

SPATIAL VARIATIONS AND CULTURAL EXPLANATIONS TO OBESITY IN GHANA

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While obesity is now recognized as a major health concern in Ghana, the major drivers, causal factors, and their spatial variation remain unclear. Nutritional changes and lack of physical activity are frequently blamed but the underlying factors, particularly cultural values and practices, remain understudied. Using hot spot analysis and spatial autocorrelation, this research investigates the spatial patterns of obesity in Ghana and the explanatory factors. We also use focus group discussions to examine the primary cultural factors underlying these patterns. The results show that wealth, high education, and urban residence are the best positive predictors of obesity, while poverty, low education, and rural residence are the best (negative) predictors of obesity. Consequently, improving the socioeconomic status, for example, through higher levels of education and urbanization may increase obesity rates. Furthermore, the cultural preference for fat body as the ideal body size drives individual aspiration for weight gain which can lead to obesity. Thus, reducing obesity rates in Ghana is impossible without addressing the underlying cultural values.

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CHAPTER 1

INTRODUCTION

1.1 Background

Obesity is a major public health problem driving non-communicable diseases in developed and developing countries (WHO 2013; Neupane et al. 2016). The World Health Organization (WHO) estimates that 2.8 million people die each year globally due to complications of obesity and overweight while 35.8 million people suffer disability (WHO 2016). In Ghana, obesity is a major health concern (Ofei 2005) but its major drivers and causal factors and their spatial variation remain unclear. A clear understanding of the geography of obesity in Ghana and the related explanatory factors is crucial to facilitate appropriate and effective intervention.

While nutritional change, physical inactivity, socioeconomic status (SES), genetics, environment, and urbanization are generally blamed for obesity, the findings of recent studies on the role of these factors are mixed. Some studies that used wealth index as a measure of SES found higher rates of obesity in richer households (Steyn et al. 2011; Case and Menendez 2009) but others (Alaba and Chola 2014; Amoah 2003) that used the level of education as a measure of SES reported mixed results. While subjects with tertiary education had higher obesity prevalence than illiterate and less literate, another study found differences in obesity prevalence in men compared to women. With such differences, tertiary education contributed to about 24.4% of the obesity prevalence. Thus, the research findings on the relationship between SES and obesity have been inconsistent.

1.2 Underlying Biology of Obesity

Obesity, the abnormal accumulation of body fat, is measured as body mass index (BMI) – the ratio of an individual's weight to the square of the height (WHO 2016). A BMI ≥ 25 but less

than 30 is classified as overweight while $BMI \geq 30$ is obese. For children and teens, the Centers for Disease Control and Prevention classifies BMI based on age and sex using percentiles, often referred to as BMI-for-age. The reason is that the weight and height of the child varies with age and differs in both sex. Therefore, in the same sex and age group, the BMI at 85th percentile or above but less than 95th percentile is overweight while BMI at 95th percentile and above is obese. Children and teens with BMI less than 5th percentile are underweight while those with BMI at 5th percentile and below 85th percentile are normal.

Several biological factors including early-life experiences, metabolic disorders, genetics, and epigenetics contribute to obesity. Nevertheless, no concrete evidence links obesity solely to these biological factors. Humans expend energy through several biological processes, including cellular maintenance and repair, growth, reproduction, and movement. Such activities, which differ among individuals, result in variation in energy expenditure (Garland et al. 2011). The imbalance between the energy intake and the expenditure coupled with other factors lead to obesity (Ngwa et al. 2015). Increased energy intake with less physical activity (expenditure) results in increased body fat (Speakman 2004). Yet, this alone is inadequate explanation of fat accumulation; other variables such as metabolic disorders, hormonal effects, and xenobiotics play a role. Excess storage of fat in the body leads to the enlargement of individual fat cells that produce a variety of nutrients and peptides leading to obesity. Metabolic disorders such as glucose intolerance and dyslipidemia may produce cell hypertrophy, and ultimately, obesity (Bray 1998).

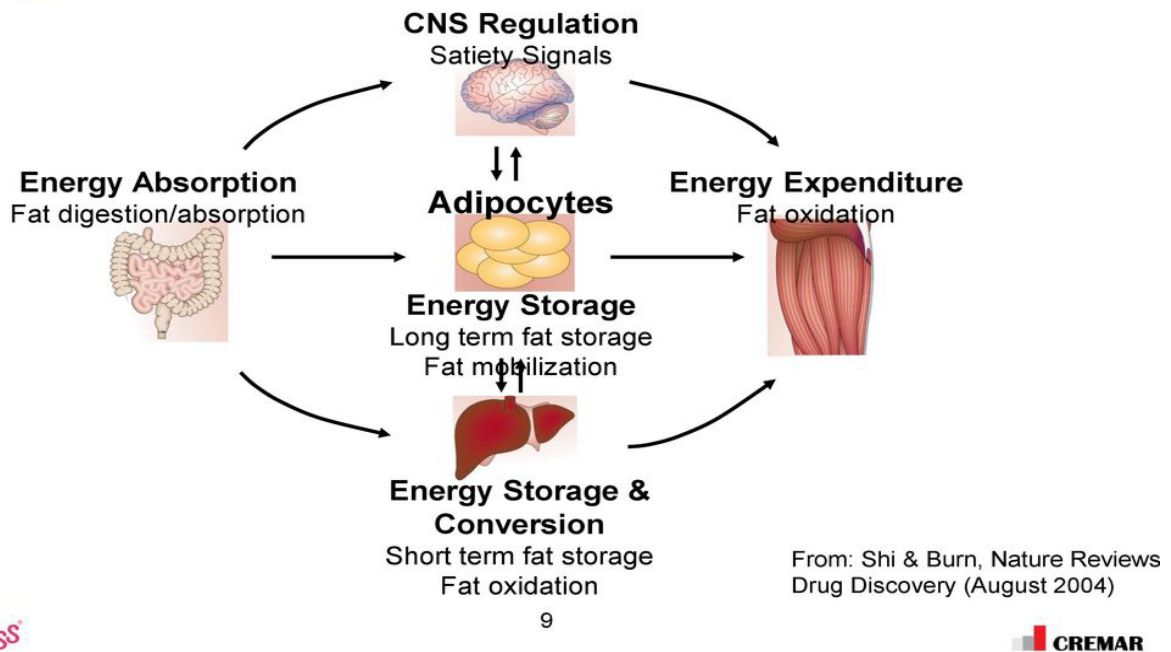
Aging is an important contributor to obesity. As individuals age, growth hormones decline leading to increased, body mass. Thus, individuals with a growth-hormone deficiency may have fat mass compared to those with normal growth hormone. This somehow explains visceral fat in the body as one ages and the increased obesity rates among adults. Additionally, hormonal changes

such as hypothyroidism (which result in weight gain due to slow metabolic activity) and polycystic ovary syndrome (Bray 1998) have the same effect. Any xenobiotic that affects hormonal changes may also cause obesity. For example, induce drugs such as corticosteroids and oral contraceptives may initiate weight gain.

Moreover, genetic background controls body mass and susceptibility to diseases related to obesity (Lyon and Hirschhorn 2005). Epidemiological studies suggest that genetic causes account for about 6 to 85% of obesity (Yang et al. 2007). Nevertheless, the genetic pathways to obesity have not yet been clarified (Ngwa et al 2015). Pérusse, et al. (1998), linked obesity as a clinical feature to several Mendelian disorders such as Bardet-Biedl and Prader-Willi syndrome. Gene mutations also account for obesity. For example, defect in the production and processing of proopiomelanocortin (POMC) which produces MSH (α melanocyte-stimulating hormone) and thyroid hormone receptor- β^{13} have been associated with obesity (Krude et al. (1998); Vaisse et al.2000). Among several genes, the transcription factor 7-like2 (TCF7L2) has been shown to relate to both obesity and diabetes (Moon et al. 1997). Depending on the population, the genetic factor underlying obesity may vary due to polymorphism. Finally, genetic drift and founder effect may provide a significant explanation in the variation of obesity population within a specific geographic location.

Figure 1 shows a simple cycle of food intake and expenditure in the body. This cycle explains the basic occurrence and tendency of obesity within the human body. As the Ghrelin hormones signals the brain of hunger, after food intake and digestion, the incretin hormone in the epithelium of the small intestine stimulates the pancreas to release insulin into the blood stream. Insulin is released and glucose moves through the body cells and expend during physical activities such as body exercising. The hormone leptin in the adipose cells and the liver play an important

role in the food intake and expenditure cycle. The leptin controls inhibits the intake of more food into the body while the liver controls the level of insulin and blood glucose. However, any damage or defect in these hormones and body parts may affect the cycle and can lead to accumulation of body fat in the body resulting in obesity.



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Figure 1: Simple biological understanding of fat storage and expenditure (Shi and Burn 2004. Natural Reviews Drug Discovery).

Obesity has been linked to several diseases. High BMI elevates the risk of diabetes mellitus, coronary heart disease, and stroke (WHO 2016; Mokdad et al. 2003). Other studies relate obesity to cancers of the endometrium, breast, prostate and kidney (WHO 2016; PubMed 2017). Obesity is also implicated in gestational diabetes, pre-eclampsia, still birth, miscarriage, and congenital anomalies (Leddy et al 2008; Lash and Armstrong 2009).

The epidemiologic transition theory is an evidence to the occurrence of obesity patterns in developing countries. This theory emphasis on the complex changes in the patterns of health and disease and their determinants and consequences among populations. In the early stages of the

transition, mortality and fertility are key factors relating to population change in this theory. The transition is marked by a shift and an ultimate decline in mortality and disease patterns (Omran 2005). Infectious diseases are replaced by degenerative diseases, which are the leading causes of death. Historically obesity was predominantly found in economically advanced countries where non-communicable diseases were the leading cause of morbidity and mortality. Underweight was typically found in developing countries where communicable diseases dominated. Advances in medicine and technology have changed the disease patterns in both developed and developing countries. More medical treatments and therapies have evolved in solving difficult medical situations. For example, surgical and genomic therapies used in diagnostic and treatments. This however, affects the life expectancy. The population will have longer life expectancy. In developing countries, these treatments are minimizing infectious diseases. For example, the use of mosquito repellent and advanced malaria drugs are helping to reduce malaria infections. In addition, high technological water treatments for providing health water has emerged in developing countries, which has led to decrease in waterborne diseases. Nevertheless, the advanced technology has also made available unhealthy manufactured products such as BPA plastics and materials in developing countries. Technological devices such as microwaves also produce radiations unhealthy for the body. These are causing diseases such as cancers, which were not predominantly known in the developing countries. Lastly, the improved socioeconomic status as one determinant of the epidemiologic transition theory, in developing countries has paved way for access to advance in technology these countries. As the SES continues to improve, the environment will change, for example, the food environment-access to unhealthy manufactured foods causing the possibility of developing countries to encounter degenerative diseases.

Although the above-mentioned factors contribute significantly to the increase of obesity, some non-communicable diseases at least have genetic component of susceptibility. Examples of such diseases are diabetes, cardiovascular disease, and obesity. These heritable traits are influenced by some environmental factors especially in the developmental stages of life resulting in the disease (Gluckman et al. 2007). Alterations in gene expressions may influence the risk of obesity. For example, maternal overweight tends to affect energy regulation of the body in infants. These expressions may pass on to generations even in the absence of the overweight (WHO 2017). Environmental influence can trigger these expressions phenotypically in an individual. This explains the concept of maternal effect in comparative biology, which proves that environmental influence on first generation may be observed in the next generation (Mousseau et al. 1998).

In addition, environmental influence on early-life nutrition and In-utero also accounts for the significant changes in the health of an individual. Nutritional quality and quantity prior to birth and in the early stages of the infant affects immune function, energy regulation, and storage of fat (Bruce and Hanson 2010). For example, Iron and Vitamin B12 deficiency during pregnancy may results in anemia, which in turn, causes low birth weight in infants. These infants in later life may be vulnerable to metabolic disease and experience abdominal adiposity (Schellong et al. 2012). Obesity or overweight can also be passed on to the offspring if the mother, during pregnancy, is overweight or obese (Bruce and Hanson 2010; Schellong et al. 2012). Undernutrition is one of the public health problems in Ghana. Based on the above evidence showing the genetic bases of obesity, the high prevalence of NCDs and undernutrition in Ghana may result in a high obese population which poses threats to many lives.

1.3 Problem Statement

In Ghana, obesity has been associated with urbanization and related changes in diet,

adoption of sedentary lifestyle, westernization, and environmental pollution. Increased consumption of refined foods such as sugary drinks, reduced physical activity, and increased sedentary lifestyles such as watching movies and playing video games – major features of urban living – promote obesity. In a survey report from the Ghana Statistical Service reported that about 77% of urban households have access to television compared to 47% in the rural areas; also, mobile phone use is 95% versus 85% in urban and rural areas respectively (GSS 2017). Currently more Ghanaians live in the urban than in rural areas and urbanization is expected to increase even more rapidly (FAO 2004). Thus, given the higher rates of obesity in urban areas and the expected further escalation of urbanization, it is important to understand the values and structures that promote obesity and, particularly, their rural-urban differences.

Other studies have argued that one important environmental factor, cultural practices and values, greatly affects the socioeconomic differences in overweight and obesity (Gupta et al. 2012). For Ghana, culture plays an important role in the society. For example, traditions and culture are more highly honored than national laws; traditional leaders are more revered than government officials. Despite the influence of globalization on Ghanaian culture, certain basic traditions such as perceptions regarding food preference, beauty, wealth, and good health have not changed. Being fat is associated with wealth, beauty, good health, and success. Therefore, most Ghanaians, including the poor, aspire to be fat in order to improve their standing in the society (Amoah 2003; Prentice 2005; Appiah et al. 2014). Consequently, as socioeconomic status (SES) increases in such populations, the desire to be fat also increases. Many Ghanaians with high SES may have all the resources (access to a gym, health food and clean water, health facilities, etc.) and knowledge (health education) to hinder obesity but these cultural barriers may prevent the use of such resources.

Evidently, available studies and reports show the rise in prevalence of obesity and an increasing rate of non-communicable diseases particularly diabetes in Ghana. Findings from these studies all prompts serious attention on addressing the issue of obesity owing to the growing urbanization. This means increasing urbanization increases poor diet, physical inactivity (use of technology devices), and therefore, obesity.

Nationally, the prevalence of adult (18years and above) obesity varies across regions, by other sociodemographic characteristics, and among ethnicities (Biritwum et al. 2005; Ofori-Asenso et al 2016; Minicuci et al. 2014). Among the adult population, 43% are either obese or overweight. Across the regions, the Greater Accra, Ashanti, Central and Northern have the highest obesity prevalence of 55.2%, 43.4%, 36.9%, and 32.4% respectively (Ofori-Asenso et al. 2016). The explanation to such variation in regards to these variables remains unclear. To address this gap this research explores the spatial variation of obesity and malnutrition in Ghana using statistical and spatial analysis and focus group discussions, to probe the explanations for increasing obesity.

1.4 Research Question/Hypothesis

The main question of this research is “what is the underlying factor that drives obesity in Ghana? To give direction to the study, the hypothesis is that cultural values and practices play a major role in the increase of obesity. They serve as a platform that cushions other obesity contributing factors such as SES, nutritional change, and physical inactivity.

1.5 Objectives

To answer the main research question, the study will address these two objectives:

- To examine the spatial variation of obesity and overweight in Ghana.
- To explain the effect of culture on obesity.

1.6 Significance of the Study

The result will provide important insights for addressing the emerging obesity epidemic in Ghana. Considering public health interventions concerning eradication of NCDs, this study may provide insights for targeting interventions. Lastly, documented report from this study as publication will contribute to previous literature on obesity. Methods used may also be applied to other health related issues in a geographical area.

CHAPTER 2

LITERATURE REVIEW

This section identifies previous studies and the possibility for future studies that are relevant to the topic of obesity in Ghana. The concentration of this study is in the field of Public Health, Biology, Statistics and Geography. However, the focus of the review will outline the drivers, effects, and spatial distribution of the prevalence of obesity. This review will present a fuller understanding of how different factors play a role in the prevalence of obesity. Also, the review will provide some ground work for the future direction of obesity research.

2.1 Drivers of Obesity

Different studies have looked at several variables to explain the causes of obesity in order to alleviate its consequences. All these causal factors can be grouped under the following headings: social and demographic, behavioral, environmental, and biological.

2.1.1 Social and Demographic

Many researchers have identified socioeconomic status as a key agent in the sociodemographic. According to these studies, variables such as age, gender, and education explain the trend and extent of obesity among populations. Exploring studies that use such variables will contribute immensely to this study.

2.1.1.1 Socioeconomic Status/Poverty

Most studies link the prevalence of obesity in Ghana to the earlier mentioned demographic factors, but the underlying role of cultural values and practices remains obscure. According to Desalew et al. (2017), high socioeconomic status, high consumption of sweetened foods, less physical activity, and sedentary lifestyle account for the high prevalence of obesity among private

school children. Likewise, Agyemang et al. (2016) examined the relationship between overweight and obesity and non-communicable disease and found that obesity was higher among populations with higher socioeconomic status living in urban areas. Similarly, Ziraba et al. (2009) reported higher rates of obesity and overweight in both the poor and the rich but much higher rates in non-educated women. In fact, different studies have shown variations in results using residence, educational level, household wealth index, and employment as a socioeconomic measure (Fezue et al. 2006; Agbeko et al. 2013; Amoah 2003; Anyanwu et al. 2010). Thus, there seems to be a consensus that socioeconomic status is a very important driver of obesity.

2.1.1.2 Gender and Age

Generally, obesity rates vary by sex and age. Various studies report higher rates among females compared to men. For example, Seidell's work on the epidemiology of obesity suggests that the prevalence of obesity is equally high in men and women. But the prevalence to be about 1.5 to 2 times higher among women than in men in countries with relatively low gross national product (Seidell 2005). Globally UNICEF estimates that 41 million children under 5 years are obese and overweight children (UNICEF 2017). Though the increase of obesity is higher in adults, child obesity is rapidly increasing globally (WHO 2015; Desalew et al. 2017; Pienaar 2015).

In Sub-Saharan Africa, obesity rates are higher among women compared to men. For the population older than 15 years, only two out of 46 countries had an obese male population of more than 10%, while the female obesity rate was above 10% in more than 17 countries (WHO 2010). Similarly, Cois and Day (2015) reported higher rate of change in increase in BMI in women than in men. Nevertheless, in Ghana, the rate increased from six times more in women than men in 2006 (Prentice 2005), to about eight times more in 2013 (Pereko et al. 2013). Similarly, in rural

and urban Accra, Amoah (2003) suggested that overweight and obesity rates were higher in females compared to males (14.1% vs. 23.4%).

A review of six papers showed that increase in obesity declines after age 64 years, yet varies in both females and males. Nevertheless, obesity declines after age 64 years in women and remains constant after age 45 years in men (Agyemang et al. 2015). This may explain the ages of females used in the demographic survey data for this study, thus from 15+ to 49 years.

2.1.1.3 Education

Obesity occurs among the educated as well as the less and non-educated population. Regardless, some reports show decreased obesity rates in educated women (secondary or tertiary level) compared to those with no formal education. Importantly, in their work, the increase in obesity in those with less than or only a primary education was 45-50%, and below 10% for the highly educated (Ziraba et al. 2009). In Nigeria, a study among Igbos suggested a negative relationship between higher educational level and obesity (Anyanwu et al. 2010). Among Ghanaian women, Agbeko et al. (2013) observed the risk of obesity and overweight to be two times more than in those with no formal education.

2.2 Behavioral Factors

Various lifestyles and everyday routines can contribute to an individual's health issues. The life you live, the people you associate with, and where you live may be determinants of your health status. For example, it is very likely for a normal body sized individual living with a group of fat people to become fat. This is because the thought of being abnormal among such people may influence the urge to eat more and increase body mass to be commensurate with peers. Our everyday activities may somehow become a habit over a long period, which in turn becomes a lifestyle. Behavioral factors that may cause obesity include lifestyle and habits.

2.2.1 Lifestyle and Habits

Most unhealthy behaviors that lead to obesity may not always be based on conscious decisions, but may be involuntary. Continuous and reinforced responses to the changes in the immediate environment may lead to such behaviors that become habits and lifestyle (WHO 2017). According to Agyemang et al. (2015), consumption of unhealthy food and alcohol, sedentary lifestyle, and smoking are associated with obesity. Thus, high calorie intake, excess fat intake, low vegetable and fruits consumption contribute to weight gain (Manyema et al. 2014; WHO 2005). Other studies indicate that the intake of foods high in fat, salt and sugar is increasing. Therefore, a low intake of micronutrients along with a sedentary lifestyle increases in the risk of obesity (Alemu et al. 2014; Karnika and Kanekar 2012). Shayo and Mugusi (2011) point out that there is a lower risk for obesity among individuals that engage in vigorous activities than those who do less physical activities. Lastly, eating disorder attitudes have a strong relationship with body image satisfaction, leading to high BMI. In South Africa, an urban cross-ethnic study in girls recorded higher BMI and an increased risk of eating disorder among black adolescent girls compared to white girls (Gitau et al. 2014). A comparative study among Non-Caucasians and Caucasians also revealed eating disorders in black girls due to body weight concerns (Le Grange et al. 1998). The habit of an eating disorder may increase body weight and lead to obesity.

Alcohol consumption and smoking have also been associated with obesity but not successfully proven as factors of obesity. In fact, previous studies have shown these substances to have both positive and inverse relationships with obesity. In Ghana, Agbeko et al. (2013), women who consume alcohol were 1.37 times more likely to be overweight and obese than non-drinkers of alcohol (Agbeko et al. 2013). In contrast, in Malawi, non-drinkers of alcohol were more likely to be obese than current drinkers (Msyamboza et al. 2013). In the same study, non-smokers were

24% more likely to be obese than current smokers (Msyamboza et al. 2013). Interestingly, Biritwum et al. (2005) a study showed obesity rates to be lower among daily smokers than those who did not smoke (Biritwum et al. 2005). Similarly, in Ghana, among a sample of 2,014 adults, the BMIs of men who consume alcohol and smoke were lower than those who do not drink alcohol or smoke. In addition, BMI was lower in women who chew tobacco (Nonterah et al. 2018).

2.3 Environmental Factors

Factors that change the environmental setting contribute to the obesity epidemic. Because most of the world's population reside in urban environments, qualitative and quantitative changes in food production and availability, along with other environmental factors influence population health. These factors result in increasing universal access to unhealthy foods and also influence the nutritional status of entire populations, as well as individuals, ultimately causing obesity. Urbanization plays an important role in such effects due to its ability to improve or worsen nutritional problems. Other factors such as culture also define the populations in the environment. Changes in culture may have a significant effect on populations, and in turn, on the environment. For example, a change in cultural perception on active occupation (farming) results in decreased organic food production exposing individuals to unhealthy food as the most readily available source of food energy.

2.3.1 Urban and Rural

In many Africa countries, urban populations have a higher rate of overweight and obesity than rural populations (Agyemang et al. 2009; Abubakari et al. 2008; Amoah 2003; Kandala and Stranges 2014) as illustrated in Figure 2.

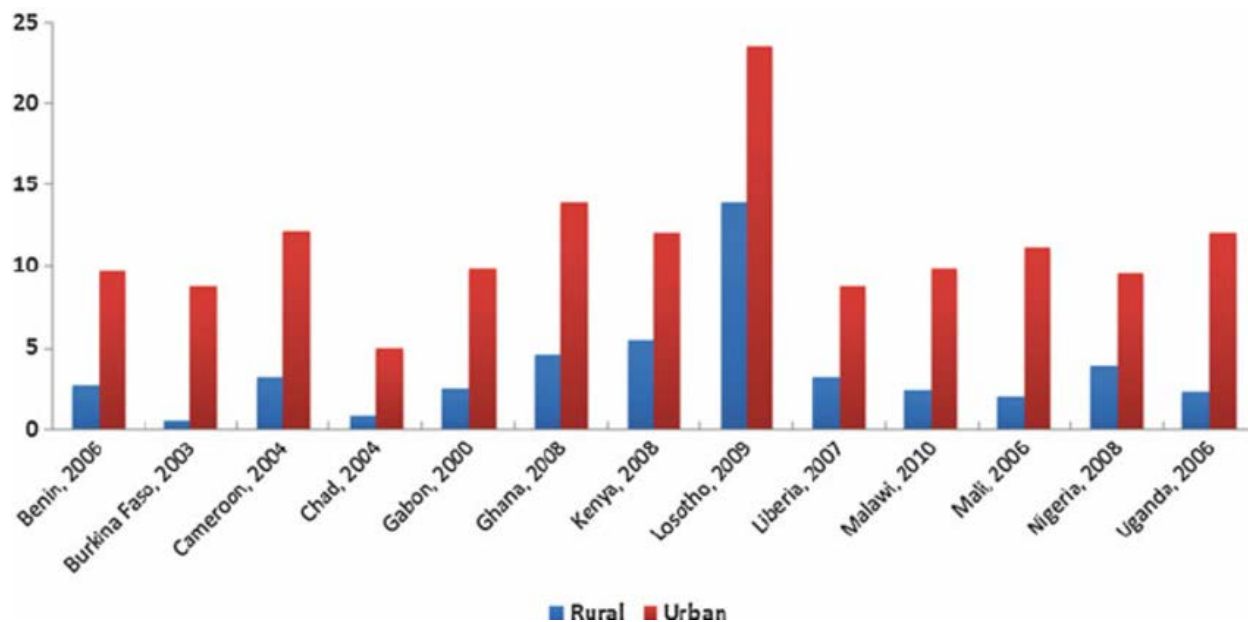


Figure 2: Prevalence of obesity by rural and urban residence in selected African countries (Source: WHO Global InfoBase). The year represents the period the study was done.

Figure 3 which summarizes rural-urban differences in overweight, obesity, and underweight trends among Ghanaian women (age 15 to 49), reveals that urban residents were more likely to be overweight but less likely to be underweight (Doku and Neupane 2015).

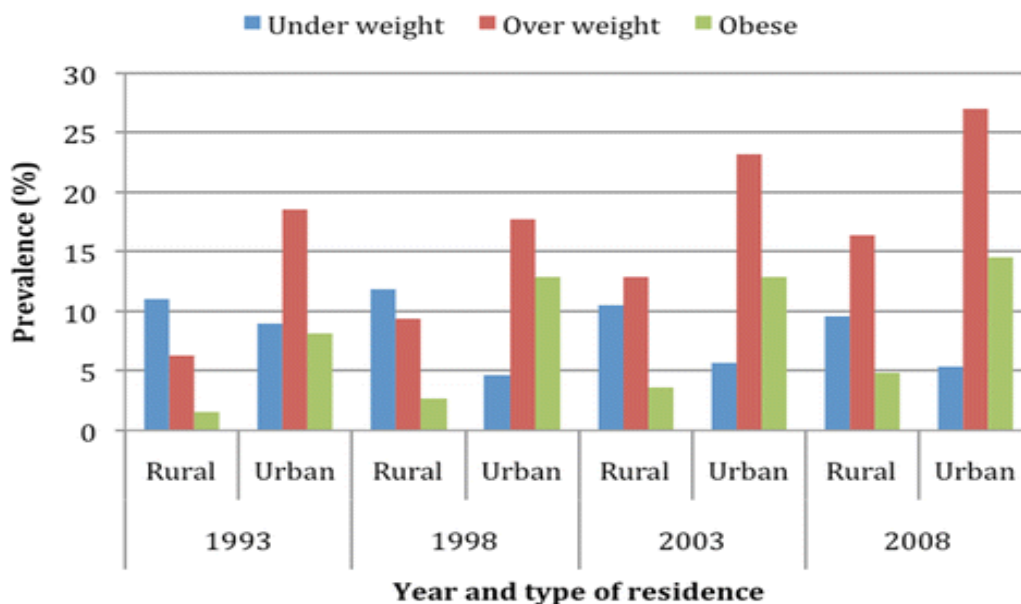


Figure 3: Prevalence of underweight, overweight, and obesity by year of survey and type of residence (Doku and Neupane 2015)

Biritwum et al. (2005) showed that though the nation's obesity prevalence is moderately high, it is very high in the capital city of Ghana (Greater Accra-Urban). The rates of obesity were higher among women in urban dwellings, though this result varied with age (Dake et al. 2010). The work of Benkeser et al. (2012) to determine if the perception on ideal body size of women in Accra influences current body size showed no difference among the 2,814 urban-dwelling women aged 18 years and above studied. About 31.5% of the total 828 participants were a normal weight, while 3.6% (95), 27.8% (730), and 37.1% (973) were underweight, overweight, and obese respectively.

Indeed, most studies have shown higher rates of obesity especially in urban women. Yet, there are also disparities. The rate of obesity differs with education, wealth, parity, marital status, and age (Biritwum et al. 2005; Ziraba et al. 2009; Doku and Neupane 2015; Amugsi et al. 2017). Due to poverty, the poor urban population may not have the financial ability to support a healthier lifestyle while the rich can afford such healthy living. In addition, women married with children may be more obese than those not married and without kids (Doku and Neupane 2015; Benkeser et al. 2012). These examples can also explain the prevalence of obesity among both the poor and the rich. Thus, the poor uneducated women will have more kids compared to an educated rich woman. On the other hand, the rich will have less physical activity compared to the poor, which could also lead to a greater chance of obesity. For instance, rural dwellers engaged more in non-mechanized agriculture and are more likely to have a vocation that involves physical activity (Monda et al. 2008). Thus, the rural-urban disparities could relate to the differences in lifestyle, diet, and nature of occupation.

2.3.2 Cultural Aspects

A shift in perception and attitudes influence traditional barriers paving the way for

interventions that promote a healthy life (Prioreshi et al. 2017). Given this, cultural values and practices play an important role in the promotion of health, such as combating obesity. The problem of obesity in most West African women relates to the social desirability for an overweight appearance, which in turn directs the correlation between obesity and socioeconomic status (Jackson et al. 2005; Fezeu 2005). Documented evidence shows that historically, some African ethnic groups embrace cultural practices that endorses obesity among women (Brink 1995). This study, however, proposes an argument that the underlying factor in the increased obesity rates and prevalence in West Africa is the societal desire of weight gain facilitated by high socioeconomic status and availability of food coexisting with less physical activities (Benkeser et al. 2012).

In Ghana, a study by Duda et al. (2007) used culturally specific silhouettes to survey women in the urban areas of Ghana. The objective was to know whether improved health outcomes would affect these women's willingness to change their current body image. The result was positive since the majority would prefer a normal body weight, but this sentiment varied with age. Nonetheless, the majority agreed with this change on the condition of their husband's acceptance or the actual improvement of their health.

The cultural and societal stigmatization of being slim (normal weight or underweight) in Ghana also poses a threat to weight loss. Underweight or normal weight is associated with (HIV or tuberculosis (TB). Large or fat body size shows prosperity, beauty, happiness in marriage, and good health (Appiah et al. 2014). Thus, individuals often desire to gain weight to avoid such stigmas. This shows how some ingrained cultural values in Ghanaian homes affects body weight.

2.3.3 Globalization

Due to globalization, an increasing number of fast food joints and other western diet and food practices are proliferating in the urban areas of Ghana. Eating such western food is currently

associated with wealth and social success and businesses selling such food are booming. Similarly, climate change affecting agricultural activities is leading to food shortages, economic crisis, and increased food prices. The problem is especially severe for urban residents who rely mostly on fast and manufactured foods. In contrast, the rural residents may have less farm produce to feed on and will be unable to afford fast foods. Such a situation does not only lead to obese urban population but also a rather malnourished rural population.

Recently, the global estimate shows that in every three persons, one suffers from at least one form of malnutrition: obesity or overweight, wasting, and stunting (WHO 2017). Areas with high obesity also have pockets of undernutrition in Ghana. Nutrition is an important determinant of healthy life and development therefore; improper feeding may result in several health-related nutritional problems such as low birth weight, risk of metabolic disease and abdominal adiposity associated with obesity later in life (Schellong et al. 2012; Godfrey et al 2016). Genetics, gender, physical environment factors, and culture have been shown to be associated with high risk of obesity (WHO 2005; 2004).

2.4 Biological Factors

Influence of biological factors does not only affect the individual but also larger populations. Effects from the onset of developmental stages may contribute to obesity in early and late life. Environmental effects may affect the individual's biological makeup. Poor nutrition, long-term exposure to contaminants, nutrient deficiencies, and heredity issues can all further be grouped as early-life experience, genetic and epigenetic characteristics.

2.4.1 Early-Life Experience

Changes during pregnancy can affect fetal development. For instance, Baker hypothesizes that in utero fetal programming explains why size at birth relates to the risk of developing disease

in adult life (Barker 1990). Further evidence also demonstrates the relationship between childhood obesity and maternal obesity in the first trimester of pregnancy. The study showed that at ages 2, 3, and 4, the risk of obesity associated with maternal obesity were 2.0 (95% confidence Interval, 1.7-2.3), 2.3 (95% CI, 2.0-2.6), and 2.3 (95%CI, 2.0-2.6) respectively (Whitaker 2004). Another study also supports a direct relationship between birth weight in early life and BMI in late life (Oken and Gillman 2003).

Nutritional deficiencies can also be transferred to the fetus affecting developmental growth. The adaptation of the fetus to nutrient supply from the mother through the placenta may change the physiology and metabolism of the fetus. A nutrient deficit or excess may result in these changes. The process underlying the in utero fetal programming explains such relationships. This programming reveals whether a fetus will have a high risk to diseases in later life. Therefore, a child from an obese mother has the likelihood to be obese (de Boo and Harding 2006).

2.4.2 Genetic and Epigenetic

The cause of obesity is comprised of different factors, involving genetic interactions of an individual, genetic predisposition, environmental variation, diet, and individual behavior (Campion et al. 2009). Mostly, previous works have focused on the socioeconomic point of view, energy intake and expenditure, and the individual lifestyles. However, recently, the emerging genetic approach to the cause of obesity considers gene mutations, polymorphisms, and the use of the thrifty gene hypothesis (Marti et al. 2008). Among these approaches, it is becoming evident that an important contributor to the differences of obesity in individuals depends on epigenetic factors (Campion et al. 2009).

Epigenetics relates to the inheritable changes in gene expression without change in the DNA sequence of the gene. The processes involved in the regulation of expression include DNA

methylation, chromatin folding, and covalent histone modifications (Campion et al. 2009). Epigenetic changes are tissue specific through which the above processes mediate biological processes such as imprinting. Genomic imprinting occurs when there is an alteration in the parental DNA during gametogenesis resulting in the silencing of one of the gene's parental allele and expression of the other throughout embryonic development (Herrera et al. 2011). Most imprinted genes are growth factors, and are related to cell differentiation, embryonic metabolic functions in embryonic and fetal development (Smith et al. 2006). Examples of imprinted genes from both mother and father are IGF2 and H19 respectively.

Obesity occurs because of imprinting failures by altering gene expressions such as growth factors. These failures are due to paternal disomy, duplication, hyper/hypo methylation etc. (Herrera et al. 2011). For example, in Prader-Willi syndrome, there is a paternal deletion at 15q11-q13, which results in early onset obesity caused by hyperphagia. Another example is the disruption of imprinting at the GNAS gene (20q13.11) (Shapira et al. 2005; Butler 2009).

Adverse environmental effects (toxins, chemicals, unhealthy diets, etc) causing gene modifications, can be transferred from both parents to the offspring by imprinting. Studies have used twins in estimating the heritability of body mass index in children and adults (Stunkard et al. 1986; Malis et al. 2005). Furthermore, Rice et al. (1999) also showed that obesity has been associated with different genes at specific ages among a Swedish obese population. In addition, using mouse models conclusively shows genes can contribute to obesity (Brockmann and Bevova 2002).

Recently, there are also emerging toxicological studies trying to explain the role of toxins in the obesity epidemic. For instance, some animal studies show that the exposure to prenatal nicotine results in postnatal weight gain (Levin 2003). Again, a cross-sectional and cohort study

by Toschke et al. (2002) demonstrates the relationship between childhood obesity and smoking during gestational period. Lastly, Bailei-Hamilton (2002) argues that genetic changes did not have to be rapid to cause obesity though genetic predisposition plays a part. However, this study assumes environmental changes coupled with other factors cause obesity. This work states that lower doses of several toxic chemicals such as polychlorinated biphenols and organophosphate cause weight gain.

2.4.3 Nutritional Change

With the global nutritional change from a diet of high nutritional quality to those in low poor diets, recent studies (Agyemang et al. 2016; Manyema et al. 2014) attribute obesity to poor diet intake. Less consumption of fresh fruits has been associated with the high risk of being overweight and obese (Biritwum et al. 2005). In addition, high calorie-dense food consumption has been associated with obesity (Manyema et al. 2014). For example, Nuepane et al. (2016) attribute the disparities in overweight and obesity in urban and rural areas to differences in diet. Obviously, because rural residents do have better access to fresher farm foods than urban residents they tend to eat relatively healthy diets, although seasonal variations in food availability may be a problem in rural areas. Thus, according to Nuepane et al. (2016), disparities in overweight and obesity in urban and rural areas relate to differences in diet.

2.5 Obesity And Non-Communicable Disease

Obesity poses various threats on an individual ranging from short term to long-term effects. Non-communicable diseases including hypertension, diabetes, and heart diseases are the major obesity-related problems.

Now both infectious and non-communicable diseases are health challenges in Ghana. Evidence from researchers has shown an increasing non-communicable burden in Ghana. For

instance, a review of population-based study on hypertension showed a conclusive result on hypertension increase in the future based on eleven hypertension studies (from 1973 to 2009). Based on this study, hypertension was higher among urban residents compared to the rural residents. Moreover, the related causes were family history, high body mass index, increased salt, and excessive alcohol intake (Addo et al. 2012). In a similar study, Anderson (2017) used descriptive statistics to analyze the prevalence of anemia, overweight and obesity, and undiagnosed NCDs (Hypertension and Diabetes) among residents in some communities in Takoradi and Cape Coast in Ghana. The study also suggested a high prevalence of the above health conditions, thus, out of 976 participants (37.9% males; 62.1% females; age 18+) almost half (47.8%) were overweight/obese. Concerning diabetes and hypertension, about 34.0% total (males 28.8%; females 37.8%) were diabetic, while 27.0% total (males 28.2%; females 26.2%) were hypertensive (Anderson 2017).

Lastly, evidence shows that an increased risk of cardiovascular disease, hypertension, diabetes, stroke, and hypercholesterolemia results from obesity (Agyemang 2006; Atkins et al. 2012; Medeiros et al. 2012). Increasing levels of obesity in Ghana also potentially increases NCDs.

2.6 Spatial Distribution and Prevalence of Obesity

Since 1990, there has been an increase in obesity throughout Africa but the rates differ according to regions around the continent. During 1990, overweight rates were highest in Northern Africa and lowest in Western Africa (Agyemang et al. 2016). The prevalence of obesity in West Africa has increased in the past decade and continues to increase in the 21st century (Benkeser et al. 2012). A recent review study reported that the obesity rate has increased about 10% from 2000 to 2004 in West Africa (Abubakari et al. 2008). However, the increase has been modest from 1990 to 2015 in Western Africa (Agyemang et al. 2016).

The increase in prevalence of weight issues also differs among the various countries within regions. For instance, in Ghana a study by Doku and team used logistics regression to conclude that the overall overweight and obesity increase among Ghanaian women was (13.2%, 95% CI=12.22-14.18 in 1993 to 31%, 95% CI=29.71-32.29 in 2008). The result revealed this increase among urban women (Doku and Neupane 2015).

Furthermore, Biritwum et al. (2005) confirms the increase in the prevalence of weight issues in the study of the epidemiology of obesity in Ghana. The study used a random sample of 5,000 adults aged 18 and above to analyze the epidemiology of obesity in the country. Results showed a 5.5% obesity prevalence increase overall, 7.4% higher in females compared to 2.8% in males. In a systematic review and meta-analysis, Asenso et al. (2016) also estimate the national prevalence to be 43% among a population who is either overweight or obese thus, 25.4% (95% CI 22.2–28.7%) and 17.1% (95% CI= 14.7–19.5%) respectively. Significantly, the prevalence was higher in women than in men and regionally in urban areas (Ashanti and Greater Accra regions).

The description and analysis of variations in disease among population in a geographic area depend, not solely on epidemiology, but also spatial epidemiology. Spatially, the prevalence of obesity is higher in the Greater Accra (capital) and lowest present in the Upper East and Upper West regions of the country (Biritwum et al. 2005). In a similar study, Dake (2012) uses spatial analysis (spatial clustering) in BMI among women to help explain the trends in health inequalities across different contexts and population groups in Ghana. At the regional scale, the study showed a high occurrence of overweight in urban areas, and most clusters were at the southern sector compared to the other sectors. Again, women living among overweight women in these clusters were more likely to be overweight. The study suggested analyzing a spatial dimension to obesity across the country, which is the purpose of this study.

In conclusion, this review of these previous works have examined the various contributing factors to the obesity epidemic in Ghana using different approaches, mostly qualitative (interviews and questionnaires) and quantitative (statistical analysis) to correlate and explain risk factor variables such as socioeconomic, perception, age, etc. to obesity. However, few studies have shown the prevalence of obesity across the regional level in the country of Ghana and in a specific geographical location (Biritwum et al. 2005; Benkerser et al. 2012; Doku and Neupane 2015; Asenso et al. 2016). Among these, Dake (2012) and a few others employed a spatial analytical method for such an investigation. Most studies mentioned have also used similar demographic health survey data (DHS). Nevertheless, the use of both the qualitative method (focus groups) focusing on culture as the risk variable to explain the quantitative (spatial analysis) of variations of the obesity is the key component that distinguishes this study from other works.

CHAPTER 3

METHODOLOGY

In this study, we used both qualitative and quantitative approach for data analysis. Advances in technology enable researchers to use GPS data and Geographical Information Systems (GIS) to link locations to other environmental variables and to explain behavioral factors linked to population within a specific location. GIS provides a computational framework that enables linkages between various types of spatially-indexed data including population-based information and environmental attributes (Hurvitz et al. 2014). The quantitative component of this research was supplemented by a focus group discussion that provided insights into the geographic patterns of obesity obtained via the use of GIS and other spatial analysis techniques.

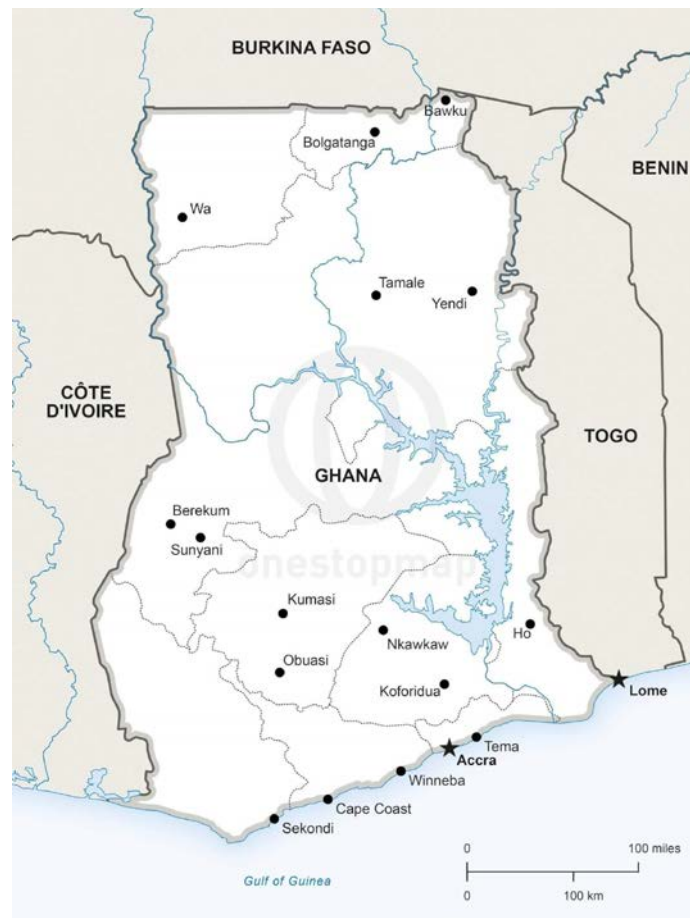


Figure 4: Map showing Ghana and the border countries

3.1 Study Area

Ghana is located in West Africa, with a landmass of 92098.8784square miles bordered by Ivory Coast in the west, Togo in the east, Burkina Faso in the north and the Gulf of Guinea in the south. Overall, the country has 10 regions yet currently there is an intent of creating new other regions. Previously, the districts in the country were 170 but now there is 216 (Ghana Statistical Service, Ghana Health Service, and ICF, 2015). The district is the lowest spatial unit at the local administrative followed by municipal, metropolitan, and region which is the highest. The country has a total population of about 28 million.

3.2 Quantitative Approach

The goal method is to examine the spatial variations across the country at the district level and show the relationship between the obesity and the independent variables. Data used for this assessment was from the Ghana Demographic Health Survey 2014. Statistical and spatial analysis was used to show the relationships of the variables and the patterns of obesity.

3.2.1 Data Description

The data source for this study is from the Ghana Demographic Health Survey (DHS), funded by the United States Agency for International Development (USAID). The DHS survey uses multistage random sampling method, which includes the household and woman's questionnaire, and measurement of Body Mass Index (BMI) from rural and urban populations collected at the district level (smallest administration unit). Basic information on the individual characteristics in the household such as age, and sex was collected. In this survey, the 10 administrative regions in Ghana were subdivided into 427 clusters resulting in 216 and 211 urban and rural clusters respectively. In this study, BMI is the dependent variable and education, household income, residency (urban or rural), age, and ethnicity are the dependent variables. The

survey was conducted at 11,835 urban and rural households with 43,945 individuals. Out of these respondents, the survey recorded BMI information for 9,265 individuals consisting of 4,417 were males (age 15-59), and 4,848 females (age 15-49).

3.2.2 Variables

Variable	Main division (% population)	Subdivision (% population)
Education	Highest educational level enrollment (poor and adequate level educational enrollment)	Poor educational level enrollment (no education, preschool to primary)
		Adequate educational enrollment (secondary and tertiary)
	Highest educational attainment (poor and adequate level attainment)	Poor educational attainment (no school, incomplete primary and complete primary, and incomplete secondary school)
		Adequate educational attainment (complete secondary and tertiary)
Residency	Rural	
	Urban	
Wealth index	Poor (poor and poorest)	
	Middle	
	Rich (rich and richest)	

3.2.3 Statistical Analysis

Descriptive statistics were computed to generate a summary report of the outcome and explanatory variables. A Pearson's correlation analysis was conducted to examine associations between the variables used in this study. Next, the multiple regression model in SPSS was used to establish the association of the obesity and overweight populations with education, wealth, and residence. Since the percentage of either urban or rural population could be used statistically to predict each other, only the percentage of urban residence population was used. Similarly, both EA-adequate and HE-adequate could be used to predict the both EA-poor and HE-poor respectively. Overall, percentage urban, rich, poor, EA_adequate, and HE_adequate were used in the analysis.

3.2.4 Spatial Analysis

The spatial data used in this study consisted of Ghana district boundaries, data records, and GPS points indicating the locations of survey respondents. The geographic unit of analysis in this study is the district level, which is the finest level at which geographic data is collected in Ghana. Data records or GPS points indicating the locations of survey respondents and associated attributes were aggregated to the district level for use in the spatial analysis component of this research. Aggregated districts map of Ghana used in producing the choropleth maps was 170 instead of the 216 districts. To visualize obesity rates across the various districts in the country, choropleth maps were produced using ArcMap. Anselin's Local Moran's I statistic in ArcMap 10.6.1 was used to measure spatial autocorrelation and to identify geographical trends in the occurrence of obesity across the country. Hotspot analysis using the Getis and Ord statistic was used to identify statistically significant clusters across the entire country (Harries 2006; Anselin 1995).

The incremental spatial autocorrelation tool was used to identify the appropriate distance threshold for use in the hotspot analysis. The tool helps in summarizing the intensity of spatial clustering at various distances from districts in the study area. The results from the incremental spatial autocorrelation analysis was used to define the spatial relationships parameter in the Hotspot analysis tool. The zone of indifference method was used as the spatial relationship parameter in the Hotspot analysis tool. In this method, a critical distance is required. Features that inside this distance are given equal weights while those outside are weighted using a distance decay function.

3.3 Qualitative Approach

The primary aim of this method is to explore and analyze how culture plays a major role in driving of obesity. Focus group was used to collect primary data for this study.

3.3.1 Data Sampling and Analysis

Focus group is a technique that involves the use of group interviews in which the topic raised relates to selected individuals involved in the discussion (Thompson et al. 1995). For such reason, criteria for selecting participants was based on a non-probability technique thus convenient sampling. This method was used due to the willingness of participants and easy accessibility of information relating to the topic of discussion (Yin 1984). The target population was Ghanaians from age 18 and above. However, individuals were mostly 20 years and above, thirteen were between 18 and 20 years. The groups were stratified into two groups: the first group consists of Ghanaians living abroad (FGa), and the second consists of those living in Ghana (FGg). This was very important to understand if different cultural environment leads to different opinions and perspectives about the role of culture on the problem of obesity in Ghana. There were 58 participants with the first and second group consisting of 8 and 50 respectively. The total participants in the focus group were 27 males and 31 female, thus 58.

The main research question “what are the cultural values and practices driving obesity” was raised. This topic was discussed under different sub-topics such as traditions, proverbs, and food preference. Examples; “what traditions cause people to gain weight?”, “what are the food preferences that drive or contribute to obesity?” These questions were answered one after the other by participants. There was no limitation on the number of comments a participants can give. Comments were audio recorded from the participants and later transcribed. With the transcription, all the recorded audio were played and typed with Microsoft word. Based on the most recurring information from the discussion on obesity, the individual comments were grouped under themes. Using themes to analyze such qualitative data from focus groups assists in discovering how the various comments contribute to the overall result from the samples. The themes were: physical

inactivity, Fat is beautiful, “Prized food” is unhealthy, food preferences, and Sayings that encourage obesity. These thematic findings are explained below in the next paragraphs ending with a conclusion summarizing the overall outcome of the focus group discussions.

CHAPTER 4

RESULTS

4.1 Quantitative Results

4.1.1 Statistical Analysis

A brief summary of the descriptive statistics is presented in Table 1. With respect to our findings, the most important refers to the actual deviation from the mean value for the variables used in the analysis. Findings from the table depict a great variability and interesting results between the variables. To be more specific, the values of the standard deviation of the dependent variable (BMI_obese) is equal to 0.0584 with a mean value of 0.066. Further, among the independent variables, HE_adqEdu had the highest mean of 54.7136 with a standard deviation of 20.4844 followed by Poor (Mean=49.4718, SD=32.0393) then pUrban which had a mean value of 38.3329 and a standard deviation of 32.2743 whereas EA_adqEdu is the explanatory variable with the least mean and standard deviation value (Mean=14.0804, SD=10.0747)

Table 1: Summary of descriptive statistics

Variable	Mean	Std. Dev.
<i>Dependent variable</i>		
BMI_obese	0.066	0.0584
<i>Independent variable</i>		
HE_adqEdu	54.7136	20.4844
EA_adqEdu	14.0804	10.0747
pUrban	38.3329	32.2743
Poor	49.4718	32.0393
Rich	27.3520	27.7656

Note: Mean and standard deviation values are corrected to two four decimal places

Table 2 shows the Pearson product moment correlation analysis between the six (6) variables used in the analysis. Evidently, from the analysis that, with the exception of the variable “rich”, BMI_obese have a statistically positive correlation with HE_adqEdu, EA_adqEdu, pUrban, and Rich. In a similar manner, HE_adqEdu also have a positive and significant linear relationship

with EA_adqEdu, pUrban and Rich but has a negative correlation with the variable “Poor”. EA_adqEdu is further identified to have a statistically significant and positive correlation with pUrban and Rich at a level of 5% significance with the exception of poor, which on the other hand was negatively correlated, with EA_adqEdu also at 5% percent level of significance. pUrban as compared to the nature of relationships among the aforementioned variables was similarly positively correlated with the variable “rich” whereas negatively correlated with “poor” all significantly at 5%. The variable contrarily was reported to have a strong but a negative statistically significant linear relationship with the variable “rich”. In summary, it can be deduced from the correlation analysis that, all the variables which include BMI_obese, HE_adqEdu, EA_adqEdu, pUrban and Rich have negative linear relationships with poor.

Table 2: Pearson correlation analysis

Variables	BMI_obese	HE_adqEdu	EA_adqEdu	pUrban	Poor	Poor
BMI_obese	Pearson corr.	0.615**	0.576**	0.438**	-0.654**	0.725**
	Sig.(2-tailed)	0.000	0.000	0.002	0.000	0.000
HE_adqEdu	Pearson corr.	1	0.703**	0.494**	-0.849**	0.768**
	Sig.(2-tailed)		0.000	0.000	0.000	0.000
EA_adqEdu	Pearson corr.		1	0.622**	-0.766**	0.852**
	Sig.(2-tailed)			0.000	0.000	0.000
pUrban	Pearson corr.			1	-0.619**	0.703**
	Sig.(2-tailed)				0.000	0.000
Poor	Pearson corr.				1	-0.875**
	Sig.(2-tailed)					0.000
Rich	Pearson corr.					1
	Sig.(2-tailed)					

Note: ** represents the significance level at 5%

The main objective of this analysis is to investigate the effect of HE_adqEdu, EA_adqEdu, pUrban, Poor and Rich on BMI_obese. As such, this section specifically estimates effect of the each of the aforementioned variables on BMI_obese. By using the enter method of multiple linear regression the following variables; HE_adqEdu, EA_adqEdu, pUrban, Poor and Rich were used as explanatory variables whereas BMI_obese was employed as the response (dependent) variable. In order to examine the effects of the aforementioned explanatory variables on the response

variable (BMI_obese), the goodness of fit as well as significance of the overall model, which includes all the variables used, was assessed using both the model summary as well as the analysis of variance (ANOVA) test respectively.

Table 3 therefore shows results based on the model summary. The R-value given in the table measures the strength of correlation between the response variable and predictive variables. The R-value which is 0.741 indicates a strong positive correlation between BMI_obese and the explanatory variables (HE_adqEdu, EA_adqEdu, pUrban, Poor and Rich). Additionally, results from the model summary gives the value of R-square (coefficient of determination) as 0.549 which implies that, about 54.9% of the variability in the dependent variable (BMI_obese) is explained by the predictive variables (HE_adqEdu, EA_adqEdu, pUrban, Poor and Rich). By referring to the adjusted R-squared value (0.535), there is an indication that about 53.5% of the R-squared value is corrected to produce a better estimate of the true population value since the R-square value in the sample tends to overestimate the true population. The results based on the model summary considering the R-value, R-squared value and the adjusted R-squared values generally indicates that, the model is appropriate and a good fit.

Table 3: Model summary

Model	R-value	R-square value	Adj. R-square	Std. error of the estimate
1	0.741	0.549	0.535	0.0398

In order to assess the overall significance of the model with HE_adqEdu, EA_adqEdu, pUrban, Poor and Rich as predictive variables, it is necessary to look at the results from the analysis of variance presented in Table 4. The ANOVA test the null hypothesis that the R-value in the population is equal to zero meaning there is no significant relationship between the response variable (BMI_obese) and the independent variables (HE_adqEdu, EA_adqEdu, pUrban, Poor and Rich). The results from the Table 5 gives an F-value of 38.04 and a significant value of 0.000,

which is less than the 5% level of significance for the regression. This therefore gives the implication that, the model that includes BMI_obese as dependent variable and HE_adqEdu, EA_adqEdu, pUrban, Poor and Rich as the predictive variables is significant, leading to the rejection of the null hypothesis. This further implies that there exists a significant relation between the response variable (BMI_obese) and the explanatory variables.

Table 4: Analysis of variance (ANOVA)

Model	Sum of squares	Df	Mean square	F-statistic	Sig-value
Regression	0.301	5	0.060	38.041	0.000
Residual	0.247	156	0.002		
Total	0.548	1161			

The regression model with BMI_obese as dependent variable and HE_adqEdu, EA_adqEdu, pUrban, Poor and Rich as independent variables is significantly fit. Further, we estimated the model in order to determine the significant effect of each of the independent variables on the response variable. The results based on the rate of contribution of each of the explanatory variables together with their respective probability values are illustrated in Table 5. The table additionally provides the unstandardized and standardized coefficients of all the five (5) independent variables regarded as explanatory variables included in the model. In order to compare the level of importance per the contribution of each independent variable to the dependent variable (BMI_obese), the “Beta” values under the column “standardized coefficients” must be looked at. Hence, by comparing the values of the various independent variables under the column “standardized coefficients” it can be deduced that, the variable “Rich” had the highest beta value (0.845). This means that, the variable Rich among the other independent variables makes the strongest contribution to explaining the dependent variable (BMI_obese) when the variance explained by the other variables in the regression model are controlled for. This is followed by the variable “HE_adqEdu” which made the next strongest contribution with a beta value of 0.155

whilst the variable “Poor” when all negative sings are ignored made the least contribution amongst the other variables with a beta value of 0.015. Table 6 further helps in determining the variables that made significant contribution to the dependent variable under the column labeled “sig-value (significant value). From this column, it can be deduced that, among the independent variables included in the model, only one variable (**Rich**) contributed significantly and positively to BMI_obese. This significant variable interestingly had positive beta values, which as such gives the indication that, increase in this variable (rich), will significantly increase BMI_obese in terms of percentage by 84.5%.

Table 5: Evaluation of the independent variables

Model	Unstandardized coefficients		Standardized coefficients	t-value	Sig.-value
	B	Std. error	Beta		
(constant)	0.014	0.028		0.502	0.616
HE_adqEdu	0.000	0.000	0.155	1.489	0.139
EA__adqEdu	-0.001	0.000	-0.167	-1.604	0.111
pUrban	0.000	0.000	-0.119	-1.561	0.121
Poor	2.272E-5	0.000	0.015	0.110	0.912
Rich	0.002	0.000	0.845	5.837	0.000

Note: Dependent variable: BMI_obese

4.1.2 Spatial Trends of Obesity

Generally, from looking at the map (Fig. 5) the darker blue color represents areas with highest obesity percentages and the lighter blue shows lower percentages. The map below shows more districts with higher rates of obesity in the southern Ghana with most of the higher rates being in the Greater Accra region. Districts in Northern part tend to have lower rates of obesity with appreciable rates in the Northern region towards the South. In addition, the areas with higher obesity rates are urban. In the map, Sawla, Kassena Nankana East, and Gonja Central districts in the Northern region all have highest obesity rates likewise Ga West, Lower Manya, Dangbe West, and Tema in the Greater Accra region. Contrary, Sissala East, and Builsa in Northern have lower

rates similarly districts found at the Volta region also have lower rates, for example Krachi West, Nkwanta South, and Kadjebi. The variation of obesity rates tends to be clustered in the South compared to the North.

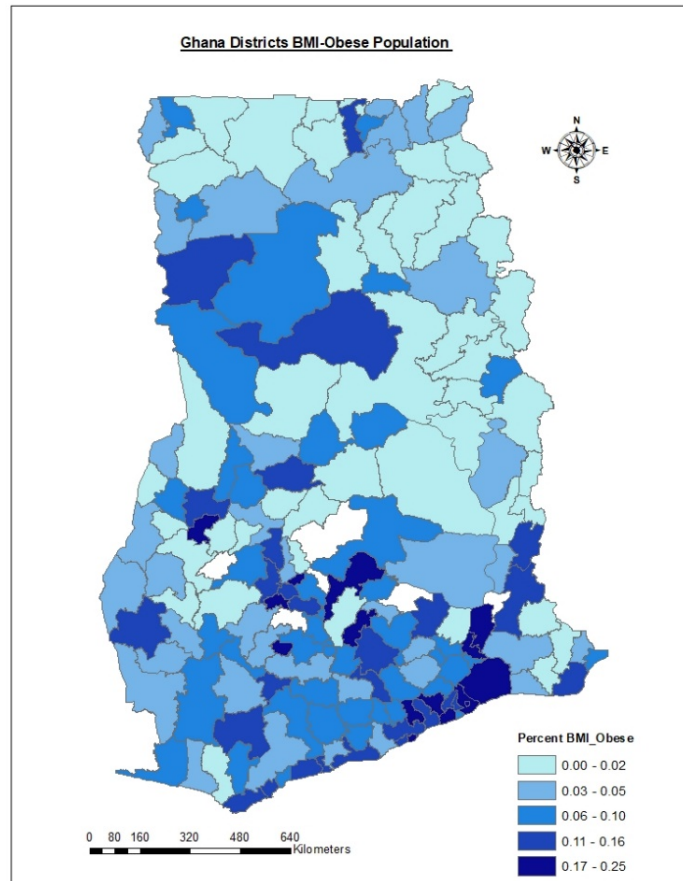


Figure 5: BMI_Obese Population Map across Districts in Ghana

4.1.3 Local Moran's I and Hotspot Analysis of Obesity

Mapping obesity rates produced from the data can help to visually identify spatial patterns; yet do not show statistical relationships (Zhang et al., 2008). This can be statistically supported using the Anselin's Moran's I as shown in Figure 6 that identifies clusters of obesity rates areas found in Ghana. From looking at the map, the Moran's I reveals a large high-high spatial cluster observed in the southern part of the country particularly part of Eastern regions, and almost entirely

the Greater Accra region. Ga West, Lower Manya, Dangbe West, and Tema are some of the districts found in the high-high clusters in Greater Accra whereas Atiwa, Fantekwa, and Kwaebibirem in the High-High clusters in the Eastern region. Relative small high-high spatial clusters areas were also found in the Ashanti region in the Ejisu Juaben, Bosomtwe/Atwima/Kwanwoma, and Sekyere Afram Plains districts. With the exception of Bole, Kassena Nankana, and Sawla/Tuna/Kalba that have high-low spatial outliers, low-low spatial clusters were observed mainly in the three Northern regions and relatively small in the Volta region. On the other hand, the low-high outliers were mainly located closely to the high-high spatial cluster areas.

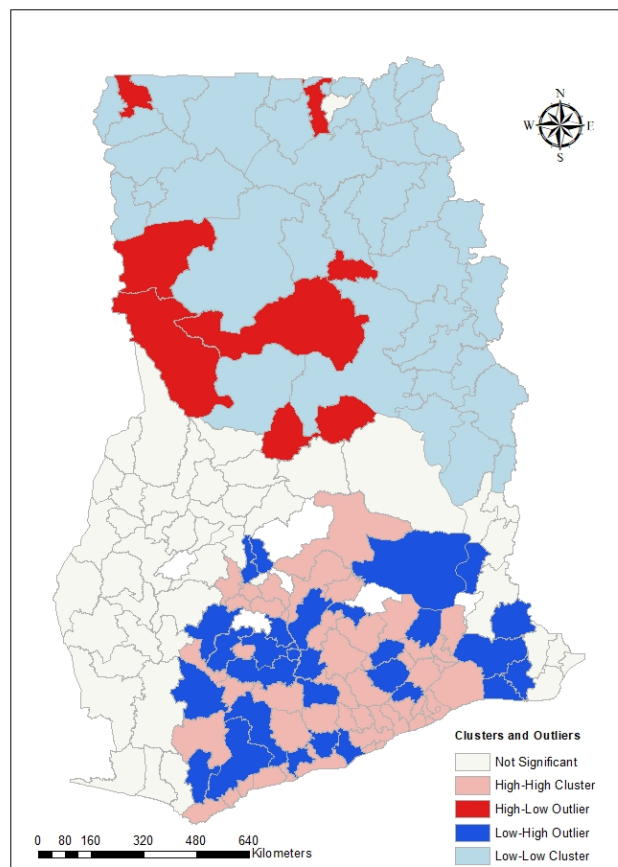


Figure 6: Map showing obesity rate clusters and outliers

A hotspot analysis was conducted to better understand which areas face greater than expected burdens of populations that are classified as obese. According to the analysis the high negative z-score values represents cold spot areas while the high positive z-score also shows hotspot areas. In the map, the colors represent the intensity of clustering of obesity rates at the across districts. Blue areas are lowest z-scores indicting significance of 90, 95-99% obesity rate clustering while the red shows highest z-scores representing significance of 90,95-99% obesity rates. White colors represent areas with no significant obesity rates.

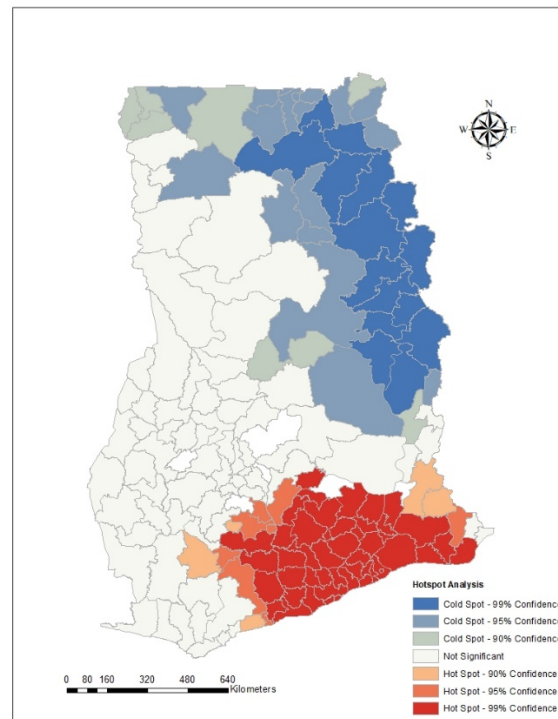


Figure 7: Map Showing Obesity Hotspots

In addition, the p-value of the analysis shows the probability that the coldspot or hot spot occurrence is random. Higher z-score values (negative or positive) shows the intensity of the coldspot or hotspot. From the map (Fig.7) there are 45 hotspots of obesity below p-value of 0.01 with 99% confidence. Thus, there is less than 1% chance that obesity rates occurring within these districts is random. Evidently, this suggest there are some factors contributing the obesity across

these areas, which could be a characteristic common to such districts. Some districts found in these areas are Ga West, Tema, Lower Manya (Greater Accra), Keta and North Tongu (Volta Region), Abura and Assin north/south (Central Region), and Adansi South (Ashanti Region). However, most districts in the Eastern Region falls into these hotspots obesity areas. Obesity rates are also intense within areas with 95% confidence, p-value of 0.01 to 0.09 and z-core $2.0 \leq 2.5$. In these areas there were about 7 districts; Upper Denkyira and Twifo Heman (Central Region), Bosome Freho and Adansi North (Ashanti Region), and Akatsi in the Volta Region to mention a few. Following these higher areas of obesity are also 5 districts with appreciable obesity rates; Ho and Adaklu (Volta), Komenda (Central), Wassa Amenfi (Western), and Obuasi Muncpal (Ashanti). Conversely, districts found to have z-scores of ≤ -2.6 have intense coldspots of obesity rates across the country. These low rates of obesity are found mostly in the Northern part of the country particularly in the Northern region. Three districts, Krachi East, Nkwanta South and North were among these lowest rates of obesity while 10 districts were found in the Northern region (ZabzuguTatali, Yendi, Mamprusi East, etc) and Talensi Nabdam (Upper East). Obesity rates were found to be extremely high in Eastern, Greater Accra, and partly Central region whereas extreme low rates were also found in the three northern regions particularly the northern region and few districts in the Volta region. Districts showing significant obesity rate clusters shows evidence of underlying spatial variation of obesity. Hence, we mapped selected variables, which may be contributing obesity to explain the variations across the districts.

Based on the statistical regression analysis conducted, percent rich and highest adequate educational level enrolled (HE_adqEdu) were the variables with the strongest correlation with BMI_Obese population. The regression model explains that increasing rich population increases obesity drastically while increase in the poor population also decreases BMI_obese. However,

increasing higher educational level enrolment also increases BMI_Obese population. Below are the maps showing the various variables which are used to deduce obesity variations in the country.

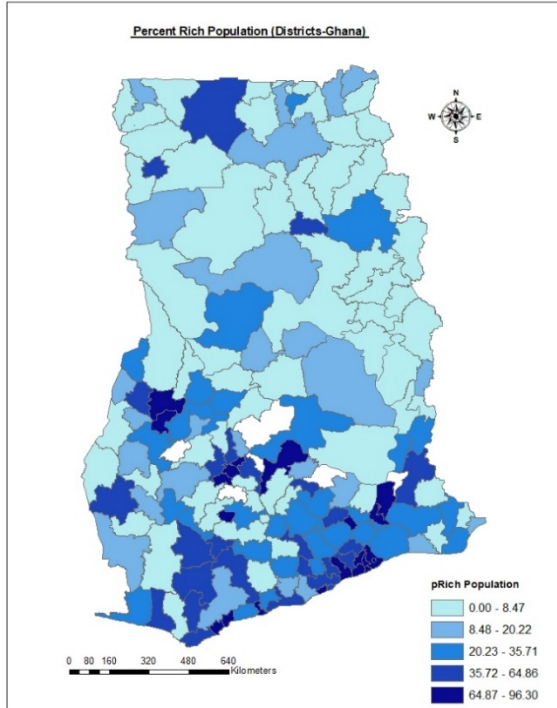


Figure 8: Map showing Rich population

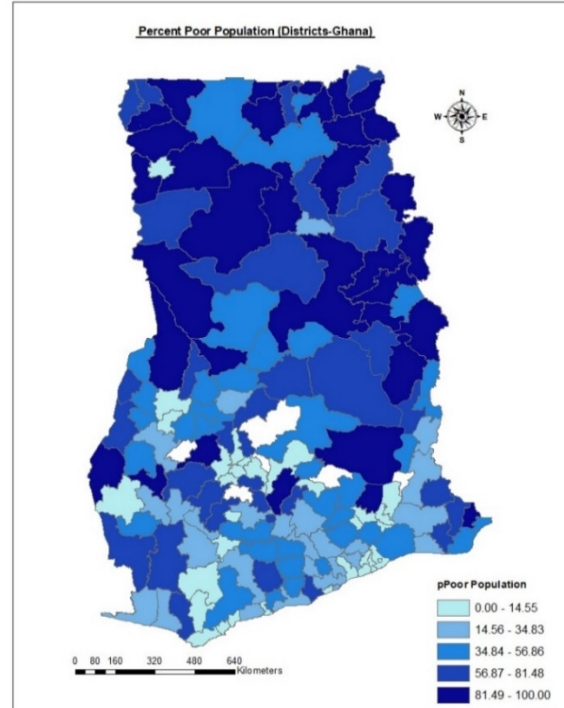


Figure 9: Map showing Poor population

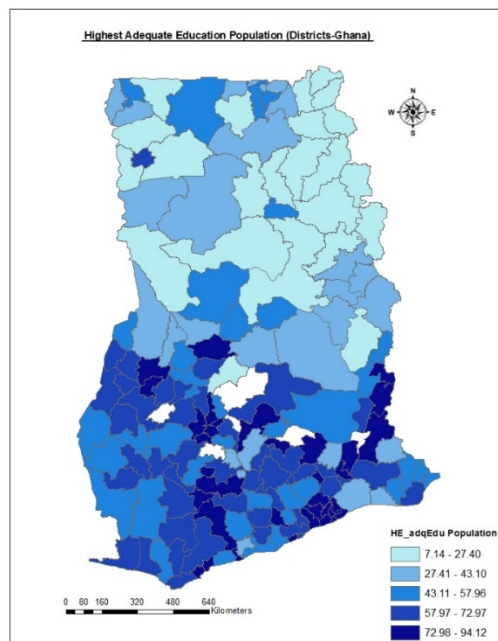


Figure 10: Map showing Highest Education Enrollment Population

4.1.4 Visualization and Comparison of Obesity Contributing Variables

Considering the variables mentioned, as a contributing factor to obesity, areas with higher percentage of rich population tends to have high BMI_Obese rates. Evidently, these rich populations are found at the southern part of the country. From the map, 64.87-96.30% of the population tends to be rich that includes districts such as Tamale Metro and Wa Municipal (Northern region), Kumasi Metro (Ashanti Region), Accra Metro and Tema (Greater Accra), Cape Coast (Central Region), and Sunyani West (Brong Ahafo Region). There are also some districts with considerable percentage of rich population, which most are found in the south.

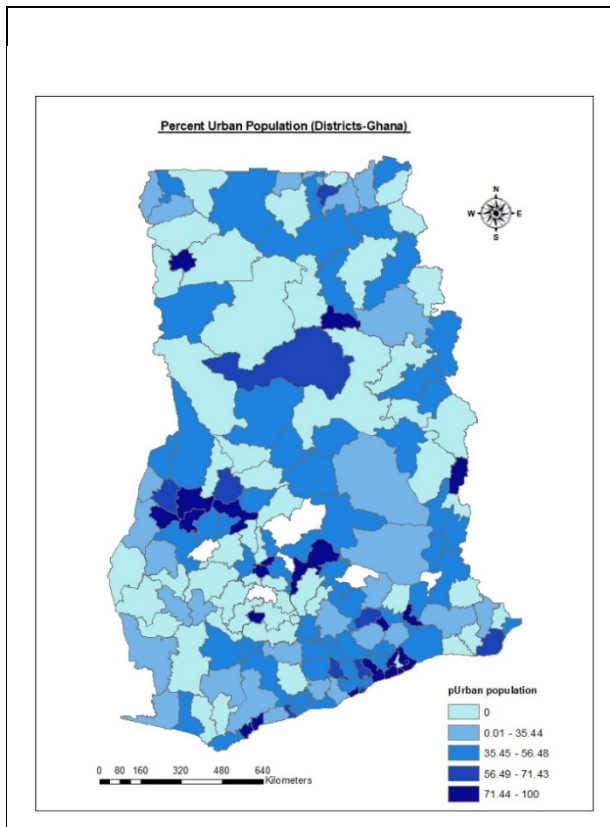


Figure 11: Map showing Urban Population

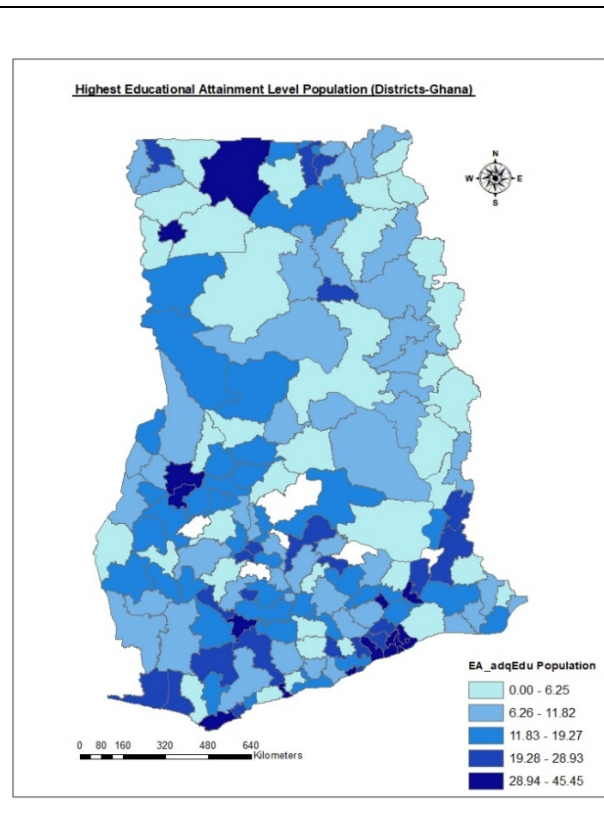


Figure 12: Map showing Population with highest Educational Attainment Population

Knowing these rich populations, obviously most districts in the three northern and Volta region part are poor. This also reflects in the poor population map in Fig. 10 with the highest poor population of 00-81.49% and lowest is 0-14.55%. Interestingly, areas with the highest rich and

less poor population also have most districts with highest adequate education enrollment. With 72.96 to 94.12% of the population mostly found in the south. Similarly, most urban districts such as (Tamale, Tema, Accra metro, Kumasi metro, Takoradi, Sunyani, and Wa) tends to have higher BMI_Obese population from 71.44-100%. The variable highest education attainment also reflects the same variation across the country. Population with the highest education attainment are concentrated at south with the exception of two districts at the north (Wa and Sissala East) which also have the same percentage of population. Overall, all these variables tend to be concentrated at the southern Ghana excluding the poor population, which is found to be more intense at the northern part. Lastly, comparing the maps all the variables are playing a role in the BMI of the populations.

4.2 Qualitative Results

With the four focus group discussions conducted, the comments and perceptions from respondents were identified clearly under the themes explained in the subsequent paragraphs. The themes revealed in the discussion were; (1) Increasing physical inactivity (2) Fat is Beautiful, (3) Unhealthy “Prized (4) Food”/Eating Habit, (5) Food Preference, (6) Sayings encouraging obesity, (7) Traditions, (8) New Lifestyle Trends. The ratio of males and females were 21 to 17 respectively.

4.2.1 Increasing Physical Inactivity

Regarding physical inactivity, most participants reported that the perception on manual labor has changed lately among Ghanaians. Reasons for this include the use of time saving devices and the perception on living wealthy. In all the group discussions, participants showed the connection between obesity and physical inactivity, and the comments attributed obesity to increasing adoption of a sedentary lifestyle with urbanization. From the FGs, the preference for a

sedentary lifestyle, considered as “wealthy living,” entails using time saving devices such as blenders and dishwashers for household chores instead of manual labor. Additionally, the perception of living wealthy includes being educated and employing people to do domestic work in your home. People from rural areas desire to live in urban areas to be seen as rich. Most homes prefer employing maidservants to run errands. Others especially the educated are ridiculed and less respected if they are unable to afford automobiles and time saving household appliances. As some respondents stated:

From the villages to Accra, ... people who used to do farming in villages prefer to hire “laborers” to weed or use spray (weedicides) to clear weeds with the intention of getting it done quicker. (FGa)

This modern Ghana, no need to stress yourself with manual work while you can get people to work for you as long as you have money. (FGa)

In our time there were no fat children because we used to play right after we are back from school. For example, we played hide and seek, soccer, hop-scotch, “chaskale”, and skipping. Sometimes we helped our parents in the kitchen. Now kids come home from school, do their assignments and watch cartoons, and play video games with phones or computer. Even some have maids/servants that do every house chores. So no physical activity to burn fat. (FGg3)

You can be an educated person and not work in the office. Manual work is not for the educated, people will even laugh at you that after all the school this is what you are doing for living? (FGg 3)

4.2.2 Fat is Beautiful

Although being overweight or fatness is associated with health problems, Ghanaian culture embraces being fat or overweight as beautiful and a compliment. Being beautiful relates not only to the facial looks, but also to the body structure, as Ghanaians call it “body form”. People regard overweight body size as attractive, and this encourages most people to become fat. The perception of the ideal body size, especially among women, recently extending to men, is a real driver of obesity. In the discussion, a respondent stated:

When you gain more weight than your normal, people give comments like; you are looking beautiful. At times the responses are: yes, my spouse is taking good care of me, good living, and thank you. (All-FGs)

Additionally, the respondents revealed that your body size sometimes determine the level of maturity and respect people accord you. The ideal wife and husband body size preferred by most people is the “big body”. Respondents emphasized how this perception is causing many to go to any extent to gain weight.

Sometimes people with big body size are considered more matured and adult while slim/thin body size means you are young. So people prefer to be big/fat than slim. (FGg3)

Women prefer their husbands to be big/overweight and muscular to gain respect at funeral grounds. (FGg2)

4.2.3 Unhealthy “Prized Food”/Eating Habit

This study revealed that the desire for prized foods and unhealthy eating habits among Ghanaians promotes weight gain, resulting obesity. People consider some foods extremely valuable and important. From the participants, some food are special and served on exceptional occasions. The perception is that food should be attractive thus, colorful, tasteful, and fatty. The connection is that the more attractive the better. This encourages people to use unhealthy ingredients in cooking. Fat, especially meat fat, gives better flavor to soups or sauces. Some people become addicted to such foods, which become part of their lives.

I will never stop eating salted meat and oily rice, even if is not healthy for me. I love it, and it tastes good with hot pepper. I have been eating it since childhood. We will all die from something someday (FGa)

Respondents stated that some foods are special therefore needs special attention when preparing especially for visitors and on occasions. A Ghanaian delicacy, “Jollof” (rice cooked together with tomato sauce) is among these foods seen as special. The redder the “Jollof looks”

the better as many stated in the discussion. This was explained by the views expressed by some respondents:

People see the imported canned tomatoes with more additives and preservatives to be more reddish than our local ones, so instead of buying less expensive fresh local tomatoes we spend so much buying canned ones. The redder it is the more attractive it is to people. It makes Jollof look very attractive. (FGa)

Furthermore, unhealthy eating habits among some Ghanaians also contributes to weight gain that eventually may cause obesity. The habit of night eating among Ghanaians is making more night businesses grow. As from the respondents, now night market is booming because most people indulge in buying night foods at roadside. Variety of foods including fried rice, fried egg, and indomie noodles are available in every corner in the cities. The type of food people consume are mostly proteins, fats, and carbohydrates. These take some appreciable time to digest therefore, builds up and causes weight gain. Many people do not know the idea about this as some respondents stated. Again, night eating is practiced in both rich and poor homes. Respondents expressed these views to show how night eating is affecting the body size of most Ghanaians:

Currently, night food businesses like fried rice and chicken, oil rice, indomie, and Tea and porridge with fried egg is the order of the day. Some people buy large size fried eggs with small Porridge or Tea. They like more sweet so asked for more milk and sugar. After eating they watch movies and sleep. Some even sleep right after eating the food. (FGg3)

In most poor homes, they eat at late evenings especially in rural areas, they go to farms, return home very late and still cook fufu to eat. (FGg3)

The youth are more into nights out to have fun. When they go too, they only eat fried rice and chicken with soft drinks. Some also buy crate of beer, share among themselves and drink. They go home late at night just to go straight to bed. (FGg3)

4.2.4 Food Preferences

Food choice is one key factor that plays a role in nutritional related health problems. Among the participants involved in the discussion, most agreed that their food preference is a challenge to weight loss. Out of all the focus groups, the participants shared similar perception

about food quantity. They believe that the heavier and more filling the food, the better. This permits many to eat larger quantity and carbohydrate foods. Preference of food varies among tribes and across the regions. Yet, some chief foods such as “Banku” and “Fufu” are common.

Perception on fat body/obesity differs but mostly it is related to good living. When people get money, their food choices and eating habits change. They eat more meat (chicken and red meat) and prefer more fatty foods”. (FGg 1)

Most fishmongers in the villages are fat. They eat more starchy foods. You can see them early morning eating Banku and stew with hot pepper and fried fish, which most people will not stop consuming.” (FGa)

Eating small doesn't give any energy; it will not help in building your body. (FGg-all)

Other views raised, support this idea that the challenge of obesity is partly due to the food availability and preferences. Frequently, carbohydrates are consumed more in the country.

4.2.5 Sayings that Encourages Obesity

Regarding respondents view on the sayings that encourage obesity, ridiculing the body size of a person increases their desire to gain weight. Interestingly, the cause of overweight is not just about the diet but the influence from the society pressures people to be fat. In attest to this, some disclosed the stigma attached to being very slim and thin.

A woman with “enough body” For me I prefer a “woman with enough body” a woman with “form”so that I can have a feel of her body. I prefer my woman to have big body size (FGg1)

Recently, I think some men prefer the normal or slim body size women. Nevertheless, after marrying them several factors causes them to gain weight. (FGg3)

Most of the respondents talked about their experiences with such situation. Sometimes people cover up not to expose their slim or thin body publicly by dressing up with more clothes. Contrary, others with fat body or fat belly are revered, not ridiculed. Fat body or fat belly is associated with wealth. When people are scorned for being fat, they tend to say it is a sign of good living. Likewise, folks with fat belly claim it to be a decent fat belly and a sign of wealth. The

findings also concealed the relevance of being fat, which allows many to opt for big body size spouse. Being slim and thin sometimes are related to “being like skeleton or the dead”. The embarrassment following such derision causes more to desire big body. Losing weight after being obese is also derided.

4.2.6 Traditions

Interestingly, the traditions once were a big challenge; however, the findings from the participants showed some traditional practices contribute to obesity. This includes puberty rites, widowhood, and enstoolment of chiefs and queen mothers. Among these practices, puberty rite is rare while widowhood is restricted. However, many tribes continuously practice enstoolment rites. Similar views from respondents testify to how some traditions have changed over time, yet, had contributed to obesity.

Puberty rites- previously during puberty girls are kept in the room for many days, just to be fed and prepare them for reproduction. They give them mashed plantain locally called “3to”(mashed plantain) and boiled egg. Digestion becomes difficult so food builds up and people grow fat. (FGg1& 3)

The intention for this is just to make you big or enlarge the body especially the reproductive parts for childbearing. They believe it expands and prepares your fertility organ. (FGg1)

I think now Christianity and education has changed some of these traditions especially the puberty rites but the widowhood rite has change a little. Instead of the previously strictly 40days indoors, it has reduced. (FGg1)

While some talked about the importance of these traditions in the past years, others disputably refute such traditions. Regarding widowhood, most respondents admit its relevance to the dead’s family. The reason of taking care of family left behind during the widowhood rite is good. Nevertheless, it could lead to an unfortunate weight gain.

They assume that you have to have a good and radiant skin to wear cloth at funeral grounds as a widow to depict that someone is taking care of you and that your been consoled. Because of this, they are kept indoors for days, bath several times within the day and you are being fed more than the usual three times a day. (FGg1)

4.2.7 New Lifestyle Trends

According to the last two focus groups, which were mostly youth, the concerns on the research topic discussed mostly relate obesity to current lifestyles. The average age for these groups was 18. While the few people (ages 18 to 20) talked about the gym life, others refute this idea stating that most people have lost the idea of using the gym for health reasons. As stated and agreed on by most participants in the two last groups, comments below supported their assertions.

Mostly on Sundays people go for walk in various neighborhood with the intent of keeping fit. However, they end up eating rice balls with soup and carbonated drinks and beer right after the walk. “They mostly call it keep fit or Sunday special” (FGg3 & 2)

We don’t go to the gym or keep fit for healthy life”It’s all about the form and six packs” so that we get attracted to the opposite sex. (FGg 3)

So now the gym is not for healthy life but to flex. All those that work out can eat more; one person can eat more than two kenkey balls after visiting the gym. So, this makes them grow big and after sometime they stop working out and the fat builds up easily which I don’t even know the reason (FGg2 &3)

Medication was also another topic raised in all the three focus groups conducted in Ghana. Since the participants in the group (FGg1) were older than in the FGg 2 and FGg3 groups, comments relates obesity to fertility medications. While the comments from the other groups especially the FGg3 were more on body enhancement medications and appetizers. Though participants had negative perceptions on weight gain medications, the idea and knowledge about using such methods in gaining weight were evident. Clearly, people abuse medications and treatments in order to gain weight.

As for me my reason for taking blood tonic is not because am sick but just to eat and gain weight”. Most people especially women do this to fit in their dresses and to be attractive (FGg 3)

If eating more is not helping then they go for body enhancement through injections” (FGg3)

It is believed that you must have big body size before getting pregnant. Even most fertility medicines given to women at the hospitals also cause women to be fat. Women with fertility issues trying to have babies tend to be fat due to the medications. Before you conceive, the womb should expand so the intent of the medication is for the expansion; the more it enlarges the more fat you become. It is believe your womb shrinks if your body shrinks especially with women who have not given birth before (FGg 1)

Regarding, the trends in lifestyle, competition among individuals plays an important role in weight gain resulting in obesity. From all the focus groups, both US and Ghana, the idea of being successful triggers weight gain. Participants uncovered some real facts about body size. Body weight communicates to the society more than just a physical appearance; rather it is a measure of the success, wealth, and health of the individual. This misconception is leading many Ghanaians to gain weight, which gradually becomes a health problem, not merely obesity. Several statements revealed that in reaching high marriage expectations people tend to live lifestyles that reflects such achievements. For example, participants stated:

After marriage people expect you to gain weight. Family and friends, people relate the success of your marriage life to your wealth as well as physical appearance, thus your body weight and size. If you are lean or have the same body size after marriage, then your marriage is not successful but with increased weight gain, people appreciate your marital status. (FGg3)

Yeah, very true among the young girls, the competition to get the ideal body shape causes most to take medications, which later affects them. (FGg3)

Before weddings, people eat more to gain weight for the occasion to show to people that they are matured and capable to marry. (FGg1)

Lastly, one major influence on weight gain leading to obesity is childbirth. In the focus groups conducted in Ghana, participants mentioned childbirth as a problem causing many women to be fat. With the listed comments below supporting their claims, obviously childbirth interferes in the decisions and aspirations of many Ghanaian women to losing weight.

During breastfeeding, especially exclusive breastfeeding mothers eat more to get more breast milk for their babies. At some point, they gain more weight. Their dress size increases, instead of size 10, they wear size 16. (FGg3)

Nursing mothers tends to eat more with the intention to be more beautiful and presentable. The perception is that a woman should gain more weight after labor. (FGg3)

After labor, nursing mothers are not allowed to work, family members do all the house chores and cook for them. In our society, you have to eat more to gain more weight so they eat large amounts of food particularly fufu and soups every day.” The intent is to have more breastmilk and gain the lost energy back. (FGg2 & 3)

Finally, the focus groups present an image of the perceptions of Ghanaians on obesity and overweight. Undoubtedly, participants’ comments under main themes reflect the reviewed literature in this work. Issues of diet, childbirth, perception on body size and marriage accounts greatly to weight gain, which may lead to obesity. Overall, the idea of relating obesity or overweight to non-communicable diseases was limited. Only few participants addressed this problem. Knowledge on obesity relating to diseases is limited. Again, the perception created by the participants were that; the desire to gain weight sometimes is unintentional. Nevertheless, the norm or new culture trend in Ghana overlook fatness, thus everyone can fit in the society.

CHAPTER 5

DISCUSSION

Evidently, there is a rising of non-communicable diseases burden in Ghana. The predominant infectious diseases coupled with non-communicable diseases pose a threat to the many Ghanaians. Previous studies blame the prevalence most Non-communicable diseases such as diabetes, hypertension, and heart disease on obesity. In an attempt to suggest solutions to such problem, other studies have also examine the causal factors of obesity (Agyemang et al. 2015; Alaba and Chola 2014, Pobee et al. 2013, Steyn et al. 2011). Other study, Dake (2012) has also examined the spatial clustering of obesity among women in Ghana. Based on these previous works, this study sought to explore the spatial variation and cultural explanations of obesity in Ghana. The results of the spatial analysis suggests that spatially obesity rates vary across Ghana; areas with high obesity rates have low rates. Considering the southern part of the country that has highest rates, there are specific districts in this area with extremely low rates. However, the intensity of obesity in these areas of higher rates also differs. Interestingly, the spatial analysis showed high-high obesity clusters in the south with low-low clusters found in mostly in the three northern regions. Districts with higher obesity rates were mostly in the Eastern and Greater Accra, and some parts of Central and Ashanti region. Nonetheless, there were some few districts found in the Brong Ahafo, Volta and Western regions as well with intense obesity rates. How, these obesity rates were not significant compared to those in the previous four regions (Eastern, Greater Accra, Ashanti, and Central). The obesity rates distribution by the analysis supports research findings, which indicate high obesity at the south more than the north.

In Ghana, the southern part is more urban especially the Greater Accra which is the capital, than the northern part. Ashanti is the next urbanized region compared to the other regions. The

evidence of rapid nutritional and economic changes occur in these urban areas due to rapid economic development. The result of the study also reveals areas with higher urban population also have higher obesity rates. Additionally, these areas also have high percentage of rich population. This support research studies which states that increase in wealth and urbanization contributes to obesity. Education on the other hand, also contributes to obesity. However, higher educational enrollment contributes positively to high rates of obesity. Thus, population with adequate higher education enrollment (secondary to tertiary enrolment) has strong correlation with Obesity though population with higher educational attainment equally has high rates. Obviously, rich population are able to afford education but not necessary to completion.

Other plausible factors such as culture could explain the variation of obesity in the country. From the qualitative result, culture as a way of Ghanaian life influence obesity rates in these areas. Regardless of the educational level of most Ghanaians, their culture values are affecting their risk to obesity. Using education as a measure, this confirms the effect of socioeconomic status on obesity rates (Amoah 2003; Alaba and Chola 2014). The focus group discussion discloses that cities (urban area) are the rich population, which also reflects the spatial analysis conducted. The perception of many Ghanaians as discussed in the focus group is that educated people are rich and live western lifestyle. Most emerging food restaurants are found typically in these urban areas. Implying most people are exposed to eating foods contributing to obesity.

In the Ghanaian society where slim/skinny is a clear reflection of poor, sick and unsuccessful and fat/big body relates to rich, healthy, and successful, most people aspire to gain more weight to avoid societal ridicule. Some traditional practices as stated by the participants contributes to obesity. For example, use of beads, traditional dressing, and enstoolment of chiefs and queen mothers. These traditions are practiced commonly in the southern part particularly

among the Asantes in the Ashanti region, the Ga in the Greater Accra, Fantes in the Central region. Generally, these regions are the most predominant obese areas from the result analysis. Weight gain after childbirth may account for the high rates at rural areas. As explained by the participants in the focus group discussion, birth control options results in weight gain among most women. The rich and educated people indulge in birth control practices than the poor therefore, such practices may also account for the obesity variation. Lifestyle styles such as alcohol consumption, hangouts, and night eating are common among the population in the cities that explains high obesity rates in urban areas. Ghanaians respect and recognize individuals especially stout and big individuals, this motivates people to gain more weight to the extent of adopting unhealthy lifestyles to gain weight. Indigenous Ghanaian foods that may promote weight gain are mostly eating among the southern population accounting for high obesity rates in the south. Lastly, the perception of weight gain to wealth and healthy life influence most people to gain weight leading to obesity. Being rich, educated, and living in the urban contributes to obesity but the underlying driver of these is the cultural perception of the people.

5.1 Limitations

Most of the participants in the focus group were stays in one region and were mainly from the same tribe. The discussion was centered on Ghanaian culture practices yet; some other related topics were discussed. Education level of these participants were from primary to tertiary however, most have tertiary education. This somehow limits the discussion to educated population, and views of non-educated were not captured. Again, the aggregation of the districts included some municipals. There is a periodic change in number of districts, thus new ones are created. Currently, there are new regions created, adding up to the previous 10 regions. Using different spatial relationship method will give different maps for obesity clustering in the country. The reason for

the method used in the study was addressed to strengthen this study. Regarding the strengths of this work, we used a well surveyed data for the obesity analysis. To know best the influence of Ghanaian culture, focus group was not limited to only Ghanaians living abroad rather those in Ghana. Using this gave a clear knowledge on the recent happenings in the country as far as obesity is concern.

5.2 Conclusion and Recommendation

This study provides insight of spatial variations of obesity across the districts in Ghana. The study draws attention to need to consider spatial variations of obesity in Ghana and the Ghanaian culture in other health issues. Sedentary lifestyle, unhealthy diets, urbanization, and socioeconomic status are among the factors examined to contribute to obesity in Ghana. However, culture plays a role in obesity rates. Culturally, weight gain is perceived richness, healthy, and successful life, therefore, the poor aspires to be fat or gain more weight to be regarded as such. Thus, the Ghanaian culture embraces weight gain; therefore, as the socioeconomic status of the individual increases, they tend to be fat. In order to solve obesity health related problems, there is the need to change the mentality of Ghanaians by educating them on the consequences and future health problems of obesity. Lastly, the spatial variation and the cultural explanation of obesity will help target effective health interventions and allocate resources to needed places.

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