculturation may influence attitudes toward childcare practices.

Pregnancy issues: does she believe that American doctors understand issues of circumcision and C-section, was she worried about giving birth in the U.S., did she have a previous C-section, has she gone on a diet during pregnancy that was not medically necessary (if so, why?), did she known a woman who has died during childbirth, how many pre-natal visits did she attend, did she rely on someone other than the doctor or husband in making pregnancy/birthing decision, did she practice any Somali specific customs regarding pregnancy and childbirth, and did she take pre-natal vitamins.

> Somali women report being fearful of complicated child births because C-sections are often performed in these situations. C-sections are seen as causing death rather than increasing survival (Essen et al. 2002). Somali women have also reported that C-sections limit the number of children they can deliver, lengthen the time between pregnancies, and restrict the woman's ability to perform her household responsibilities and care of the children (Beine et al. 1995). As such, Somalis may underutilize prenatal services to intentionally reduce the size of the child to ensure a vaginal delivery (Essen et al. 2002). The reduction in size, however, is associated with a decrease in health (i.e. increased mortality and morbidity) (Roche and Sun 2003; Vangen et al. 2002). Whether similar attitudes are present in the U.S. is not known. The questions posed here assess this possibility and allow comparisons between mothers of different beliefs regarding pre-natal care.

Post-natal childcare: did she breastfeed and for how long, were children given any type of food other than breast-milk for their first meal, on what foods were the children weaned, were children given vitamins, and did the children visit the pediatrician on a regular basis for check-ups.

> Duration of breastfeeding impacts the health of children. The WHO recommends children be exclusively breastfed for the first 6 months (Butte et al. 2002).

Premature introduction of supplemental foods often leads to reduced height-for-age and weight-for-age (Hop et al. 2000; Mamabolo et al. 2004). Therefore, post-natal diet is a key variable when assessing health disparities. Vitamin supplementation is also a concern. Children who are exclusively breastfed are often deficient in Vitamin D (Wagner and Greer 2008). The American Academy of Pediatrics recommends supplementing breastfeeding with Vitamin D beginning a few days post-delivery (Wagner and Greer 2008). Since Vitamin D aids in bone formation, low levels are often associated with reduced body size (i.e. shorter stature) (Nejentsev et al. 2004). Thus, vitamin supplementation is important in proper growth and development. The questions posed here examine these practices in the study population.

5.9 Statistical Procedures

The focus of this research is anthropometric variability between populations of Somali children, including U.S.-born, Somalia-born, and U.S. standards. Hypotheses #1 and 2 require comparisons between two populations at a time. Hypothesis #1 compares U.S.- and Somali-born children, while Hypothsis #2 compares U.S.-born Somalis and NCHS standards. Since only two populations are compared at a time, independent-samples t-tests were used. The same statistical method was used to examine sexual differences in anthropometrics. Levene's test for equality of variance was used to assess whether the data required transformations (i.e. exponential or logarithmic).

Hypotheses #3 and 4 examine the impact of socio-economic variables on anthropometrics. Multiple linear regression analyses were used to control for multiple independent variables at a time. Statistical analyses were performed in SPSS, version 17.0 (SPSS, Inc., Chicago, IL). The level of significance is set at $p \leq 0.05$ for all analyses.

Chapter 6: Results: Population Comparisons

In this chapter, the effects of environmental change on the health of Somali children born in the U.S between 2002 and 2009 are presented. Anthropometric data on Somali children living in Columbus are described by sex and age. Comparisons are then made between the sexes to determine whether significant anthropometric variability exists. Next, data on Somali children in Somalia and those in Columbus are compared to assess potential differences in growth associated with immigration to the U.S. Data on Somali children in Columbus are then compared to U.S. growth standards (NCHS) to examine commonalities and difference. Finally, anthropometric data on mothers are presented.

6.1 Sample Composition

A total of 412 children between 0.5 and 9 years of age were examined. Table 6.1 shows the sample distribution by sex and age. All age categories consist of approximately the same number of participants which ensures that one age group does not disproportionately influence the outcome in any analysis. For both boys and girls, sample sizes for ages 8 and 9 are too small for statistical comparisons and therefore, have been removed from consideration. Also eliminated were children who were younger than 1 year because comparative reference data are not available. The exclusion of those < 1.0 and > 7.0 years of age reduced the total sample to 358 (179 boys and 179 girls). However, not all children are included in each analysis because applicable data may be missing. Thus, the sample cohort is not constant throughout.

Age (yr)	Age (mo)	Boys	Girls	Total
< 1.0	6 – 11	15	20	35
1	12 – 23	26	21	47
2	24 – 35	27	35	62
3	36 – 47	27	26	53
4	48 – 59	33	23	56
5	60 – 71	24	32	56
6	72 – 83	27	24	51
7	84 – 95	15	18	33
8	96 – 107	7	8	15
9	108 – 119	1	3	4
	Total	202	210	412

Table 6.1 Sample Distribution

6.2 Sex Comparisons

Cross-culturally, boys and girls share similar growth rates throughout infancy (2 weeks to 3 years of age) and childhood (3 to 7 years of age) (Bogin 1999). However, they do not always follow the same distance curves. On average, girls exhibit lower height, weight, and BMI compared to boys through age 7. Conversely, girls tend to have larger triceps skinfolds during the same growth period (McDowell et al. 2008, Tables 1, 7, 13 and 30). Sex-related differences in growth were assessed here to identify possible deviations from this pattern.

Recumbent length/heights of boys and girls 1 to 7 years of age are listed in Table 6.2. Except for 6-year olds, boys are taller than or equal in height to girls at all ages. Six-year-old girls, on the other hand, are over 3 cm taller than boys. While substantial, this difference is not statistically significant. Children's weights are presented in Table 6.3. As observed, girls are heavier than boys in all age groups except 1 and 2-year olds. Similar to height-for-age, there are no statistically significant differences in weight-for-age between the sexes.

	Boys			**Girls**			
Age	N	mean	s.d.	N	Mean	s.d.	P
1.0	26	84.77	4.67	21	82.74	4.39	0.136
2.0	27	94.04	3.43	34	94.28	3.52	0.796
3.0	27	102.81	4.91	26	101.65	5.08	0.398
4.0	33	110.08	4.40	23	108.45	4.31	0.174
5.0	24	116.60	5.66	32	116.68	5.39	0.962
6.0	27	122.03	5.09	24	125.05	6.59	0.070
7.0	15	129.85	4.75	18	129.23	4.99	0.721
Total	179			178			

Table 6.2 Sex Comparisons in Recumbent Length/Height-by-Age

	Boys			Girls			
Age	N	mean	s.d.	N	Mean	s.d.	P
1.0	26	12.31	1.17	21	11.53	2.05	0.108
2.0	27	14.92	2.95	35	14.31	2.43	0.371
3.0	27	16.74	2.42	26	17.41	3.20	0.398
4.0	33	20.02	4.77	23	19.32	3.30	0.546
5.0	24	21.22	4.30	32	22.21	3.81	0.366
6.0	27	25.06	6.33	24	25.74	6.83	0.711
7.0	15	28.75	6.41	18	28.82	6.93	0.975
Total	179			179			

Table 6.3 Sex Comparisons in Weight-by-Age

BMI values are displayed in Table 6.4. Given the lack of significance in height-for-age and weight-for-age between the sexes, it is not surprising that significant variation in BMI is also absent. The data further reveal that BMI remains fairly constant across age groups, suggesting that height and weight in this sample are strongly correlated. Regression analyses indicate significant positive correlations for both boys ($F = 1179.13$, $df = 200$, $p < 0.001$) and girls ($F = 1358.62$, $df = 206$, $p < 0.001$) – see Figures 6.1 and 6.2 for a graphical representation.

	Boys			Girls			
Age	N	mean	s.d.	N	Mean	s.d.	p
1.0	26	17.17	1.49	21	16.73	1.68	0.355
2.0	27	16.79	2.60	34	16.13	2.56	0.327
3.0	27	15.81	1.79	26	16.74	1.82	0.067
4.0	33	16.41	3.08	23	16.37	2.25	0.962
5.0	24	15.48	1.91	32	16.28	2.32	0.177
6.0	27	16.68	3.41	24	16.27	2.99	0.649
7.0	15	16.96	3.03	18	17.16	3.67	0.865
Total	179			178			

Table 6.4 Sex Comparisons in BMI-by-Age

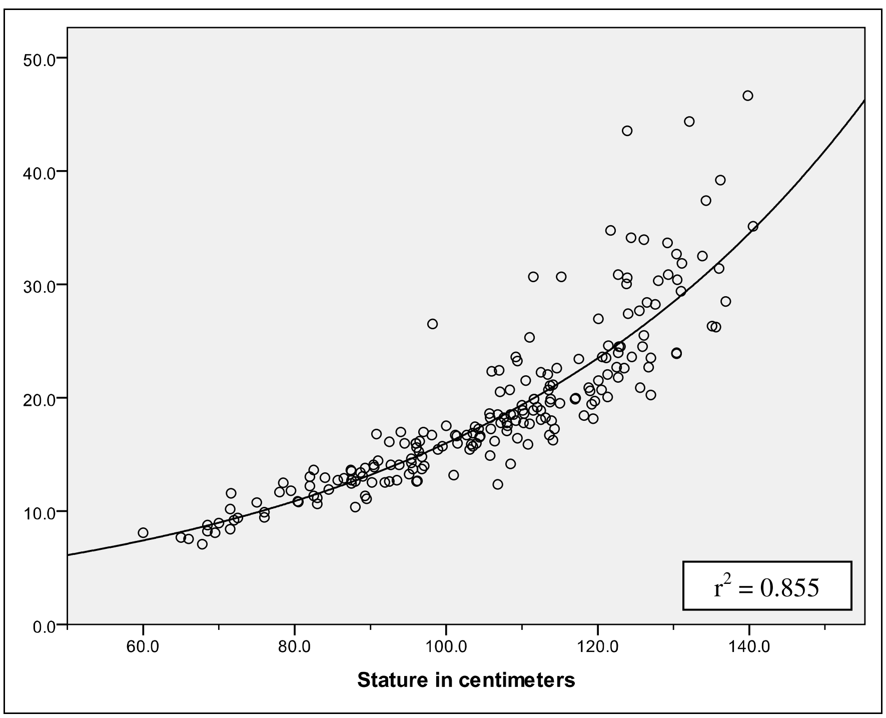

Figure 6.1 Height-by-Weight Regression; Boys

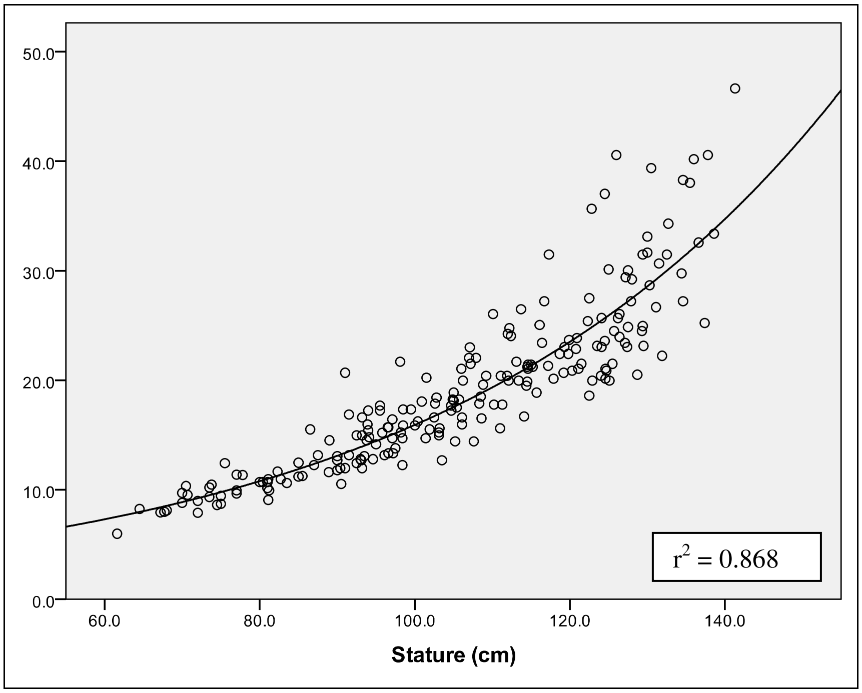

Figure 6.2 Height-by-Weight Regression; Girls

Other anthropometric variables examined include the Cormic Index, upper-arm circumference, triceps skinfold, arm fat index, and upper-arm muscle area. Means and standard deviations for the Cormic Index (CI) are included in Table 6.5 and displayed in Figure 6.3. These data agree with the expected pattern. Boys have higher indices than girls in every group except 4-years olds for whom the two sexes are virtually identical. This suggests that girl's legs are growing faster than boy's at all ages examined. Statistically significant differences in CI are observed in 3- and 6-year olds. Data on leg length show that 6-year old girls have legs over 2 cm longer than those of 6-year old boys (Table 6.6). The same is not found in 3-year olds where leg length is similar between the sexes.

	Boys			Girls			
Age	N	Mean	s.d.	N	mean	s.d.	P
1.0	26	60.96	2.65	21	60.13	2.56	0.286
2.0	27	57.67	1.65	34	57.10	2.32	0.290
3.0	27	55.07	1.60	26	54.17	1.25	0.028
4.0	33	53.65	1.84	23	53.61	1.60	0.921
5.0	24	52.58	1.47	32	52.39	1.19	0.600
6.0	27	52.29	1.05	24	51.39	1.46	0.014
7.0	15	51.03	1.21	18	50.61	1.43	0.374
Total	179			178			

Table 6.5 Sex Comparisons in the Comic Index by Age

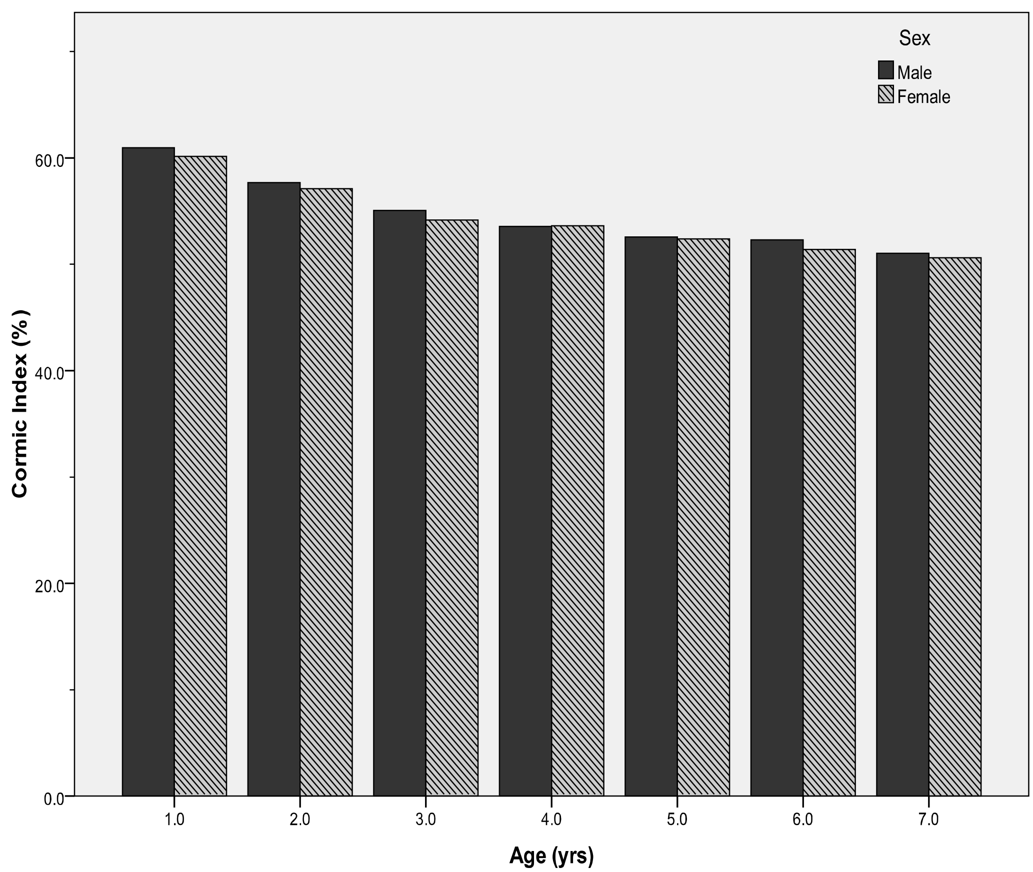

Figure 6.3 Sex Difference in the Comic Index-by-Age

	Boys			Girls			
Age	N	Mean	s.d.	N	mean	s.d.	p
1.0	26	33.16	3.64	21	33.03	3.13	0.898
2.0	27	39.82	2.29	34	40.47	3.10	0.367
3.0	27	46.20	2.80	26	46.61	3.13	0.616
4.0	33	51.15	3.61	23	50.33	3.08	0.379
5.0	24	55.33	3.72	32	55.58	3.41	0.795
6.0	27	58.21	2.56	24	60.80	3.88	0.006
7.0	15	63.61	3.25	18	63.83	3.19	0.842
Total	179			178			

Table 6.6 Sex Comparisons in Leg Length

In addition to BMI, other measures of body composition are examined. Upper-arm circumference is a commonly used measure of body fat (Frisancho 1990). A statistically significant difference in mean upper-arm circumference among 3- and 5-year olds is observed, with girls nearly 2 cm larger (Table 6.7). Data on triceps skinfold show that this difference is likely due to greater fat deposition rather than increased muscle mass (Table 6.8). Girls age 1- to 6-years old have larger mean values than boys, with 1-, 3- and 5-year old girls exhibiting significantly greater adipose tissue.

	Boys			Girls			
Age	N	mean	s.d.	N	Mean	s.d.	P
1.0	25	16.74	1.28	20	16.77	1.45	0.943
2.0	27	17.83	1.84	34	17.48	1.91	0.482
3.0	27	17.51	1.55	26	18.90	1.65	0.002
4.0	33	19.08	2.78	23	18.92	2.22	0.822
5.0	24	18.42	2.05	32	20.00	2.14	0.007
6.0	27	20.36	3.54	24	20.11	2.83	0.779
7.0	15	21.34	2.95	18	21.35	3.48	0.993
Total	178			177			

Table 6.7 Sex Comparisons in Upper-Arm Circumference-by-Age

	Boys			Girls			
Age	N	Mean	s.d.	N	mean	s.d.	P
1.0	20	9.41	1.48	16	10.97	2.67	0.033
2.0	25	11.01	3.66	31	11.76	3.45	0.758
3.0	27	10.64	2.95	25	13.85	3.57	0.001
4.0	33	12.42	5.55	22	13.65	4.57	0.394
5.0	24	11.50	3.47	32	15.56	4.34	<0.001
6.0	26	13.85	4.52	23	14.29	5.14	0.749
7.0	15	17.76	6.38	18	16.26	6.63	0.517
Total	170			167			

Table 6.8 Sex Comparisons in Triceps Skinfold-by-Age

While arm circumference and triceps skinfold are useful measures of nutritional status, they have inherent limitations. For example, arm circumference does not differentiate between fat mass, muscle mass, and bone (Frisancho 1990). Triceps skinfold is a more informative measure of stored energy (i.e. fat mass), but it does not indicate the levels of energy intake (i.e. muscle mass) (Frisancho 1990). Obtaining data to correct for these limitations is achieved by determining the arm fat index (AFI) and upper-arm muscle area (UMA). Advantage to these measures is that they identify the percentage of arm circumference that can be attributed to either muscle or fat independently (Frisancho 1990). AFI data for both sexes is listed in Table 6.9. At all ages, girls have higher AFI values than do boys indicating greater adiposity. Similar to the triceps skinfold data, girls aged 1-, 3-, and 5-years have significantly higher percentages of fat in the upper-arm than do similar aged boys.

	Boys			Girls			
Age	N	Mean	s.d.	N	mean	s.d.	P
1.0	20	32.62	3.86	16	36.38	6.79	0.044
2.0	26	35.33	8.91	31	37.21	6.70	0.368
3.0	27	34.04	6.44	25	40.14	6.58	0.001
4.0	33	35.25	9.57	22	39.44	7.63	0.091
5.0	24	34.76	6.99	32	42.19	7.23	<0.001
6.0	27	38.63	8.12	23	39.18	8.66	0.818
7.0	14	43.43	10.54	18	40.53	9.82	0.429
Total	171			167			

Table 6.9 Sex Comparisons in Arm Fat Index (AFI)-by-Age

UMA is a valuable measure of protein consumption. Unlike upper-arm circumference, triceps skinfold, and AFI, no statistically significant sex differences in UMA are observed at any age (Table 6.10). This suggests that boys and girls have similar access to nutrients, both in quality and quantity. Consequently, discrepancies between UMA and AFI reported here indicate that some girls (i.e. 1-, 3-, and 5-year olds) store more energy (i.e. higher adiposity) than do boys.

	Boys			Girls			
Age	N	Mean	s.d.	N	mean	s.d.	P
1	20	14.54	2.08	16	14.42	2.68	0.881
2	26	16.31	2.62	31	15.24	2.62	0.130
3	27	16.04	2.28	25	17.05	2.45	0.130
4	33	18.46	3.40	22	16.88	2.48	0.067
5	24	17.57	3.17	32	18.28	2.80	0.379
6	27	20.16	5.42	23	18.89	3.51	0.340
7	14	19.79	3.70	18	21.24	4.82	0.359
Total	171			167			

Table 6.10 Sex Comparisons in Upper-Arm Muscle (UAM) Area-by-Age

6.3 Population Comparisons: Somali-born versus U.S.-born Children

Comparisons of height between the Somalia 1971 and Somalia 2006 studies are presented in Table 6.11 and Figure 6.4. Children 5-years of age have been excluded in these comparisons because samples sizes in the 2006 study are too small for statistical analysis. Secular trends are clearly present. With the exception of 1-year old girls, children measured in 1971 were taller than those measured in 2006. Statistically significant differences were observed in 3- and 4-year old boys and 4-year old girls. Similar trends were observed for weight. At all ages, boys and girls measured in 1971 were heavier than children examined in 2006 (Table 6.12 and Figure 6.5). However, only 4-year old boys and girls showed significant differences in weight between the two surveys.

Boys	1971			2006			
Age	N	Mean	SD	N	Mean	SD	P
1.0	39	77.40	5.80	534	75.98	6.63	0.192
2.0	45	84.20	6.50	595	83.07	6.45	0.259
3.0	60	93.20	9.40	579	90.68	7.69	0.019
4.0	16	104.00	5.90	583	96.84	8.13	0.001
5.0	12	109.50	4.30	7	101.69	4.94	Nd
Total	172			2298			

Girls	1971			2006			
Age	N	Mean	SD	N	Mean	SD	P
1.0	42	74.10	6.40	470	75.16	6.60	0.320
2.0	51	83.70	7.00	535	82.00	6.88	0.093
3.0	44	92.00	5.90	578	89.76	7.65	0.058
4.0	18	103.80	3.60	550	96.63	7.81	0.000
5.0	10	109.90	3.70	5	92.56	16.42	Nd
Total	165			2138			

Table 6.11 Comparisons of Height between Somalia 1971 and Somalia 2006 by Age

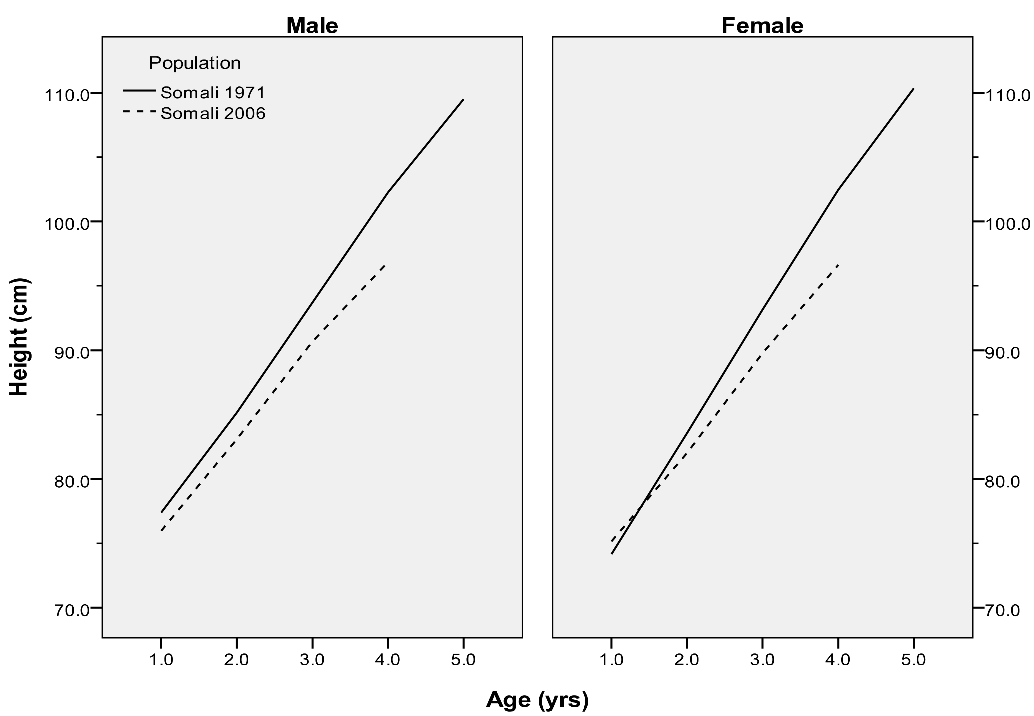

Figure 6.4 Comparisons of Height between Somalia 1971 and Somalia 2006 by Age

Boys	1971			2006			
Age	N	Mean	SD	N	Mean	SD	P
1.0	86	9.30	1.80	534	9.36	1.75	0.760
2.0	91	11.20	1.80	596	10.86	2.07	0.144
3.0	93	12.80	2.10	583	12.61	2.29	0.448
4.0	36	15.30	3.60	589	13.97	2.55	0.003
5.0	17	17.20	2.50	7	15.16	2.43	Nd
Total	323			2309			

Girls	1971			2006			
Age	N	Mean	SD	N	Mean	SD	P
1.0	89	9.0	1.7	475	8.97	1.75	0.895
2.0	99	10.7	1.9	537	10.44	1.96	0.229
3.0	70	12.3	1.8	581	12.14	2.22	0.558
4.0	38	15.0	2.4	554	13.87	2.58	0.009
5.0	15	17.3	2.5	5	11.62	2.89	Nd
Total	311			2152			

Table 6.12 Comparisons of Weight between Somalia 1971 and Somalia 2006 by Age

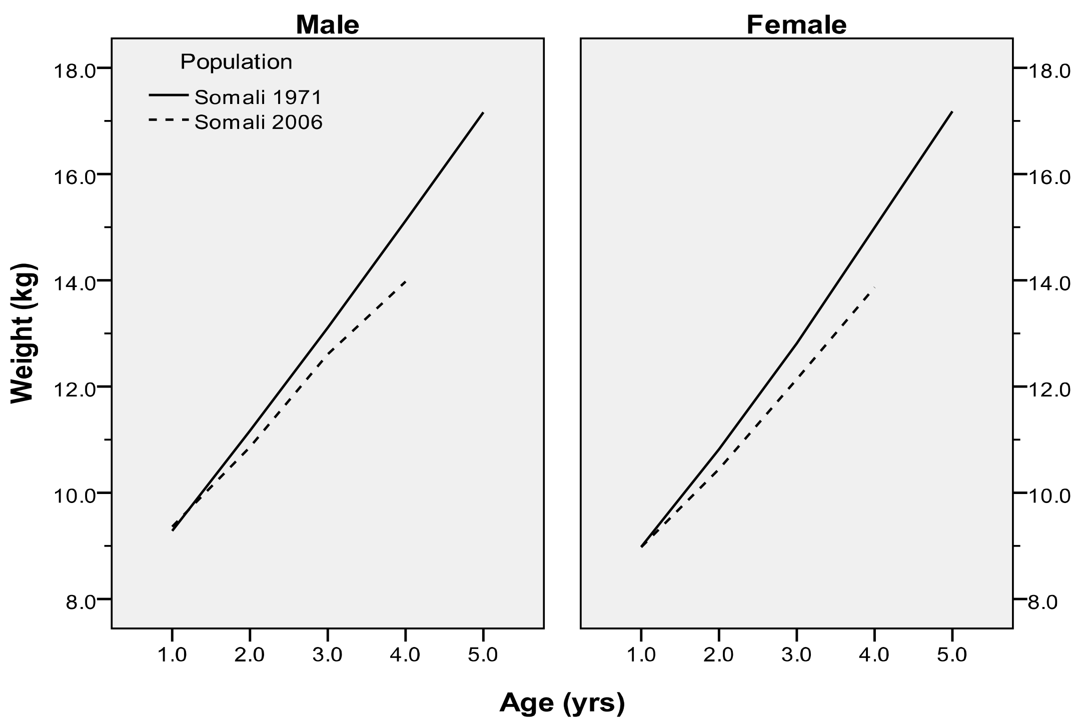

Figure 6.5 Comparisons of Weight between Somalia 1971 and Somalia 2006 by Age

The greater height and weight of children in 1971 was unexpected. Trends in life expectancy and infant mortality between 1955 and 2009 are displayed in Figure 6.6. With the exception of the years 1990-1995, life expectancy in Somali steadily increased while infant mortality decreased (Figure 6.7). These figures indicate an improvement in health over the past 50 years. As such, the growth of Somali children should reflect these secular changes. The data from 2006 do not support this prediction.

The sudden decrease in life expectancy and increase in infant mortality in the early 1990s is likely a response to conditions created by the civil war. The disintegration of the government in 1991 led to the collapse of the healthcare system including medical clinics and educational programs (Qayad 2007). In addition, the number of medical professionals decreased during this period as an estimated 330 physicians and 500 nurses "disappeared" (Qayad 2007:197). Following the collapse, national and international efforts began to restore medical services. For example, the Somali Red Crescent Society (a division of the Red Cross) established 62 clinics and two hospitals during this period (IFRC 2009). The rapid recovery in life expectancy and infant mortality after 1995 demonstrates the effectiveness of these efforts.

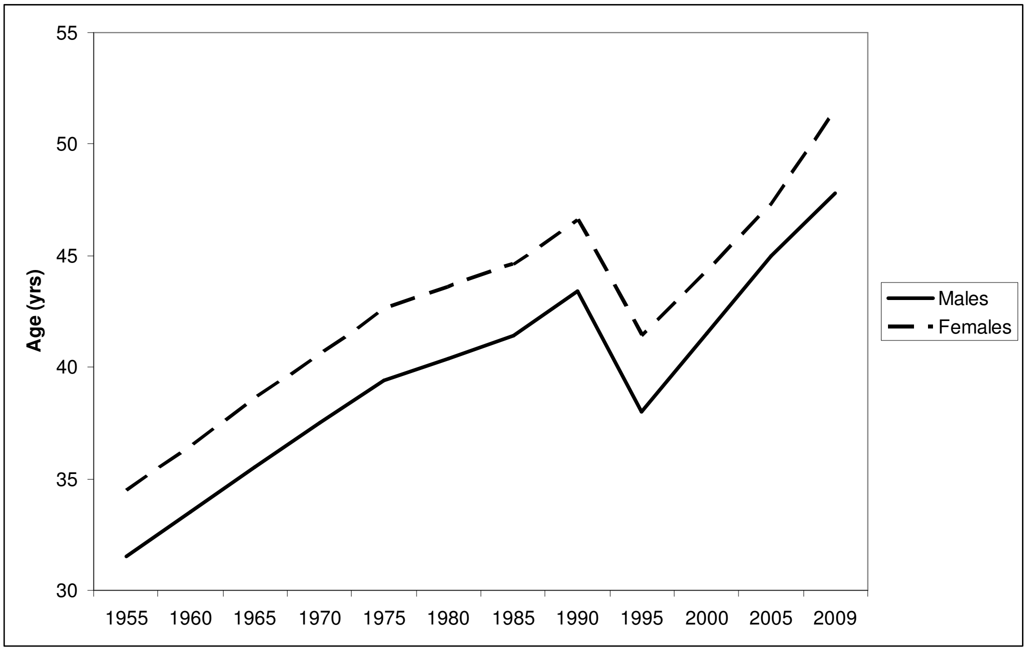

Figure 6.6 Life Expectancies between 1955 and 2009 in Somalia
Source: CIA 2009, UNSD 1997, UNDESA 2006

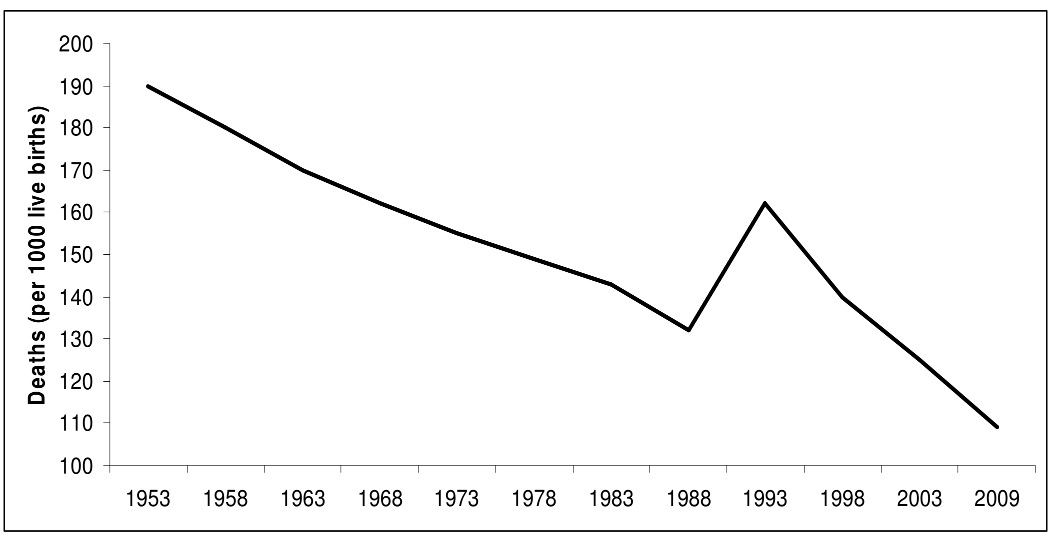

Figure 6.7 Infant Mortality between 1955 and 2009 in Somalia
Source: CIA 2009, UNSD 1997, UNDESA 2006

Height and weight comparisons between Somalia 1971, Somalia 2006, and Columbus 2009 are reported in Tables 6.13-6.16. In support of Hypothesis #1, Somali children in Columbus are significantly taller and heavier at all ages and within each sex than Somali children in either 1971 or 2006. BMI data for Somalia 2006 and Columbus 2009 (comparable data are not available for Somalia 1971) are presented in Table 6.17. Similar to height and weight, greater BMI is observed in Columbus children in each demographic category. However, only 2- and 4-year old boys and 3- and 4-year old girls show a significant difference between these two populations.

Boys	**Somalia 1971**			**Columbus 2009**			
Age	N	Mean	SD	N	Mean	SD	P
1	39	77.4	5.8	26	84.8	4.7	0.000
2	45	84.2	6.5	27	94.0	3.4	0.000
3	60	93.2	9.4	27	102.8	4.9	0.000
4	16	104.0	5.9	33	110.1	4.4	0.000
5	12	109.5	4.3	24	116.6	5.7	0.001
Total	172			137			

Girls	**Somalia 1971**			**Columbus 2009**			
Age	N	Mean	SD	N	Mean	SD	P
1	42	74.1	6.4	21	82.7	4.4	0.000
2	51	83.7	7.0	34	94.3	3.5	0.000
3	44	92.0	5.9	26	101.6	5.1	0.000
4	18	103.8	3.6	23	108.5	4.3	0.001
5	10	109.9	3.7	32	116.7	5.4	0.001
Total	165			136			

Table 6.13 Height Comparisons between Somalia 1971 and Columbus 2009

Boys	Somalia 1971			Columbus 2009			
Age	N	Mean	SD	N	Mean	SD	P
1	86	9.3	1.8	26	12.3	1.2	<0.001
2	91	11.2	1.8	27	14.9	2.9	<0.001
3	93	12.8	2.1	27	16.7	2.4	<0.001
4	36	15.3	3.6	33	20.0	4.8	<0.001
5	17	17.2	2.5	24	21.2	4.3	<0.001
Total	323			137			

Girls	Somalia 1971			Columbus 2009			
Age	N	Mean	SD	N	Mean	SD	P
1	89	9.0	1.7	21	11.5	2.1	<0.001
2	99	10.7	1.9	35	14.3	2.4	<0.001
3	70	12.3	1.8	26	17.4	3.2	<0.001
4	38	15.0	2.4	23	19.3	3.3	<0.001
5	15	17.3	2.5	32	22.2	3.8	<0.001
Total	311			137			

Table 6.14 Weight Comparisons between Somalia 1971 and Columbus 2009

Boys	Somalia 2006			Columbus 2009			
Age	N	Mean	SD	N	Mean	SD	P
1	534	76.0	6.6	26	84.8	4.7	<0.001
2	595	83.1	6.4	27	94.0	3.4	<0.001
3	579	90.7	7.7	27	102.8	4.9	<0.001
4	583	96.8	8.1	33	110.1	4.4	<0.001
5	7	101.7	4.9	24	116.6	5.7	<0.001
Total	2298			137			

Girls	Somalia 2006			Columbus 2009			
Age	N	Mean	SD	N	Mean	SD	P
1	470	75.2	6.6	21	82.7	4.4	<0.001
2	535	82.0	6.9	34	94.3	3.5	<0.001
3	578	89.8	7.6	26	101.6	5.1	<0.001
4	550	96.6	7.8	23	108.5	4.3	<0.001
5	5	92.6	16.4	32	116.7	5.4	<0.001
Total	2138			136			

Table 6.15 Height Comparisons between Somalia 2006 and Columbus 2009

Boys	Somalia 2006			Columbus 2009			
Age	N	Mean	SD	N	Mean	SD	P
1	534	9.4	1.8	26	12.3	1.2	<0.001
2	596	10.9	2.1	27	14.9	2.9	<0.001
3	583	12.6	2.3	27	16.7	2.4	<0.001
4	589	14.0	2.5	33	20.0	4.8	<0.001
5	7	15.2	2.4	24	21.2	4.3	<0.001
Total	2309			137			

Girls	Somalia 2006			Columbus 2009			
Age	N	Mean	SD	N	Mean	SD	P
1	475	9.0	1.8	21	11.5	2.1	<0.001
2	537	10.4	2.0	35	14.3	2.4	<0.001
3	581	12.1	2.2	26	17.4	3.2	<0.001
4	554	13.9	2.6	23	19.3	3.3	<0.001
5	5	11.6	2.9	32	22.2	3.8	<0.001
Total	2152			137			

Table 6.16 Weight Comparisons between Somalia 2006 and Columbus 2009

Boys	Somalia 2006			Columbus 2009			
Age	N	Mean	SD	N	Mean	SD	P
1	532	16.31	3.00	26	17.17	1.49	0.152
2	592	15.75	2.59	27	16.79	2.60	0.042
3	579	15.37	2.45	27	15.81	1.79	0.358
4	581	14.95	2.96	33	16.41	3.08	0.006
5	n.d.	n.d.	n.d.	24	15.48	1.91	n/a
Total	2284			137			

Girls	Somalia 2006			Columbus 2009			
Age	N	Mean	SD	N	Mean	SD	P
1	468	15.99	3.80	21	16.73	1.68	0.370
2	533	15.49	2.18	34	16.13	2.56	0.102
3	578	15.15	2.70	26	16.74	1.82	0.003
4	549	14.89	2.53	23	16.37	2.25	0.006
5	n.d.	n.d.	n.d.	32	16.28	2.32	n/a
Total	2128			136			

Table 6.17 BMI Comparisons between Somalia 2006 and Columbus 2009

Comparisons in mean height, weight, and BMI between populations are reported in Table 6.18. Regarding height, 2-, 3-, and 4-year old boys and girls in Columbus are taller than Somalia 2006 children by an average of 12.1 and 12.0 cm, respectively. Weight also differs substantially between Columbus and Somalia 2006. On average, 2-, 3-, and 4-year old boys in Columbus are 4.75 kg heavier than their Somalia-born age-mates. Similarly, girls in Columbus outweigh their 2006 age-mates by an average of 4.9 kg. Disparities in BMI are also observed. Both boys and girls in Columbus have higher BMI indices at all ages than children in the Somalia 2006 population. However, these differences are relatively small, at approximately 0.94 for each sex.

Boys	**Somalia 1971**		**Somalia 2006**		
Age	Height (cm)	Weight (kg)	Height (cm)	Weight (kg)	BMI
1	7.40	3.00	8.80	2.90	0.85
2	9.80	3.70	11.00	4.10	1.04
3	9.60	3.90	12.10	4.10	0.44
4	6.10	4.70	13.20	6.00	1.46
5	7.10	4.00	14.90	6.10	n.d.

Girls	**Somalia 1971**		**Somalia 2006**		
Age	Height (cm)	Weight (kg)	Height (cm)	Weight (kg)	BMI
1	8.60	2.50	7.60	2.60	0.75
2	10.60	3.60	12.30	3.90	0.64
3	9.60	5.10	11.90	5.30	1.59
4	4.70	4.30	11.80	5.50	1.48
5	6.80	4.90	24.10	10.60	n.d.

Table 6.18 Differences in Height, Weight, and BMI between Somalia 1971/2006 and Columbus 2009

6.4 Population Comparisons: U.S.-born Somali Children and NCHS standards

At all ages, U.S.-born Somali boys and girls are taller than NCHS 2008 reference data (Table 6.19). Significantly greater height was observed among 1-, 2-, and 3-year old boys and 1-5-year old girls. Heights of children in Columbus compared to NCHS 2008 percentiles are illustrated in Figure 6.8. At one year of age, boy's height is just over the 50th percentile, while at age 2, it increases to around the 75th percentile where it remains through age 7. Similarly, girls exhibit heights at or near the 75th percentile from 1 to 7 years of age. These data fail to support Hypothesis #2 in which it was argued that U.S.-born Somalis will exhibit significantly lower height compared to NCHS standards.

Boys	**Columbus 2009**			**NCHS 2008**			
Age	N	Mean	SD	N	Mean	SD	P
2	27	94.04	3.43	258	91.90	3.53	0.003
3	27	102.81	4.91	209	98.50	6.36	<0.001
4	33	110.08	4.40	206	107.10	6.32	0.009
5	24	116.60	5.66	202	114.40	7.39	0.160
6	27	122.03	5.09	176	120.60	6.24	0.258
7	15	129.85	4.75	181	124.70	10.09	0.052
Total	153			1232			

Girls	**Columbus 2009**			**NCHS 2008**			
Age	N	Mean	SD	N	Mean	SD	P
2	34	94.28	3.52	285	90.20	5.91	<0.001
3	26	101.65	5.08	187	98.30	4.79	<0.001
4	23	108.45	4.31	225	105.20	6.00	0.012
5	32	116.68	5.39	199	112.20	7.62	<0.001
6	24	125.05	6.59	193	119.00	7.36	<0.001
7	18	129.23	4.99	157	125.80	9.65	0.139
Total	157			1246			

Table 6.19 Height Comparisons between Columbus 2009 and NCHS 2008

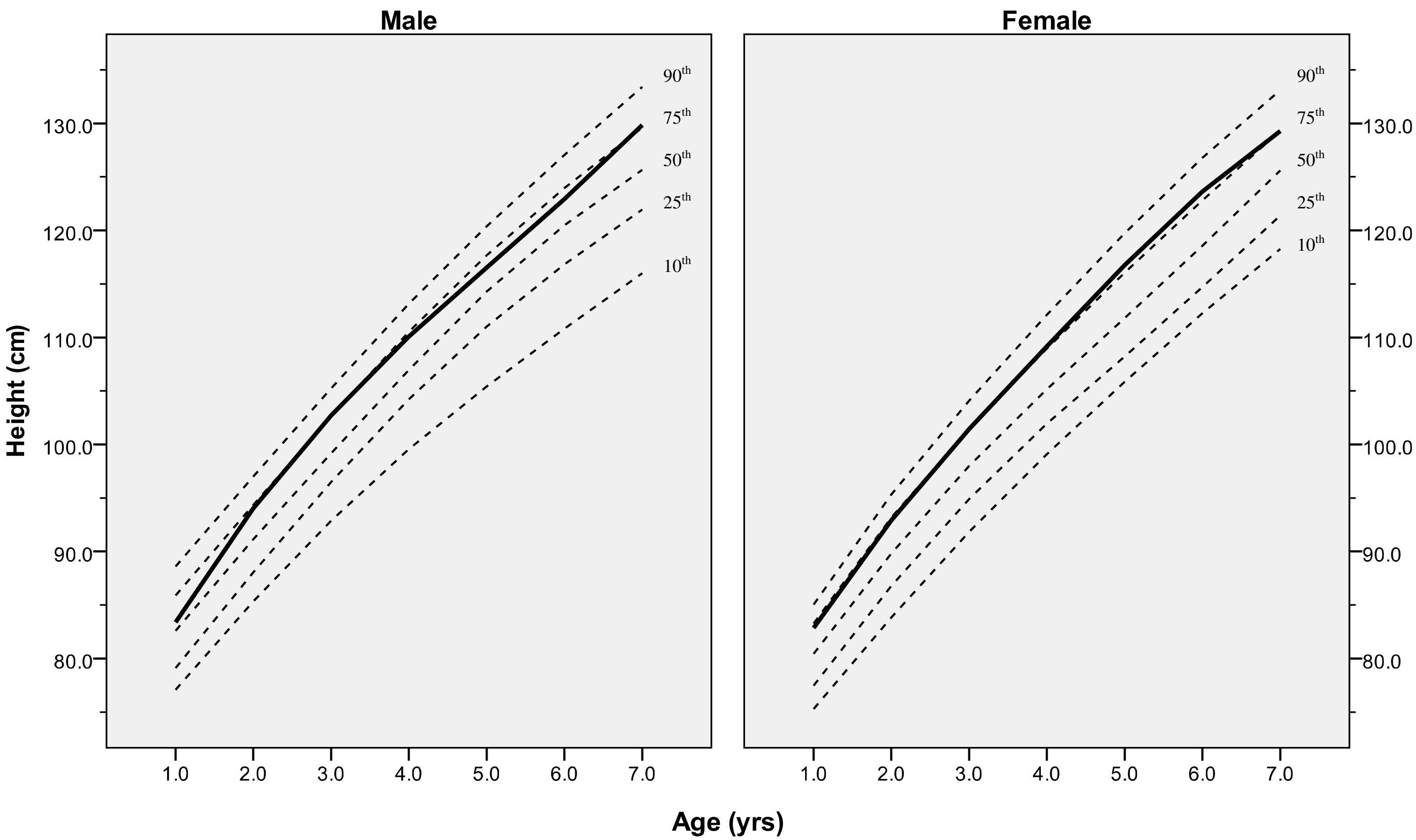

Figure 6.8 Height Comparisons between Columbus 2009 and NCHS 2008 Percentiles

In contrast to height, it was hypothesized that U.S.-born Somali children would have greater weight-for-age than NCHS 2008. Data presented in Table 6.20 support this prediction. Except for 5-year old boys, Columbus children are heavier at every age than NCHS standards. However, only 3-year old Somali boys and 2-, 3-, and 4-year old Somali girls show a statistically significant difference from U.S. standards. Both Somali boys and girls track the 75th percentile throughout the first 7 years (Figure 6.9).

Boys	**Columbus 2009**			**NCHS 2008**			
Age	N	Mean	SD	N	Mean	SD	P
1	26	12.31	1.17	360	11.60	2.28	0.120
2	27	14.92	2.95	292	14.10	2.39	0.096
3	27	16.74	2.42	210	15.80	2.32	0.049
4	33	20.02	4.77	208	18.60	4.47	0.094
5	24	21.22	4.30	202	22.10	6.96	0.546
6	27	25.06	6.33	176	24.20	4.38	0.374
7	15	28.75	6.41	181	26.60	7.80	0.300
Total	179			1629			

Girls	**Columbus 2009**			**NCHS 2008**			
Age	N	Mean	SD	N	Mean	SD	P
1	21	11.53	2.05	328	10.90	1.99	0.161
2	35	14.31	2.43	335	13.40	2.38	0.032
3	26	17.41	3.20	191	15.80	2.76	0.006
4	23	19.32	3.30	226	17.90	3.16	0.041
5	32	22.21	3.81	199	20.50	5.22	0.076
6	24	25.74	6.83	193	23.40	6.81	0.113
7	18	28.82	6.93	157	27.30	7.77	0.428
Total	179			1629			

Table 6.20 Weight Comparisons between Columbus 2009 and NCHS 2008

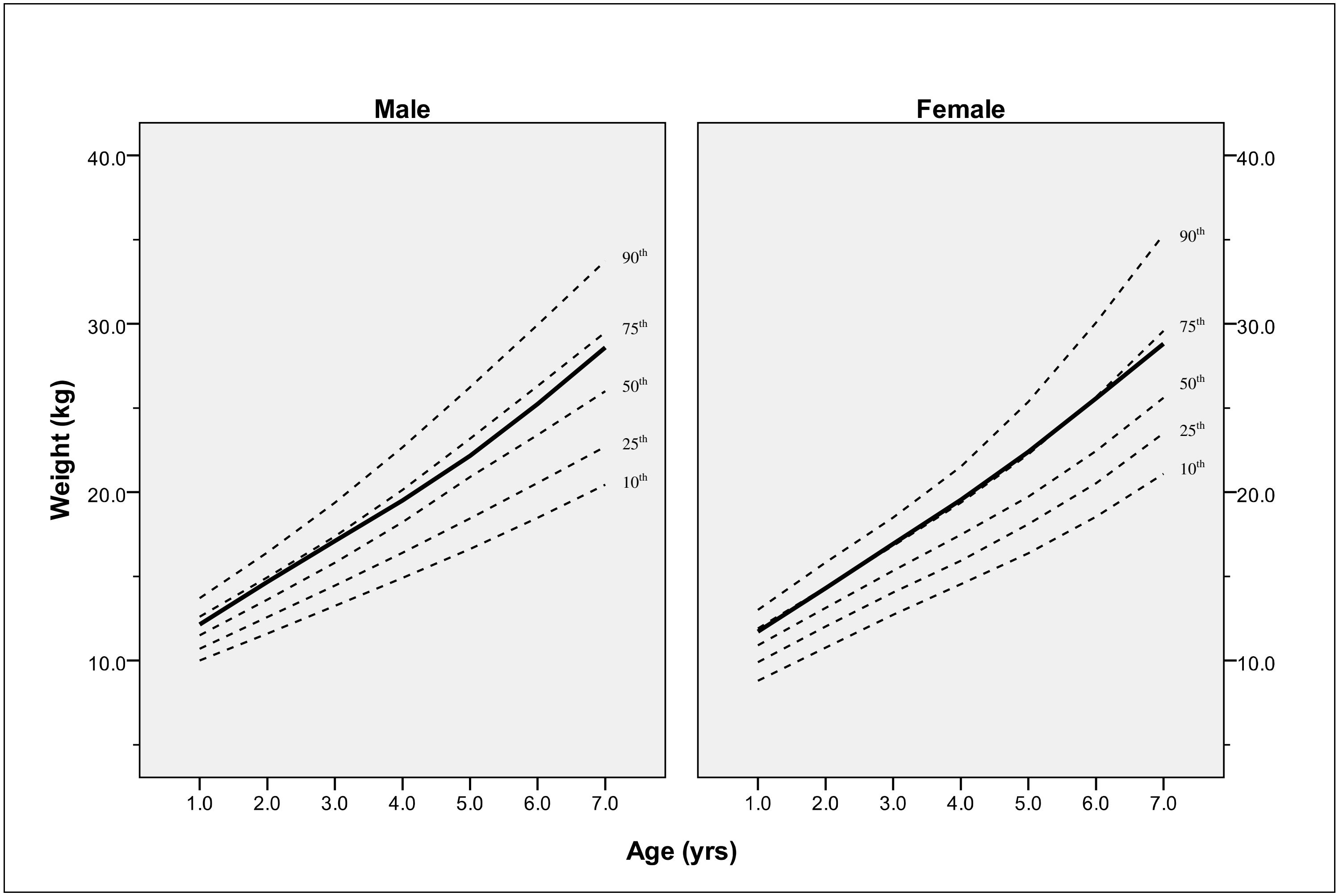

Figure 6.9 Weight Comparisons between Columbus 2009 and NCHS 2008

In addition to weight, body composition is examined through the analyses of BMI, upper-arm circumference, and triceps skinfold. Within both sexes and at every age, a statistical significant difference in BMI is not observed (Table 6.21). BMI values for both sexes are between the 50th and 75th percentiles of NCHS 2008 standards (Figure 6.10). Because the incidence of overweight (> 85th percentile) and obese (> 95th percentile) children is a major health concern in the U.S., this issue was examined in the Columbus sample.

Boys	**Columbus 2009**			**NCHS 2008**			
Age	N	Mean	SD	N	Mean	SD	P
2	27	16.79	2.60	258	16.80	1.61	0.977
3	27	15.81	1.79	209	16.20	1.59	0.238
4	33	16.41	3.08	206	16.20	2.01	0.609
5	24	15.48	1.91	202	16.80	3.55	0.075
6	27	16.68	3.41	176	16.50	1.99	0.696
7	15	16.96	3.03	181	16.90	3.23	0.945
Total	153			1232			

Girls	**Columbus 2009**			**NCHS 2008**			
Age	N	Mean	SD	N	Mean	SD	P
2	34	16.13	2.56	285	16.60	1.86	0.712
3	26	16.74	1.82	187	16.30	2.46	0.381
4	23	16.37	2.25	224	16.10	2.10	0.559
5	32	16.28	2.32	199	16.20	2.68	0.874
6	24	16.27	2.99	193	16.40	2.92	0.838
7	18	17.16	3.67	157	17.10	3.26	0.942
Total	157			1245			

Table 6.21 BMI Comparisons between Columbus 2009 and NCHS 2008

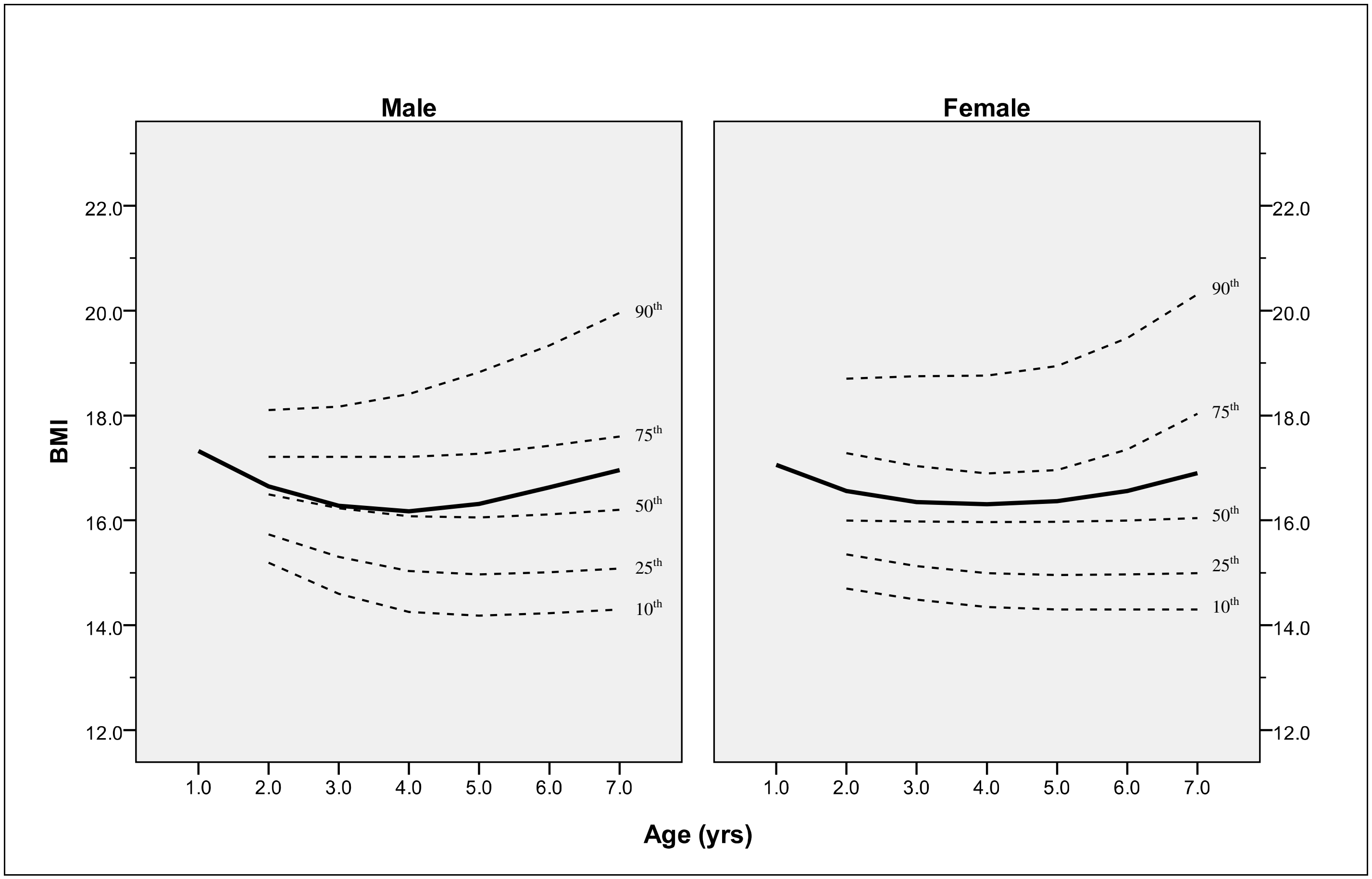

Figure 6.10 BMI Comparisons between Columbus 2009 and NCHS 2008 Percentiles

Roughly 17% of Somali boys and 22% of Somali girls in Columbus are overweight, while in Somalia 2006, only 8% of boys and 7% of girls are overweight (Table 6.22) – incidence of obesity could not be examined because NCHS 2008 standards do not list data for the 95th percentile. These data support the hypothesis that the transition in environmental conditions between Somalia and the U.S. is associated with increased adiposity.

Boys	Columbus 2009		Somalia 2006	
Age	N	%	N	%
2	4/27	14.8	55/592	9.3
3	4/27	14.8	55/579	9.5
4	7/33	21.2	33/581	5.7
		16.9		8.2

Girls	Columbus 2009		Somalia 2006	
Age	N	%	N	%
2	6/34	17.6	39/533	7.3
3	6/26	23.1	40/578	7.0
4	6/23	26.1	44/549	8.0
		22.3		7.4

Table 6.22 Percentages of Overweight in the Columbus 2009 and Somalia 2006

Although BMI is a commonly used measure of body fat, it does not take into account the effects of frame size and muscle mass. Upper-arm circumference and triceps skinfold are more specific measures of adiposity. Data on upper-arm circumferences are reported in Table 6.23. With the exception of 5- and 7-year old boys and 7-year old girls, children in Columbus have significantly larger upper-arm circumferences than NCHS

2008 standards. Both Somali boys and girls track between the 75^{th} and 90^{th} percentiles (Figure 6.11). These results indicate the presence of substantial energy stores among Somali children. This supports the prediction in Hypothesis #2 that children in Columbus will show significantly greater body fat than NCHS 2008 standards.

Boys	Columbus 2009			NCHS 2008			
Age	N	Mean	SD	N	Mean	SD	P
1	25	16.74	1.28	341	15.60	1.66	0.001
2	27	17.83	1.84	270	16.10	1.48	<0.001
3	27	17.51	1.55	199	16.60	1.55	0.005
4	33	19.08	2.78	200	17.30	2.55	<0.001
5	24	18.42	2.05	200	18.40	3.39	0.978
6	27	20.36	3.54	174	18.90	1.98	0.002
7	15	21.34	2.95	177	19.70	3.19	0.056
Total	178			1561			

Girls	Columbus 2009			NCHS 2008			
Age	N	Mean	SD	N	Mean	SD	P
1	20	16.77	1.45	319	15.40	1.61	<0.001
2	34	17.48	1.91	305	16.10	1.57	<0.001
3	26	18.90	1.65	176	16.80	1.59	<0.001
4	23	18.92	2.22	223	17.40	1.79	<0.001
5	32	20.00	2.14	195	17.90	2.51	<0.001
6	24	20.11	2.83	187	18.80	2.60	0.022
7	18	21.35	3.48	155	20.10	3.11	0.113
Total	177			1560			

Table 6.23 Upper-arm Circumference Comparisons between Columbus 2009 and NCHS 2008

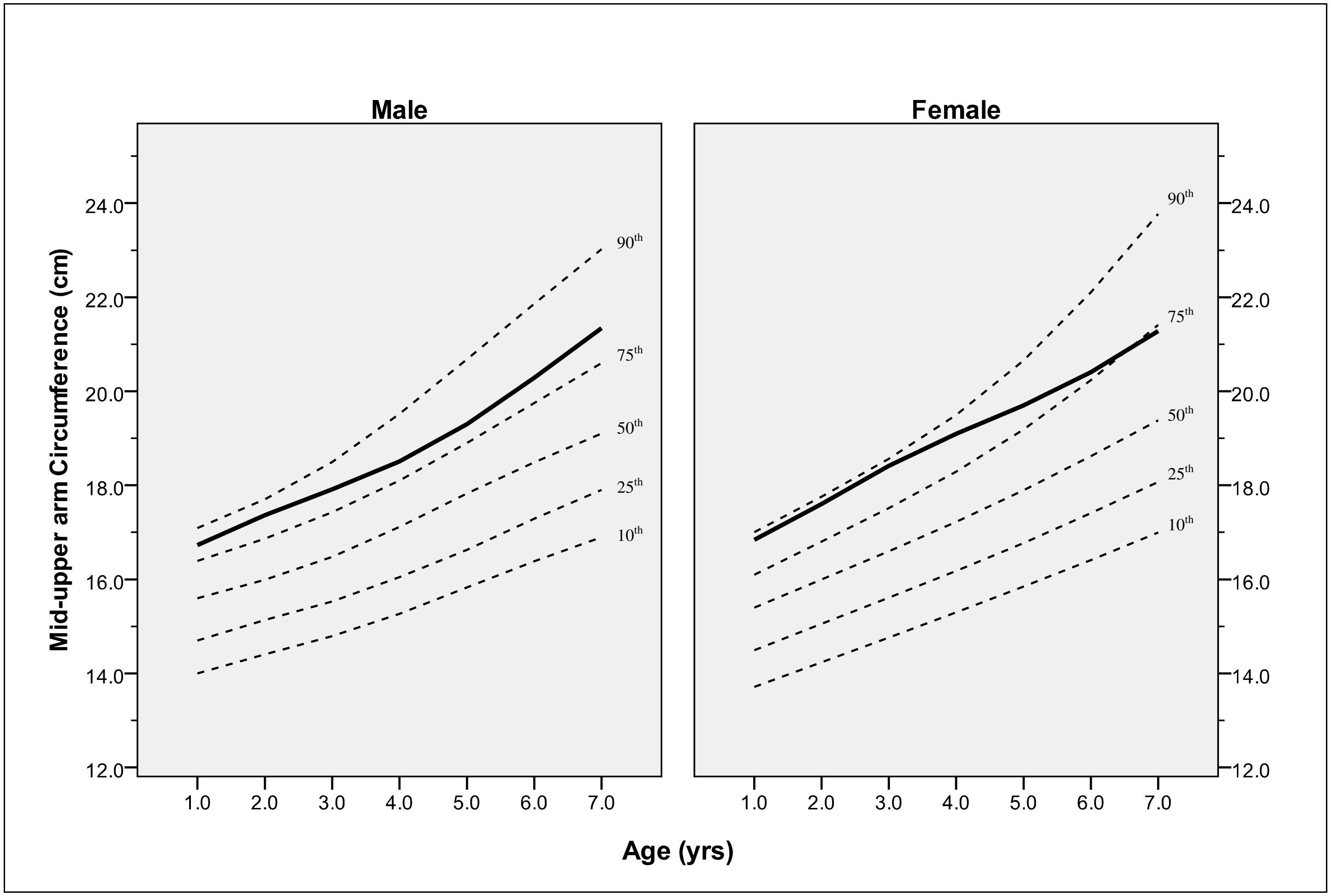

Figure 6.11 Upper-arm Circumference Comparisons between Columbus 2009 and NCHS 2008 Percentiles

Finally, because upper-arm circumference includes bone and muscle, triceps skinfolds are examined to directly assess body fat. Except for 1- and 5-year old boys and 1- and 2-year old girls, children in Columbus exhibit significantly greater skinfold thicknesses than the NCHS standards (Table 6.24). Both Somali boys and girls track between the 75th and 90th percentiles from age 2 until age 7 (Figure 6.12). At 1-year of age, Somali children are near the 50th percentile. These data verify the findings reported on upper-arm circumferences in that the differences between Columbus 2009 and NCHS 2008 are likely due to greater adiposity. As with weight and BMI, these results are in agreement with predictions posed in Hypothesis #2.

Boys	**Columbus 2009**			**NCHS 2008**			
Age	N	Mean	SD	N	Mean	SD	P
1	20	9.41	1.48	336	9.80	3.48	0.619
2	25	11.01	3.66	260	9.60	2.10	0.003
3	27	10.64	2.95	195	9.30	2.93	0.027
4	33	12.42	5.55	199	9.10	3.67	0.000
5	24	11.50	3.47	197	10.00	4.49	0.116
6	26	13.85	4.52	173	9.80	3.29	0.000
7	15	17.76	6.38	176	10.50	7.03	0.000
Total	170			1536			

Girls	**Columbus 2009**			**NCHS 2008**			
Age	N	Mean	SD	N	Mean	SD	P
1	16	10.97	2.67	316	10.10	3.38	0.311
2	31	11.76	3.45	299	10.50	3.63	0.066
3	25	13.85	3.57	174	10.20	3.69	0.000
4	22	13.65	4.57	220	10.60	3.41	0.000
5	32	15.56	4.34	194	10.70	4.46	0.000
6	23	14.29	5.14	188	10.80	4.11	0.000
7	18	16.26	6.63	153	12.70	4.70	0.004
Total	167			1544			

Table 6.24 Triceps Skinfold Comparisons between Columbus 2009 and NCHS 2008

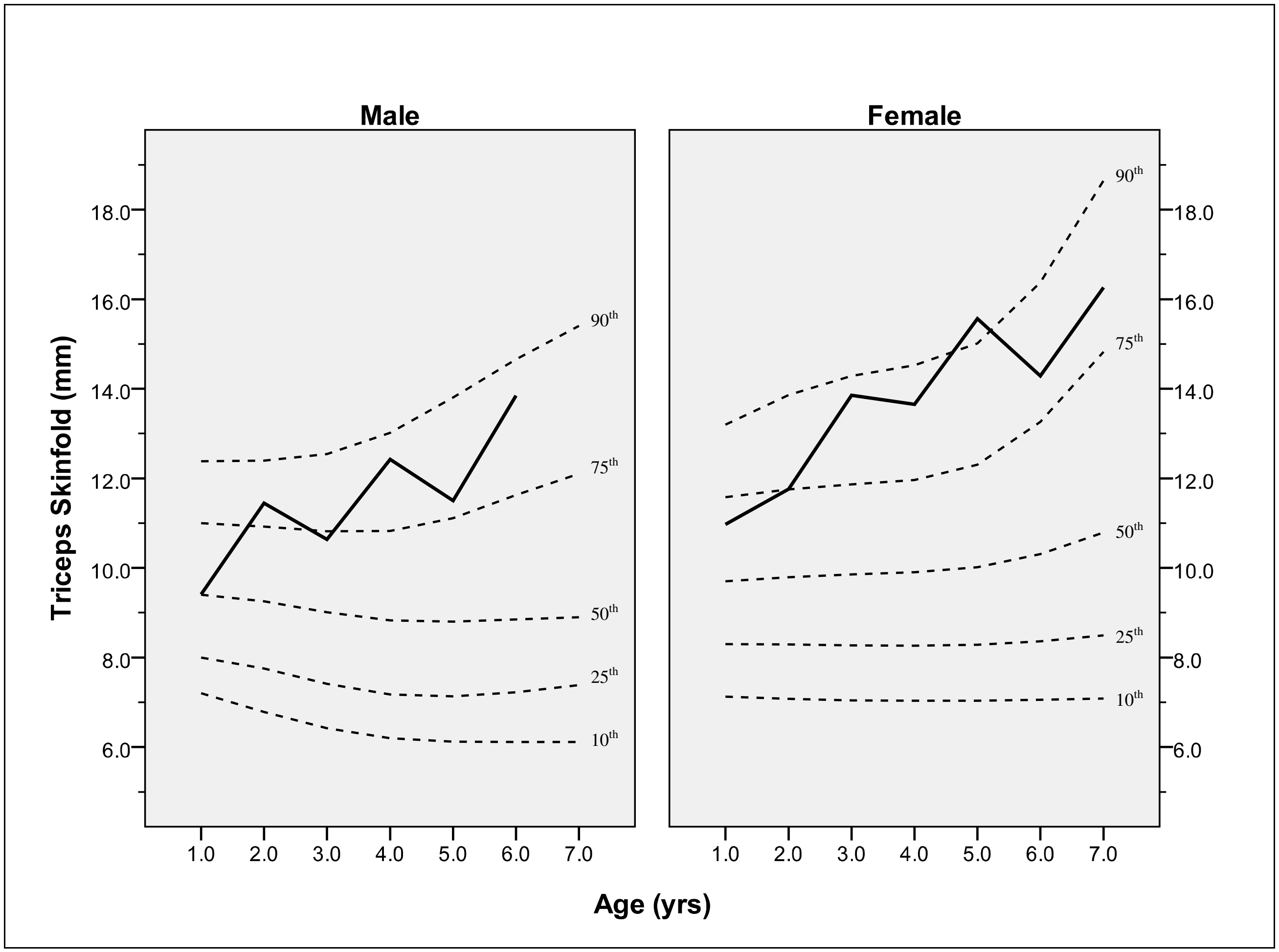

Figure 6.12 Triceps Skinfold Comparisons between Columbus 2009 and NCHS 2008 Percentiles

6.5 Anthropometric Data: Mothers

A total of 165 mothers were included in this study, although not all of them could be measured due to various cultural and medical reasons. Height, weight, and BMI data are listed in Table 6.25. At age 25, the average height of Somali mothers is nearly identical to the 50th percentile of NCHS standards (Figure 6.13). Average weight and BMI, on the other hand, are just over their respective 50th percentiles at the same age (Figures 6.14 and 6.15).

	N	Mean	SD	Min	Max
Height	151	163.22	5.99	148.5	177.3
Weight	145	75.42	15.81	42.64	127.73
BMI	144	28.3	5.71	15.15	46.06

Table 6.25 Anthropometrics, Mothers

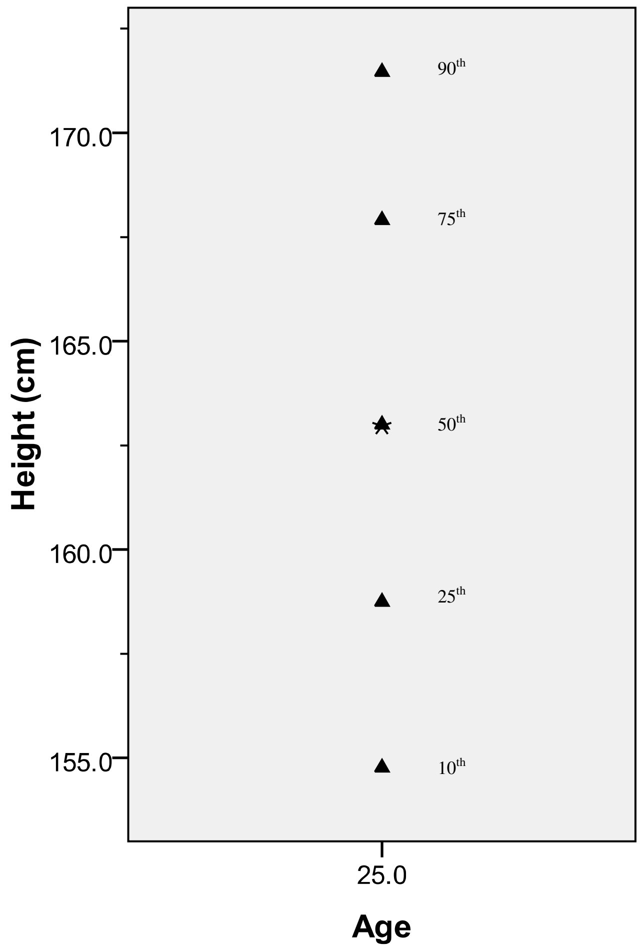

Figure 6.13 Height Comparison between Somali Mother and NCHS 2008 Percentiles.
▲ = NCHS 2008 Percentiles; ★ = Mother's Mean Height at Age 25

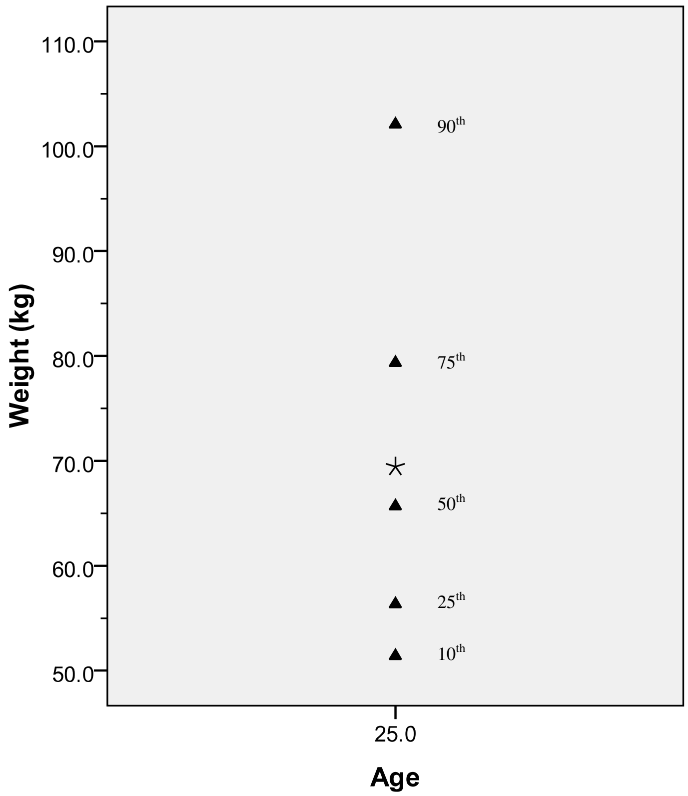

Figure 6.14 Weight Comparison between Somali Mother and NCHS 2008 Percentiles.
▲ = NCHS 2008 Percentiles; ★ = Mother's Mean Height at Age 25

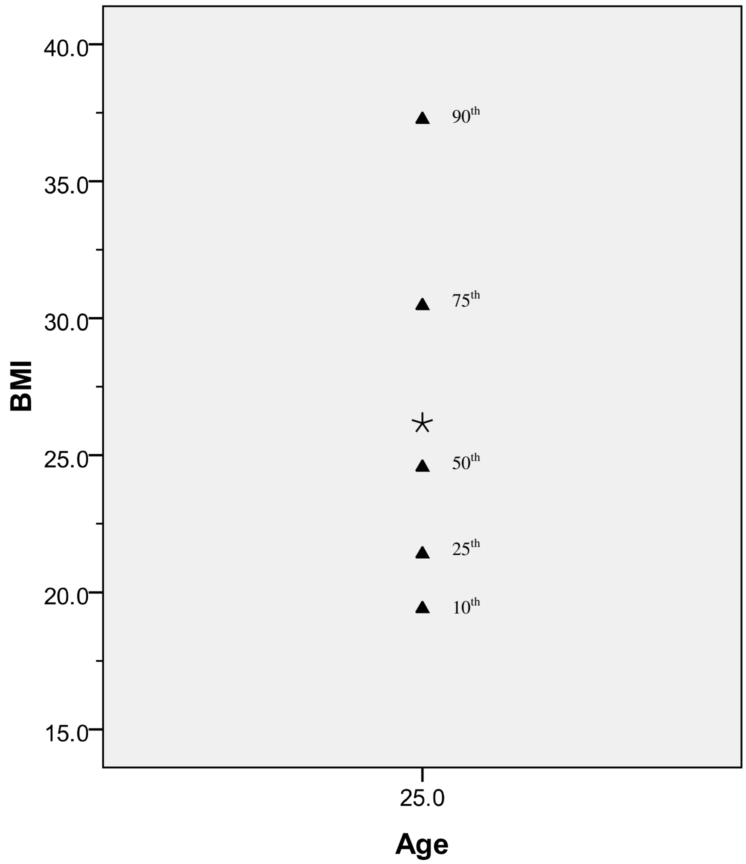

Figure 6.15 BMI Comparison between Somali Mother and NCHS 2008 Percentiles
▲ = NCHS 2008 Percentiles; ★ = Mother's Mean Height at Age 25

Less than 2% of mothers were either stunted or underweight (Table 6.26). In contrast, 71% of mothers are overweight or obese. The majority of obese mothers are Class 1, the least serious form of obesity. Four mothers are morbidly obese (Class 3).

	N	%
Stunted	2/151	1.3
Underweight	2/144	1.4
Overweight	50/144	34.7
Obese		
Class 1	37/144	25.7
Class 2	11/144	7.6
Class 3	4/144	2.8

Table 6.26 Percentage of Somali Mothers in Columbus Outside Normal Ranges for Height and Weight

Comparisons with Somali mothers in Somalia would be valuable in understanding the degree of change that has taken place. Unfortunately, corresponding data are not available. Thus, this research was limited to comparisons with U.S. standards for adult females.

Chapter 7: Results: Socio-Economic Comparisons

Cultural behaviors and ideologies are developed to reduce stressors to which populations have been exposed (Sussner et al. 2008). Though these traits are adaptive in native conditions, they may be of little value or even detrimental in new environments with different stressors (Sussner et al. 2008). As such, examining traditional and non-traditional socio-economic traits is important for better understanding health conditions of immigrant children. This chapter reports on possible effects of socioeconomic change on Somali children born in the U.S. First, descriptive statistics on mothers and their cultural behaviors are presented to identify disparities in socioeconomic conditions. Anthropometric data on the children are then compared within each variable.

7.1 Descriptive Statistics

a) Household Demography

A total of 165 households were surveyed. The average number of occupants per household was 5.4 with as few as 2 and as many as 12. However, because of continual population movements in the U.S., the actual number of people living in a single house often fluctuates. Therefore, these figures should be interpreted as averages over time rather than constants. As expected, the majority of those in each house are children, averaging 3.87. Household income varies from less than $10,000 to over $60,000 (see Figure 7.1). Average annual income is roughly $17,500 which is considered poverty level for a family of four (U.S. Department of Health and Human Services 2009). Since nearly 92% of Somali households in this sample have at least 2 children, many of these families are likely impoverished based on this definition.

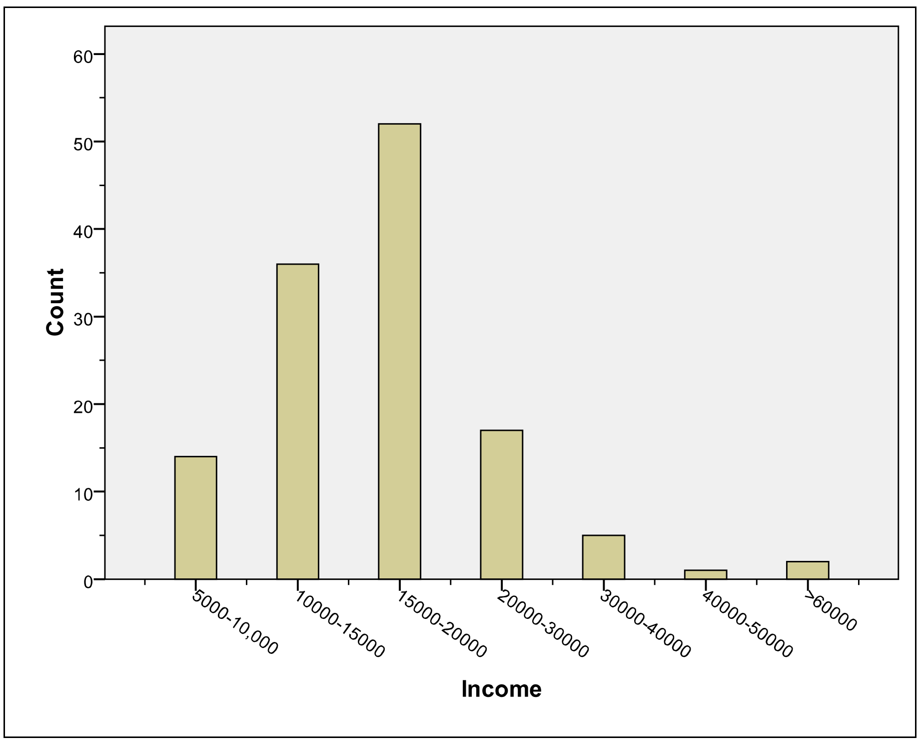

Figure 7.1 Distribution of Annual Household Incomes

b) Mother's Characteristics

All mothers were born and reared outside the U.S. The youngest mother in the study was 18, while the oldest was over 50. More than half of the mothers (53.4%) were between 21 and 29 years of age (Table 7.1). Regarding education, less than half of the mothers (44.8%) have a high school diploma and only 8.5% have attended college (Table 7.2). Of those who did not graduate high school (41.8%), 17.5% had less than a 6th grade education and 4% never attended school.

Age (yr)	N	%
< 21 years old	10	6.1
21-24 years old	42	25.5
25-29 years old	46	27.9
30-34 years old	31	18.8
35-39 years old	23	13.9
> 39 years old	13	7.9

Table 7.1 Age Distribution, Mothers

Education	N	%
Didn't complete H.S.	69	41.8
Completed H.S.	74	44.8
Attended College	11	6.7
Earned a Degree	3	1.8

Table 7.2 Education Level, Mothers

Lack of education among these Somali mothers is accompanied by high levels of illiteracy. Roughly 44% of mothers in the study were unable to read and write English – this was assessed by having mothers read a short passage and by asking them to write down a phrase that was spoken to them. This is surprising since nearly 80% of mothers have been in the U.S. for at least 7 years. Illiteracy is far less common among younger mothers (Table 7.3). A chi-square statistical test shows that mothers who were 21 years old or younger when they arrived in the U.S. were significantly more likely to be literate than mothers who were older than 21 years when they arrived ($x^2 = 20.089$, $df = 1$, $p < 0.000$). The high levels of illiteracy in the older mothers suggest that the ability to speak, read, and write English is not a necessity in many aspects of their lives. When asked with whom they interacted most often, all of the women reported other Somalis. Given Somali is the primary language spoken in these households, it was expected that English literacy would not be universal.

	≤ 21 years old		> 21 years old		
English Literacy	N	%	N	%	Total
Literate	43	74.1	37	39.8	80
Illiterate	15	28.9	56	60.2	71

Table 7.3 English Literacy by Age

Approximately 20% of mothers are employed outside the home (Table 7.4), which is considerably lower than the national average. In 2008, 59.6% of mothers who had children under 6 participated in the work force (U.S. Department of Labor 2009). Several reasons may explain the low employment rate of Somali mothers. First, the lack of English literacy for many mothers is likely an issue when seeking employment, particularly given most jobs require English proficiency. Second, transportation to and from work is a problem. Many Somali mothers in this community do not have access to a vehicle because it is often in the father's possession. Finally, the majority of mothers reported that they must stay home to care for the children. Some also indicated that they wished to have more children as soon as possible. This desire is guided by the cultural expectation that a married couple should have as many children as can be supported (Lewis 2008). As a result, Somalia has the fourth highest fertility rate in the world at 6.52 children/woman (CIA 2009).

Occupation	N	%
Employed	33	20.0
Unemployed	80	48.5
Student	26	15.8

Table 7.4 Mother's Employment Status

Completed fertility is not available for mothers in Columbus since most are still in their reproductive years. However, data indicate a 'moving' fertility of 4.9 children per woman (see Table 7.5) – 'moving' refers to the possibility that this figure may continue to increase since most women are still reproductively active. This level of fertility is nearly two and a half times higher than the average completed fertility in the U.S. (CIA 2009). As a further comparison, only 29 countries in the world have higher fertility than the Somali population in Columbus (CIA 2009).

Age (yrs)	N	F	Min	Max
< 21	10	2.1	1	5
21-24	41	3.2	1	6
25-29	46	3.9	1	8
30-34	31	4.8	2	9
35-39	23	4.9	1	14

Table 7.5 Fertility Rates by Age

c) Childcare Practices

Research on Somali refugees in the U.S., Great Britain, Norway, Sweden, and Australia indicate that most Somali women continue to practice traditional childrearing practices in their new environments (Burns 2004; Essen et al. 2000; Maxwell et al. 2006; Vangen et al. 2002; Werner 2005). Reasons for maintaining traditional ways of childcare were outlined in Chapter 4. The following section compares practices observed by Somali mothers in Columbus with those practiced by Somali mothers in other populations, specifically Minneapolis, MN. This affords a broader view of childcare variation among Somalis in the U.S., while aiding an understanding of the effects of migration on the health of Somali children.

Childcare begins not at birth but at the time of conception. Mothers are encouraged to start eating a well-balanced diet right from the start. However, even a quality diet does not supply mother and baby with adequate amounts of folic acid and vitamin D (Sullivan et al. 2009). As such, it is necessary to begin taking pre-natal vitamins as soon as possible (Sullivan et al. 2009). The majority of Somali mothers in Columbus (86.5%) reported taking pre-natal vitamins at some point during pregnancy

(Table 7.6). In comparison, only 57% of women in the U.S. reported taking pre-natal vitamins (Sullivan et al. 2009).

	N	%
Took Pre-natal Vitamins	134	86.5
No Pre-natal Vitamins	21	13.5
Total	155	100

Table 7.6 Pre-natal Vitamin Supplement Usage during Pregnancy

Delivery by Caesarean-section is extremely rare in urban areas and absent all together in rural areas of Somalia (WHO 2009). C-section is viewed as an unnecessary procedure which puts mothers at risk of death (Beine et al. 1995). In Sweden, mothers reported avoiding prenatal-care because they feared medical professionals would force them to give birth by C-section (Essen et al. 2002). Consequently, Essen et al. (2002) found that 63% of infant and mother deaths were attributed to the refusal of a C-section until it became an emergency situation.

Similar behaviors are not present in the current sample. Thirty-six percent (36%) of mothers reported having a C-section in the U.S., which is comparable to the national rate of 32% (Menacker and Hamilton 2010). None of these were performed out of emergency, even though 40% of these mothers were strictly opposed to the procedure. In addition, Somali mothers indicated that they visited the obstetrician on a routine basis. Of the 153 mothers who responded, 91.5% reported attending more than 8 pre-natal appointments (Table 7.7). This is substantially more than the Somali population in

Minneapolis where just 75% of mothers reported going to at least 5 pre-natal visits (Herrel and Leinberger 2004). Only 6% of Somali mothers in Sweden attended more than 3 visits (Essen et al. 2000). These results indicate that Somali mothers in the current sample are perhaps more acculturated than in other places.

Visits	N	%
3-4	4	2.6
5-6	7	4.6
7-8	2	1.3
>8	140	91.5
Total	153	100.0

Table 7.7 Number of Pre-natal Visits Attended

Breastfeeding plays an important role in proper growth and development. *Exclusive* breastfeeding is beneficial because it promotes stronger immunity, improved physical growth and motor development, increased growth in length and weight, and protection against infant obesity (Mamabolo et al. 2004). In addition, exclusively breastfed children experience lower rates of morbidity (i.e. intestinal and respiratory infections) than other children (Hop et al. 2000; Kalanda et al. 2006). In Somalia, breastfeeding is quite common in rural areas where more than 90% of children are breastfed for longer than 12 months (Ezepue 2001; Ibrahim et al. 1992; Nur and Darnton-Hill 1985). Breastfeeding is not as prevalent in urban areas where less than 10% of children are breastfed for more than 10 months (Nur and Darnton-Hill 1985). Although breastfeeding is common, *exclusive* breastfeeding is rare, even among neonates (Ibrahim et al. 1992). Only 9.1% of children in Somalia are *exclusively* breastfed for at least 6 months (WHO 2009).

In the current study, only 2 of the 154 mothers (1.3%) stated that they did not breastfeed at all for undisclosed medical reasons. Fifty percent (50%) of mothers reported they breastfed for 6 months (Table 7.8). Based on our conversations, it was clear that most were aware that 6 months was the minimum recommended duration (Butte et al. 2002). This is most likely a result of information obtained at wellness checkups. More than 80% of mothers reported taking their children to at least one checkup per year.

Months	N	%
Never	2	1.3
3	1	0.6
4	30	19.5
5	27	17.5
6	77	50.0
7	9	5.8
8	4	2.6
9	1	0.6
12	3	1.9

Table 7.8 Breastfeeding Duration

The percentages of Somali mothers from Somalia, Columbus, and Minneapolis who breastfed for 1, 6, and 12 months are listed in Table 7.9. The U.S. is also included as a comparative reference. At least 94% of mothers in the three Somali populations reported breastfeeding for 1 month. This number was much lower among non-Somalis among whom only 73% breastfed for 1 month. In Minneapolis, 65% of those surveyed breastfed for 6 months and 36% were still breastfeeding at 1 year (Werner 2005). Comparatively, only 1.9% of Somali mothers in Columbus were breastfeeding at 12 months. In both Minneapolis and Columbus, no Somali mother reported *exclusively* breastfeeding their children (Werner 2005).

Population	1 month	6 months	12 months
Somali (Columbus)	98.7%	50.0%	1.9%
Somali (Minneapolis)[a]	94.0	65.0	36.0
Somalia (Rural)[b]	98.0	98.0	95.0
United States[c]	73.8	41.5	20.9

[a] Werner 2005
[b] Ezeque 2001
[c] Scanlon et al. 2007

Table 7.9 Duration of Breastfeeding among Somali and U.S. Children (%)

Within Somali culture, early supplementation to breastfeeding often occurs prior to the recommended period. Between 49% and 90% of children in Somalia are given something other than breastmilk for their first meal (Ibrahim et al. 1992; Nur and Darnton-Hill 1985). Primary foods include cow's milk, sugar water, ghee (clarified butter), honey, and oil (Abdullahi 2001; Ibrahim et al. 1992; Nur and Darnton-Hill 1985). Roughly 40% of Somali mothers in Minneapolis reported supplementing their children's diets during the first 3 days post-partum. Primary supplements were plain water, infant formula, and milk from other animals (e.g. cow and goat). Comparatively, almost 90% of Somali mothers in Columbus stated they fed their children foods other than breastmilk for their first meal (Table 7.10). These foods included formula, dates (juices), honey, and water.

	N	%
Something other than Breastmilk	140	89.7
Breastmilk Only	16	10.3
Total	156	100.0

Table 7.10 Percentage of Children Given Something other than Breastmilk for First Meal

7.2 Comparisons between Socio-economic Conditions and Children's Growth

Somatic growth is the result of interactions between genotypes and the environments to which they are exposed. Environmental factors can be viewed from two, not mutually exclusive, perspectives: biological and socioeconomic. Biological aspects include such things as genes, disease, bacterial infections due to a lack of clean drinking water and adequate sanitation, and changes in climatic conditions. As a bio-cultural group, we utilize culture to buffer ourselves from these external stressors. However, cultural change itself can put a strain on our ability to adapt to our physical and social surroundings (Baker 1984). In this section, anthropometrics on Somali children in

Columbus are examined in relation to cultural practices, traditional and non-traditional, practiced by these mothers.

It was hypothesized that children of mothers who adopted some of the pre- and post-natal practices followed in the U.S. will have significantly greater birth weight, height-for-age, weight-for-age, and body fat than those of more traditional mothers. Further, children in smaller households are hypothesized to show significantly greater body measurements (see Chapter 4 for more discussion). To test these hypotheses, several socio-economic variables were examined to better explain variation in body size and composition. The variables and their justifications are as follows:

1. *Child's Age:* body size is positively associated with age (Bogin 1999).
2. *Income:* body size is positively associated with income. Income influences the quality of diet and to some degree morbidity (Larrea and Kawachi 2005). Above average income allows more diverse dietary consumption and greater access to medical facilities, both of which assist in promoting a positive growth environment (Larrea and Kawachi 2005).
3. *Family Size (or Household Size):* body size is negatively associated with family/household size. As family size increases, the amount of resources available for each child diminishes, possibly resulting in poorer health. This situation is more evident in low socio-economic status (SES) families who have relatively few resources at their disposal (Smith et al. 2002).
4. *Length of time in the U.S.:* body size is positively associated with length of time mothers have been in the U.S. Growth is influenced by environmental conditions both pre- and post-natally. The quality of *in-utero* conditions is

largely dependent on health of the mother (Smith et al. 2002). Greater access to health promoting conditions (i.e. improved nutrition) prior to pregnancy contributes to proper growth and development (Smith et al. 2002). Given the U.S. offers relatively advantageous conditions (see Chapter 4), the length of time mothers have been exposed may influence overall growth of their children.

5. *Pre-natal vitamin supplements:* body size is positively associated with mothers taking pre-natal vitamins. For example, folic acid is critical for proper development of the neural tube (NT). Without sufficient folic acid, birth defects, such as spina bifida, are common (Rosenberg et al. 2003). However, when folic acid supplements are taken in the recommended amount (400µg/day), at least 50% of NT defects can be avoided (Rosenberg et al. 2003). Vitamin D is also important for positive pregnancy outcomes. Vitamin D supplementation helps improve length of gestation and birth weight (Sullivan et al. 2009).

6. *Breastfeeding:* body size is positively associated with breastfeeding. Breastfeeding is beneficial as it improves immunity, motor development, and physical growth in length and weight (Mamabolo et al. 2004).

7. *Vitamin supplements for children:* body size is positively associated with supplementation of essential vitamins. Vitamins A and D influence growth through calcium absorption and bone mineralization (St-Arnaud 2008). Both vitamins are ligands of the Vitamin D Receptor which operates through up-regulation of growth associated loci (Uitterlinden et al. 2002).

Breastmilk is not a good source of these vitamins and therefore, children need to take supplements for proper growth (Wharton and Bishop 2003).

a) Birth weight

Birth weight is a good indicator of environmental conditions experienced by the mother. For example, children who are small-for-gestational-age indicate that the mother's health was poor due to self-imposed or external stressors. Therefore, secular trends in birth weight are valuable in understanding environmental transitions. Since the children in this study are older than 6 months, collecting birth weights relied on maternal recall. Although birth weight was an intended measurement in this study, issues of maternal recall prohibited collection. It was common for mothers to ask their older children about birth weights. Given the mothers were finding it difficult to recall weights, eliminating the measurement from the research was justified.

b) Height-for-age

Results of multiple regression analyses involving the variables outlined above are reported in Table 7.11. Child's age is significantly correlated with height, weight, BMI, arm circumference, and triceps skinfold. In contrast, sex was not significantly associated with any of these measures. Based on these findings, age was included in all analyses to control for its possible confounding effects, while sex was not since it does not contribute appreciably to explaining anthropometric variability.

Child's age alone describes 89.2% of the variability in height within this sample. As expected, a negative association was observed for family/household size, while length of time in the U.S., income, and children taking vitamin supplements showed a positive association. These findings, however, were not statistically significant. Contrary to predictions, both breastfeeding duration and taking pre-natal vitamin supplements exhibited negative associations with height, although breastfeeding duration was not significantly related. Taking prenatal vitamins was expected to be associated with increased body size. This was not the case. Women who took pre-natal vitamins had children who were significantly shorter than children of mothers who did not take prenatal vitamins.

Variable	B	Std Error	p	r^2	r^2 adj.
Sex	-0.239	1.836	0.897	0.000	-0.002
Child's age	7.535	0.139	0.000	0.892	0.892
Family / Household Size	-0.529	3.13	0.093	0.899	0.899
Length of time in the U.S.	0.05	0.097	0.605	0.898	0.898
Income	0.067	0.244	0.784	0.903	0.902
Pre-natal vitamin supplements	-1.985	0.781	0.012	0.902	0.902
Breastfeeding	-0.15	0.192	0.436	0.898	0.897
Vitamin supplements for children	1.07	0.636	0.094	0.900	0.899

Table 7.11 Regression Analyses between Predictive Variables and Height-for-age

c) <u>Weight-for-age</u>

As with height, age was significantly associated with weight, explaining 59% of the variation (Table 7.12). Sex again did not show a significant relationship with weight. Family size showed a significant negative association. That is, as family size increased, children's weight decreased. These findings support expectations. Also in agreement with predictions, breastfeeding duration, length of time in the U.S. and giving children vitamins were positively associated with weight. Of the three variables, only breastfeeding duration was not statistically significant. Income and taking pre-natal vitamins showed a negative association with weight indicating that increased income and taking pre-natal vitamins may have inhibit growth. This was not anticipated since both variables have been reported to promote growth (Larrea and Kawachi 2005; Wharton and Bishop 2003). These associations, however, were not statistically significant.

Variable	B	Std Error	P	r^2	r^2 adj.
Sex	0.082	0.734	0.911	0.000	-0.002
Child's age	2.709	0.119	0.000	0.593	0.592
Family / Household Size	-0.544	0.273	0.047	0.597	0.594
Length of time in the U.S.	0.173	0.084	0.040	0.602	0.599
Income	-0.326	0.214	0.130	0.596	0.593
Pre-natal vitamin supplements	-0.919	0.688	0.182	0.605	0.603
Brreastfeeding	0.179	0.169	0.290	0.595	0.592
Vitamin supplements for children	1.342	0.560	0.017	0.603	0.600

Table 7.12 Regression Analyses between Predictive Variables and Weight-for-age

d) <u>BMI</u>

In contrast to height and weight, age and sex are not significantly associated with BMI throughout the first 7 years (Table 7.13). A negative association was observed between BMI and family size, although it is not significant. Length of time in the U.S.

and providing children with vitamin supplements are, however, significantly positively correlated with BMI as expected. Breastfeeding duration is also positively associated with BMI, but the results are not significant. Interestingly, income and taking pre-natal vitamins showed negative associations with BMI, which is in opposition to established predictions. Similar negative associations were reported for weight. Since weight and BMI are related, it is not surprising that they are in agreement.

Variable	B	Std Error	P	r^2	r^2 adj.
Sex	0.008	0.256	0.976	0.000	-0.002
Child's age	-0.018	0.071	0.796	0.000	-0.003
Family / Household Size	-0.23	0.161	0.155	0.008	-0.001
Length of time in the U.S.	0.131	0.051	0.010	0.020	0.011
Income	-0.314	0.129	0.016	0.021	0.011
Pre-natal vitamin supplements	-0.181	0.419	0.667	0.001	-0.008
Brreastfeeding	0.139	0.101	0.169	0.006	-0.003
Vitamin supplements for children	0.771	0.335	0.022	0.017	0.008

Table 7.13 Regression Analyses between Predictive Variables and BMI

e) <u>Arm circumference and Triceps Skinfold</u>

Along with BMI, arm circumference (AC) and triceps skinfold (TS) are measures of body composition. With the exception of sex and income, the remaining variables show the same associations for both AC and TS (Tables 7.14 and 7.15). Sex is significantly associated with TS. Girls have larger TS measures than boys indicating greater fat mass (i.e. adiposity). As with weight and BMI, conflicting results were observed for income, which was negatively associated with AC. Also of interest are the negative associations between AC/TS and pre-natal vitamin use. Although not significant, these findings conform to the general trend observed in height, weight, and BMI of decreased body size in children whose mothers took pre-natal vitamin supplements. In contrast, AC is significantly positively associated with vitamin supplementation in children. TS shows a similar, but non-significant, association. These results contribute to a pattern seen across all measures of greater size of children who have taken vitamin supplements.

Family size is significantly associated with both AC and TS. As expected, larger families have children who are leaner than those in smaller families. Length of time in the U.S. also shows a significant association with AC and TS. That is, fat mass increases with the amount of time mothers have lived in the U.S. which was predicted. Finally, breastfeeding duration was positively associated with both AC and TS, but only TS showed a significant effect.

Variable	B	Std Error	P	R^2	r^2 adj.
Sex	0.294	0.282	0.296	0.003	0
Child's age	0.704	0.066	0.000	0.244	0.242
Family / Household Size	-0.344	0.148	0.021	0.255	0.25
Length of time in the U.S.	0.101	0.046	0.029	0.262	0.258
Income	-0.191	0.121	0.115	0.253	0.247
Pre-natal vitamin supplements	-0.196	0.381	0.607	0.255	0.25
Breastfeeding	0.144	0.092	0.116	0.254	0.249
Vitamin supplements for children	0.634	0.305	0.038	0.264	0.26

Table 7.14 Regression Analyses between Predictive Variables and Mid-upper Arm Circumference

Variable	B	Std Error	P	r^2	r^2 adj.
Sex	1.604	0.475	0.001	0.160	0.155
Child's age	0.932	0.131	0.000	0.132	0.129
Family / Household Size	-0.661	0.280	0.019	0.178	0.170
Length of time in the U.S.	0.261	0.087	0.003	0.189	0.181
Income	0.005	0.232	0.982	0.161	0.152
Pre-natal vitamin supplements	-0.329	0.753	0.662	0.169	0.160
Breastfeeding	0.387	0.173	0.026	0.181	0.173
Vitamin supplements for children	1.068	0.585	0.069	0.175	0.167

Table 7.15 Regression Analyses between Predictive Variables and Triceps Skinfold

Chapter 8: Discussion and Conclusions

Positive associations between migration to the U.S. from poor socio-political-economic conditions and greater health have been previously reported (Mascie-Taylor and Little 2004). For example, children of first generation immigrants from Europe (Boas 1912; Fishberg 1905), Japan (Greulich 1957; Shapiro 1939), China (Lasker 1946), Mexico (Goldstein 1943; Lasker 1952), and Guatemala (Bogin and Loucky 1997) showed greater height and weight than age-mates in their parent's country of origin. Increases in size likely are attributable to better quality food in larger quantities, cleaner drinking water, adequate sanitation, and access to medical facilities in the new environment (Bogin 2002; Smith et al. 2002).

In addition to improved physical environments, cultural customs influence changes post-migration (Sussner et al. 2008). People share cultural behaviors and ideologies developed to reduce stressors to which they previously were exposed (Sussner et al. 2008). Though these traits are adaptive in traditional settings, they may be of little value or even detrimental in new environments. As such, cultural attributes are important variables contributing to the health of immigrant children (Mascie-Taylor and Little 2004). This study examines the effects of migration on the health of Somali children born and reared in the U.S. utilizing the bio-cultural approach. Previous research, as well as disparities in health indicators between the U.S. and Somali samples inform the hypotheses examined.

8.1 Hypothesis #1

It was hypothesized that Somali children born in the U.S. to first generation immigrants would have greater height and weight than their Somali-born age-mates. Results reported here support this prediction. Both boys and girls born in U.S. were significantly taller and heavier than children from Somalia at every age. On average, boys were 8.23 cm and 11.28 cm taller than Somali-born children measured in 1971 and 2006, respectively. Girls also showed substantial differences, averaging 8.38 cm taller than Somalis in 1971 and 10.9 cm taller than those in 2006. The magnitude of increase in height among Somalis is above any reported for a migrant population. Prior to this study, the largest reported change in migrants occurred among Maya who immigrated to the U.S. from Guatemala in the late 1980s. Bogin (1999) reported that in one generation, Maya experienced an average increase in height of 5.5 cm.

This up to two-fold difference between Maya and Somali immigrants is intriguing. Both populations immigrated to the U.S. following political upheavals. As a minority group, Maya were forced to flee Guatemala in the late 1970s and early 1980s in the wake of governmental collapse (Bogin and Loucky 1997). Similarly, many Somalis were displaced following the onset of inter-tribal conflicts and the ensuing civil war in the late 1980s and early 1990s (Abdullahi 2001). For both groups, nutrition, sanitation, and personal/family safety, were a continual stress that ultimately leads to negative health outcomes (Abdullahi 2001; Bogin and Loucky 1997; Crews 2007).

A possible explanation the greater height response is that the effects of civil unrest were more wide-spread and severe in Somalia than in Guatemala. If so, it would be expected that Somalis experienced comparatively greater deficits in growth. Upon exposure to better environmental conditions, generational 'rebound' may be more pronounced among Somalis. Although possible, this explanation lacks clear support since direct measures of health and environmental differences are not available. However, several indirect measures of health and well-being are available. Life expectancy, death rates, and GDP for both countries may be compared (Table 8.1). Changes in life expectancy are a primary indicator of improving environmental conditions (Bogin 1999). In Guatemala, life expectancy increased by 18 years from 1970 to 2008 (UNICEF 2010). Arguably, the long-term impacts of civil war were moderate since life expectancy increased by 10 years during the two decades there was no effective government (Bogin and Loucky 1997). In addition, the crude death rate decreased by 40% (UNICEF 2010). Guatemala also experienced a positive gross domestic product (GDP) annual growth rate between 1970 and 1990 (UNICEF 2010). Although life expectancy is poor in general, improvements across categories indicate better conditions throughout this period of governmental uncertainty (Bogin and Loucky 1997).

Conditions in Somalia, on the other hand, do not reflect the same improvements (Table 8.1). First, life expectancy in 1970 was already 12 years below that of Guatemala indicating substantially poorer environmental conditions (UNICEF 2010). Since the civil war began in 1991, life expectancy only increase by 5 years (UNICEF 2010). Crude death rates (CDR) were 60% higher in Somalia than Guatemala in 1970, 122% higher in 1990, and 166% higher in 2008 (Table 1) (UNICEF 2010). Between 1970 and 1990, Somalia's GDP annual growth rate was -0.9, while Guatemala's was 0.2 (UNICEF 2010). Based on these indirect measures of well-being, conditions experienced by Somalis over the past 40 years may have been more 'detrimental' than those experienced in Guatemala. Therefore, improved environmental conditions are expected to have greater impact on Somali growth and development.

Life Expectancy (yrs)	**Somalia**	**Guatemala**
1970	40	52
1990	45	62
2008	50	70
Crude Death Rate (per 1,000)	**Somalia**	**Guatemala**
1970	15	24
1990	9	20
2008	6	16
GDP Annual Growth Rate (%)	**Somalia**	**Guatemala**
1970-1990	-0.9	0.2
1990-2008	n.d.	1.4

n.d. = no data

Table 8.1 Indirect Measures of Well-being in Somalia and Guatemala

Another consideration is that Somalis are prone to grow taller than Maya due to local environmental adaptations (Gallo and Mestriner 1980). Somalis may carry genetic predispositions for greater height attainment that is more highly repressed under caloric and nutritionally restricted diets than do the Maya. Thus, children in Somalia may be showing the effects of fetal programming or complete molecular remission (CMR), some of which is unfettered in environments of plenty (Kuzawa et al. 2008). Research on Somalis in countries around the world will aid in assessing genetic potential for growth.

As expected, Somali children in the U.S. were significantly heavier than their Somali-born age-mates. Given possible intergenerational influences, the greater availability of nutrients in the U.S. would be expected to promote weight gain (see section 4.4). Contributing to weight gain in the U.S. are the multitude of dietary options. In the midst of widely available fresh fruits, vegetables, and meat, American dietary choices include many high calorie, high fat, processed foods which are associated with adiposity (Smith et al. 2002). In addition to dietary considerations, physical activity affects the maintenance of adequate weight. Smith et al. (2002) reported that immigrant children in the U.S. often replace physical activity with watching television and playing on the computer. Coupling diets high in calories with sedentary lifestyles likely contributes to unhealthy weight gain among immigrants.

While weight gain is desirable in cases of chronic under-nutrition, excessive weight-gain can be problematic. Obesity is associated with many health issues including coronary heart disease, type 2 diabetes, hypertension, dyslipidemia, stroke, and liver disease (CDC 2009b). Increased obesity has been reported in migration studies involving Maya-Americans (Bogin and Loucky 1997), Hispanic-Americans (Popkin et al. 1996), and Asian-Americans (Popkin and Udry 1998). Obesity in the current Somali sample is lower than that reported in these studies. Based on NCHS 2008 standards, only 16.9% of boys 2-4 years of age and 22.3% of girls 2-4 years of age are considered overweight. Because NCHS standards do not list values for the 95 percentile, assessing how many children are obese is not possible at this time. Thus, the category “overweight” includes those who are obese. As such, it is likely that fewer than 16.9% of boys and 22.3% of girls are obese.

While considerably higher than in children in Somalia (8.2% of boys and 7.4% of girls 2-4 years of age – UNICEF 2006), these figures are substantially lower than among other immigrant populations. For example, nearly 90% of Maya-Americans were either overweight or obese (Smith et al. 2002). It must be noted, however, that the sample of Maya-Americans is based on children 6-12 years of age (Smith et al. 2002). Since the current Somali sample deals with children younger than 6, the percentage of obesity may increase to levels observed among Maya-Americans when they attain the same age range. Early signs of this trend are already evident. The percentage of Somalis in Columbus who are considered overweight increased by 6.4% and 8.5% between ages 2 and 4 in boys and girls, respectively. Further, at age 4, approximately 25% of both boys and girls were overweight. If this trend continues, Somalis may be faced with an obesity problem in the near future.

8.2 *Hypothesis #2*

It was hypothesized that Somali children born in the U.S. would be shorter and heavier, on average, than NCHS standards. Because Somali mothers were born and reared in a less than adequate environment, intergenerational influences may exert themselves by promoting energy retention (i.e. increased body fat) in the children. On the other hand, height may be restricted due to much of the energy needed for proper growth being allocated to increasing fat reserves. Thus, Somali children should have higher than average weights, but lower than average heights. The results of this study support the prediction of excessive weight gain, but do not support the prediction that height will be retarded due to energy retention. In fact, boy's heights are just over the 50th percentile at age 1 and approximately the 75th percentile from 2 to 7 years of age (Figure 6.8). Girl's heights tracked the 75th percentile from 1 to 7 years of age (Figure 6.8). In addition, only 1.6% of the children (3 boys and 3 girls) are stunted. In comparison, more than 21.0% of first generation Maya-American children were identified as stunted during childhood and adolescence (Varela-Silva et al. 2009).

Two explanations may be offered. First, the Intergenerational Influences Hypothesis (IIH) is predicated on mothers experiencing nutritional deprivation as a child, which is often marked by stunting (Varela-Silva et al. 2009). As reported in Chapter 6, Somali mothers included in this study show very little sign of deprivation during the growth period. In fact, only 2 of the 151 mothers (1.3%) are classified as stunted. Although health indicators in Somalia are some of the poorest in the world (WHO 2008), mothers in the current sample appear to have faired well based on long-term growth. As such, the IIH may not be useful in explaining the results of this research.

Second, Somalis are suggested to be a very tall population (Brandt 1988; Hiernaux 1975; Gallo and Mestriner 1980). Compared to other African populations, Somali males are taller than those previously reported (Eveleth and Tanner 1990) (Table 8.2). Somali females are also tall relative to other African populations. Only Tutsi females are taller than Somalis, although the difference is a mere 0.5 cm (Eveleth and Tanner 1990). Although Somalis are tall compared to other African populations, they are shorter than NCHS standards (McDowell et al. 2008). Somali males are below the 25th percentile, while females are between the 25th and 50th percentiles. Since no Somali population has been born and reared to adulthood in an advantageous environment (i.e. developed country), their growth potential is unknown. However, based on information currently available, it is suggested that given better living conditions, Somalis will attain adult heights that meet or exceed NCHS standards. If so, it is possible that Somali children are naturally taller at every age than American children. This may explain why Somali children in the current sample are taller than NCHS standards.

Population	Males		Females	
	Height	Weight	Height	Weight
Somali	170	50	159	49.5
Kenya				
Kitui District	159	44.5	156	46
Machakos	156.5	42	151.5	40
Turkana	154.8	38.1	158.7	38.6
Namibia				
Hottentots	153.4	34.2	154.5	43.8
Rohoboth Basters	164.7	54.7	159	56.2
Rwanda				
Hutu	155	42.6	152.7	43
Tutsi	164.3	45.5	160.5	nd
South Africa				
Soweto	162.1	50.8	157.6	51.9
NCHS Standards	176.6	75.0	162.2	66.0

Table 8.2 Height and Weight Comparisons between African Populations
Source: Eveleth and Tanner 1990

8.3 Hypothesis #3

Socio-economic factors play a significant role in health and well-being. Several cultural variables were examined, including length of time the mother has been in the U.S., breastfeeding duration, giving vitamin supplements to children, taking pre-natal vitamin supplements, and income. As expected, the former three variables were positively associated with greater height, weight, BMI, arm circumference, and triceps skinfold.

Giving children vitamin supplements is a practice adopted by Somalis in the U.S. In traditional Somali culture, vitamin supplements are not considered necessary for proper growth and development (Qayad 2007). The lack of availability of supplements in Somalia is likely a factor. It is important though that Somali mothers are becoming more open to giving their children vitamins. This research demonstrates the positive effect this practice has on children's health. Whether Somali mothers were aware of vitamin supplementation and its benefits prior to coming to the U.S. is not known. However, it is clear that Somali mothers are becoming more educated on and more accepting of medical practices in the U.S.

Counter to the hypothesis, a negative association was observed between taking pre-natal vitamin supplements and height, weight, BMI, arm circumference, and triceps skinfold do not support the hypothesis. Most notabe is the statistically significant association with height ($p = 0.012$). Taking pre-natal vitamin supplements helps ensure the fetus has the nutrients required for proper growth and development. It is expected, therefore, that these children would be healthier at birth (i.e. longer) and throughout childhood. Assessing the children's health at birth was not possible given the absence of data in this study (see section 7.2a). As such, only children's cumulative health can be observed. It is possible that the children were in good health at birth (due in-part to the mothers taking prenatal vitamin supplements) followed by an overall decline. Poor diet, limited exercise, and high morbidity may contribute to such a decline.

It is important to note that taking pre-natal vitamin supplements does not guarantee good health. There are many other factors that influence the health of a fetus such as stress, protein intake, and the consumption of foods/drugs not approved during pregnancy (i.e. caffeine and pain medications). Thus, it may be suggested that mothers who did not take pre-natal vitamin supplements were not educated in recommended pre-natal practices. Though possible, this explanation is not probable. Of those who did not take vitamins, 94.6% reported attending at least 8 pre-natal appointments suggesting a lack of education is not likely. However, whether these mothers followed recommendations is an issue for future research.

A final consideration is the sample distribution between mothers who did and did not take pre-natal vitamin supplements. The majority of mothers (87%) reported taking pre-natal vitamin supplements and therefore, this analysis was based on a highly skewed distribution. Of the 380 children whose mothers responded to questions regarding vitamin use, 324 had mothers who took vitamin supplements. Therefore, sampling error could be creating a spurious association.

Household income was hypothesized to by positively associated with body size. As expected, income was positively related with height. This was not the case for body mass. Although these results do not support predictions, they may be explained not by changes in quantity, but rather in quality. Low-income diets are commonly based on high-energy-dense, fatty foods because they often have the lowest associated cost (Darmon and Drewnowski 2008). High-income diets, on the other hand, include more nutrient-rich, low-energy-dense, healthier foods (Darmon and Drewnowski 2008). Thus, as income increases, the degree of overweight is likely to decrease. The negative associations found in this study may reflect this principle.

8.4 Hypothesis #4

Household size was negatively associated with height, weight, BMI, arm circumference, and triceps skinfold, the latter four of which were statistically significant. These findings are in support of the hypothesis that as family size increases, the amount of resources available for each child decreases resulting in diminished health. This is more evident in low-income households. The median household income in this study is approximately $17,500, which is substantially lower than that in the U.S. Based on 2008 data, the median household income of foreign-born, non-citizens in the U.S. was nearly $38,000 (DeNavas-Witt et al. 2009). Thus, it is expected that each additional member in these Somali households will have a major impact on individual resource availability.

8.5 Study Limitations

As with all studies of this nature, there are inherent limitations to what can be concluded from the data. This research has three such limitations. First, because of issues surrounding individual participation in this research (see Section 5.4), the results are based on cross-sectional rather than longitudinal data. Hypotheses #1, 2, and 4 are not seriously affected by this approach because repeat measures on each child are not required. Hypothesis #3, on the other hand, investigated socio-economic variables which are argued to be causally related to overall body size (i.e. health). A longitudinal approach allows changes in health to be examined in light of observed changes in environmental conditions. Thus, the results are based on a natural experiment. In contrast, cross-sectional data are valuable in identifying the presence of associations, but are unable to derive cause and effect. Since each measurement is a snap-shot in time, it is not possible to suggest a direct connection between the variables in question because of potential confounding factors. Longitudinal data avoids this limitation by tracking both the variable of interest and those which may be influential in the hypothesized relationship.

Second, this study only included Somali children from a single population in the U.S. Although these results are informative about the conditions experienced by those in Columbus, OH, they may not be used to generalize about the impact of immigration on the health of Somali children throughout the U.S. Each Somali population has been exposed to unique environmental conditions and therefore, the benefits of living in U.S. may not be experienced equally across groups. Research on other Somalis in the U.S. will be helpful in making more confident conclusions about the impact of migration on Somali health and well-being.

Third, the representative nature of the sample is a possible concern. Because random sampling was not feasible, an opportunistic approach was employed. To ensure the possible inclusion of participants of differing socio-economic status (SES) and immigration history, it is necessary to select informants from various backgrounds and positions in the community. If the ‘correct’ informants are selected, this approach will generate a reliable, representative sample (Bernard 1995). However, identifying the most appropriate informants is a difficult task, one which may potentially bias the sample. For example, even though the informants are from different areas of the community, they may each recommend initial families who are of equal SES. These families are then likely to recommend other families of similar SES. The resulting bias toward one segment of the population comes at the cost of obtaining data on a more diverse, representative sample. Therefore, the inability to use a more accurate method of sampling (i.e. random sampling) in this study must be considered.

8.6 Conclusions

The ability to adapt to changing environmental stressors is an important hallmark of our past and present. The environment is not a static backdrop onto which we live, but rather is an ever changing, dynamic aspect of our lives. Thus, as we adapt to the environment, it too must adapt to us. The unpredictable nature of this relationship requires the capacity to make adjustments when necessary to ensure survival of parents and their offspring. As such, there is a selective advantage to having increasing degrees of plasticity. Those with sufficient plasticity to adapt to current conditions will likely have more children than those who express no such plasticity promoting the continuation of plastic responses (Pritchard 1995).

Based on this concept, Life History Theory (LHT) posits that due to resource limitations, there is an inherent trade-off between the costs and benefits of allocating more resources to one aspect of fetal growth and development at the expense of others (Worthman and Kuzara 2005). To 'cope' with challenging environmental conditions, energy is often diverted from somatic growth to the developing organs (Bogin et al. 2007; Worthman and Kuzara 2005). The results of this research indicate that Somali-born children are ‘coping’ with resource deprivation, stress, and morbidity through growth restrictions. Following immigration to the U.S., however, Somali children are exposed to better environmental conditions to which less ‘coping’ is necessary. This results in children of greater health as identified by increased body size.

The current study illustrates the degree to which human are capable of adjusting to poor conditions. The difference between Somali-born and U.S.-born Somali children is the greatest reported on any population. In some cases, the difference is more than two-fold that experienced by other immigrant communities (see Chapter 6). These findings demonstrate that humans are capable of enduring severe insults while maintaining reproductive efforts.

Beyond the theoretical considerations, this study demonstrates the impact immigration may have on the health and well-being of these children. In addition to the transition in physical environments, transitions in socio-economic-political environments also contribute to the improvements in health that are observed in this study and others. These findings established a framework which will inform future research on Somali populations in the U.S. and around the world.

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Appendix A: Interview Questionnaire

Research Questionnaire

Parental Information: **DATE:**

1. Date of Birth:
   - Father: _______
   - Mother: _______

2. Father's Occupation: ______________________________

   Mother's Occupation: ______________________________

3. Annual Income:

☐ 0-$5,000	☐ $15,000-$20,000	☐ $40,000-$50,000
☐ $5,000-$10,000	☐ $20,000-$30,000	☐ $50,000-$60,000
☐ $10,000-$15,000	☐ $30,000-$40,000	☐ $60,000 or more

4. Education:
   - Father:
     - Finished High School: yes / no
       - if not, last completed year: _______
     - Attended College: yes / no
       - number of years: _______
       - degree: _______________
   - Mother:
     - Finished High School: yes / no
       - if not, last completed year: _______
     - Attended College: yes / no
       - number of years: _______
       - degree: _______________

5. English literacy:
- Father:
  - speak: yes / no
  - read/write: yes / no

- Mother:
  - speak: yes / no
  - read/write: yes / no

6. Place of Birth:
- Father: ______________________________
- Mother: ______________________________

7. How long have you lived in the United States?
- Years _______, Months ________

8. In what country did you live before you moved to the U.S.? ______________________

9. Where you living in a refugee camp? yes / no
- if yes, how long were you there? ______________________

10. How many people live in your home?

☐ 1-2	☐ 7-8
☐ 3-4	☐ 9-10
☐ 5-6	☐ > 10 How many? ___________

11. Is Somali the primary language spoken in your home? Yes / No
- if no, which language is spoken most often? __________________________

12. How many children do you have? __________
- how many still live at home? __________
- how many were born in the United States? __________

Pre- and Post-natal Practices:

13. Do you believe that healthcare professionals in the U.S. have adequate knowledge about Somali birthing practices (i.e. female circumcision, dislike of C-sections, etc.)? Yes / No

14. Were you worried about giving birth in a hospital in the U.S.? Yes / No
    if yes, why?

15. Have you ever given birth by Caesarian Section? Yes / No

16. How do you feel about Caesarian Sections?

17. Have you ever gone on a strict diet during pregnancy to lose weight? Yes / No

    a) was the weight lose an attempt to reduce the size of the baby to make giving birth easier? Yes / No

        - why did you decide to do this?

18. Have you ever known another woman who died and/or had a baby die during child birth? Yes / No

        - did this affect the decisions you made regarding child birth? Yes / No

        - how?

19. What do you think is the ideal birth size of a baby?

    - weight: _______________ length: ______________

20. Did you visit the doctor during your pregnancy with each of your children? Yes / No

    - if yes, roughly how many times:

        A = 1-2 B = 3-4 C = 5-6 D = 7-8 E = >8

21. In making pregnancy and birthing decisions, did you rely on someone other than a doctor?

Yes / No

-if yes, who?

- ☐ Mother
- ☐ Grandmother
- ☐ Sister
- ☐ Friend
- ☐ Other:

22. Did you take pre-natal vitamins or other supplements? Yes / No

23. Did you practice any Somali cultural customs regarding pregnancy and/or childbirth that were not suggested by a doctor? Yes / No

- if yes, which one(s)?

24. Were your children given any type of food other than breast-milk for their **<u>first meal</u>** after leaving the hospital and if so, what was it. **Ex. of foods: honey, water, water w/sugar, ghee, oil, formula, animal milk.**

<u>Given another food?</u>	<u>What was it?</u>
Yes / No	______________

25. Once you started breastfeeding, when did your children begin to eat other foods besides breast-milk?

<u>At what age?</u>

____

26. What food(s) were given to the children at this time?

27. Do your children currently take vitamins? Yes / No

28. Have your children been taken to the doctor regularly for check-ups and if so, how often.

A = once a month, B = once a year, C = twice a year, D = > than twice a year

<u>Visit doctor regularly?</u> Yes / No