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Epidemiology of Adiposity in Childbearing Ghanaian Women

Emma Roselyne Konan Mrs
IPH

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ABSTRACT

BACKGROUND: The prevalence of adiposity (overweight and obesity) is increasing in among Ghanaian women. The disparity between urban and rural Ghanaian women in adiposity is seldom described due to data paucity. The purpose of this study was to provide a comparative analysis between urban and rural women in regards to the socio-demographic factors associated with adiposity.

METHODS: The analyses used cross-sectional data from the Ghana Demographic Health Survey involving child bearing women ages14 to 49 years old. The eligible population comprised 4848 non-pregnant women (2023 from urban and 2825 from rural areas). Residence-specific (urban versus rural) associations between selected independent variables and adiposity were quantified using odds ratios from univariate and multivariate logistic regression analyses. Stepwise logistic regression analyses were used to describe the variables that were best predictors of adiposity.

RESULTS: The overall crude prevalence of overweight (25.0-29.9 kg/m^2) and obesity ($\geq 30 kg/m^2$) were 40% and 18% in urban and rural areas, respectively. There was a positive statistically significant difference between urban and rural women with respect to the distribution of overweight as well as obese ($p<.001$). Result from the univariate models showed that among rural and urban resident women, older age, higher education, higher wealth, and lack of job was each associated with increased odds of overweight. Compared to Akan women, being of other ethnic group was associated with decreased odds of overweight in women of urban and rural settings. Lack of fruits consumption and Muslim religion were each associated with increased odds of overweight in women who live in rural settings. Consumption of less than 5 fruits in a day was associated with decreased odds of overweight in urban resident women. For urban and rural resident women, wealth index and age were the best predictors for overweight. Older age, higher education, higher weight index, lack of jobs and being other than Akan ethnicity were each associated with increased odds of obesity in urban and rural settings. Compared to married women, being unmarried was associated with increased odds of obesity in urban and rural women. Wealth index was the best predictor variable of obesity in urban women. older age, education, wealth index, having a job, and fruit consumptions were the best predictors of obesity in rural women.

CONCLUSION: Adiposity was more prevalent in urban living women compare to women who reside in rural areas. This finding is critical for planning effective adiposity control in Ghana. Proving education for Ghana women may enhance their wealth and knowledge about adiposity.

KEY WORDS: overweight, obesity, BMI, women, Ghana, urban, rural

EPIDEMIOLOGY OF ADIPOSITY IN GHANAIAN WOMEN OF CHILDBEARING AGE: a comparative study between urban and rural place of residence

By **Emma Roselyne Kossere-Konan**

MD, Abidjan- Cocody School of Medicine (Ivory Coast)

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Approval Page

A comparative analysis of the attitudes towards people living with HIV/AIDS between Haiti and the Dominican Republic

By:

Emma Roselyne Kossere-Konan

Approved:

Ike Okosun, MS, MPH, PHD, FRIPH, FRSH
Committee Chair:

Rodney Lyn, PhD, MS, Assistant Professor
Committee Member:

Date: 07/29/2010

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To the Ivory Coast, you are undergoing a hard moment in your history, you are seeking peace, and soon you will find it by the grace of God.

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The author of this thesis is:

Emma Roselyne Kossere-Konan
737 Twin Oaks Drive, Apt # 4
Atlanta, GA 30030

The Chair of the committee for this thesis is:

Ike Okosun, MS, MPH, PHD, FRIPH, FRSH

College of Health and Human Sciences

Georgia State University

P.O. BOX 4018

Atlanta, GA 30302-4018

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737 Twin Oaks Drive, No # 4 Decatur, GA, 30030
Mobile: 404 437 0618 **ekonan1@student.gsu.edu**

EDUCATION and ACADEMIC DEGREES

- Georgia State University, Atlanta GA
  MPH with concentration in Epidemiology **2010**

- University of Abidjan, Faculty of Medicine, Côte d'Ivoire
  Diploma in Emergency Medical Services **2004**

- University of Abidjan, Faculty of Medicine, Côte d'Ivoire
  MD **2003**

Volunteer

- Health condition of the African Diaspora: **2008 – 2009**
- HealthSTAT Childhood Obesity Prevention Initiative **2009**

Intern CDC-DGPHCD **2009**

SKILLS: MS office package, Epi-Info program, SPSS 18.0 for Windows, SAS, PowerPoint, Excel

HONORS

- Fulbright Scholar (Foreign Student Program for a Master in Public Health at Georgia State University, Atlanta, USA) **2008 - 2010**

AFFILIATION AND MEMBERSHIP

- Member of the American College of Sports Medicine (ACSM)
- Member of National Society of Physical Activity Practitioners in Public Health (NSPAPPH)
- Member of the Medical Board of Cote d'Ivoire

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CHAPTER 1:

INTRODUCTION

1.1 Background

Adiposity including overweight and obesity is a major disease worldwide (WHO Monica 1989) and is major risk factor to many chronic diseases. Obesity is associated with increased risk for type 2 diabetes mellitus, hypertension, cardiovascular disease, stroke, hyper-lipidemia and certain types of cancers (Bray, 1996; Burton, 1985). Although genetic pattern may be underlying certain cases, most chronic diseases are preventable through behavioral changes at individual and community levels and also policies adjustment at the government level.

The obesity pandemic originated in the US and crossed to Europe and the world's other rich nations before, remarkably, it penetrated even the world's poorest countries especially in their urban areas (Prentice, 2006). The WHO even warns that the greater future burden of adiposity and diabetes will affect developing countries and the projected numbers of new cases of diabetes run into the hundreds of millions within the next two decades (WHO: Obesity, 2000). The pandemic is transmitted through the vectors of subsidized agriculture and multinational companies providing cheap, highly refined fats, oils and carbohydrates, labor-saving mechanized devices, affordable motorized transport, and the seductions of sedentary hobbies such as television (Prentice, 2006). Yet, public health awareness alerts have triggered two alternative interventions: First, specialists prescribe and implement medical interventions comprising medication, physical activity and surgery to treat patients. Secondly, another alternative consists of preventive protocols and ongoing legislative actions to contain the spread. Preventive measures are the hope for the future so that in the US, in Europe and other western countries including Australia interventions now focused on childhood obesity prevention.

In developing countries almost three decades ago, the WHO in collaboration with international nutritionists and experts were looking for interventions to assist starving populations, particularly children and childbearing women; today, those experts are seeking strategies to minimize the effects of overeating or at least improperly eating on the said-starving populations years ago. In Africa, the ongoing nutritional transition, along with certain socio-cultural beliefs are fertile grounds for both undernourished infants living in the same household with oversized mothers. Unfortunately, little is known about the epidemiology of adiposity in the sub-Saharan region of Africa. Populations, although unaware of the alarming statistics on obesity by the WHO, continue to suffer and die from diseases associated with adiposity (Boutayeb, 2006). Adding to other causes of adiposity already diagnosed in developed countries, factors such as illiteracy, poverty and social inequities are significant contributors to its emergence in Sub-Saharan Africa where the prevalence of adiposity is said to be 1.5 to 2 times higher among women than men (Scidell, 2005).

In Ghana particularly, some studies confirm this trend in the Capital city, Accra. However, very few epidemiology studies have been conducted on women in the country. The Demographic Health Survey (DHS), funded by the United State Agency for International Development (USAID), has collected nationally representative data on anthropometric measurements, diet, physical activity and socio-demographic information in more than 80 countries around the world including Ghana. The DHS contains questionnaires that serve as valuable indicators of adiposity in child bearing Ghanaian women.

1.2 Defining adiposity

Adiposity or obesity is defined based on the WHO criteria as abnormal or excessive fat accumulation that present a risk to health (WHO, 2000). The most common and crude measure of obesity is the Body Mass Index (BMI) or Quetelet Index. The BMI is a statistical measure which compares a person's weight and height. The BMI is a good tool to screen for problems in weight status that may lead to health hazards. An adult who has a BMI between 25 and 29.9 is considered overweight. An adult who has a BMI of 30 or higher is considered obese (CDC, 2008). The BMI, however has some limitations when used with some categories of persons. For example because athletes have a disproportionately higher muscle mass for a given height, their BMI calculation often places them in the high risk categories for many chronic diseases. In such cases, an assessment of body composition is required to determine how much of the body weight is composed of fat and nonfat tissues.

Other methods exist to estimate body fat and fat distribution including measurements of skinfold thickness and waist circumference, calculation of waist-to-hip circumference ratios and techniques such as ultrasound, hydrostatic weighting, computed tomography, and magnetic resonance imaging (MRI). All these techniques measure a person's:

- Body composition: the ratio of person's body fat to lean body mass
- Body fat mass: the amount of body fat, or adipose tissue, a person has.
- Lean body mass: the amount of fat-free tissue, or bone, muscle, and internal organs, a person has (CDC, 2008).

1.3 Purpose of the Study

The primary purpose of this study is to determine socio-demographic factors that are associated with overweight and obesity in child bearing women respondent to the Ghana Demographic Health Survey. First, the study will conduct a review of the literature for an accurate understanding of the economic and nutrition transition ongoing in developing countries like Ghana. Second, the study will examine the consequences of that transition at a public health level. The study will conduct a comparative analysis by type of place of residence: urban versus rural. Finally, the study will propose some recommendations for public health interventions in order to contain the obesity trend in Ghanaian women.

The main **research questions** will be:

1- Is there any association between the type of place of residence and obesity prevalence in Childbearing women

2- Is there any difference in adiposity of the respondents in urban versus rural according to their socio-demographic status?

3- Is there any difference in obesity between women living in rural and urban areas according to their diet and physical activity level?

4- Are age, marital status, education and socio-economic status factors related to obesity of urban women as compared to rural ones?

1.4 The Theoretical Framework

Despite the scientific knowledge, the prevention campaigns and other educational programs, obesity has progressed from the USA in the past three decades, to Europe, Australia and now reaching into developing countries. Thus, it should be considered a pandemic (James, 1992). Obesity is the result of imbalance between energy intake and energy expenditure. The energy intake is the composition of food and drink and the expenditure relates to physical activity. Changes in weight equal energy intake minus energy expenditure. Traditionally, overweight/obesity treatment consisted only in finding, at an individual level, the best way to recreate the energy balance. Public Health campaigns encouraged populations either to reduce the amount of food consumed or to increase the level of physical activity. This approach has shown limited success.

Obesity, like HIV/AIDS, is a real public health threat to our millennium. Many public health professionals have tried to understand the problem that goes beyond individual behaviors alone to include other factors. A contemporary approach suggests that environment surrounding the individual is a determinant in the occurrence of disease.

Intervention models are, therefore, dominated by a socio-ecological model which tends to intervene at different levels. The Jane Moore socio-ecological model has five levels of intervention: the individual level, interpersonal level, the organizational level, the community level and the public policy level (figure1) (Moore, 2010).

Figure 1: The Socio-ecological Model by Jane Moore

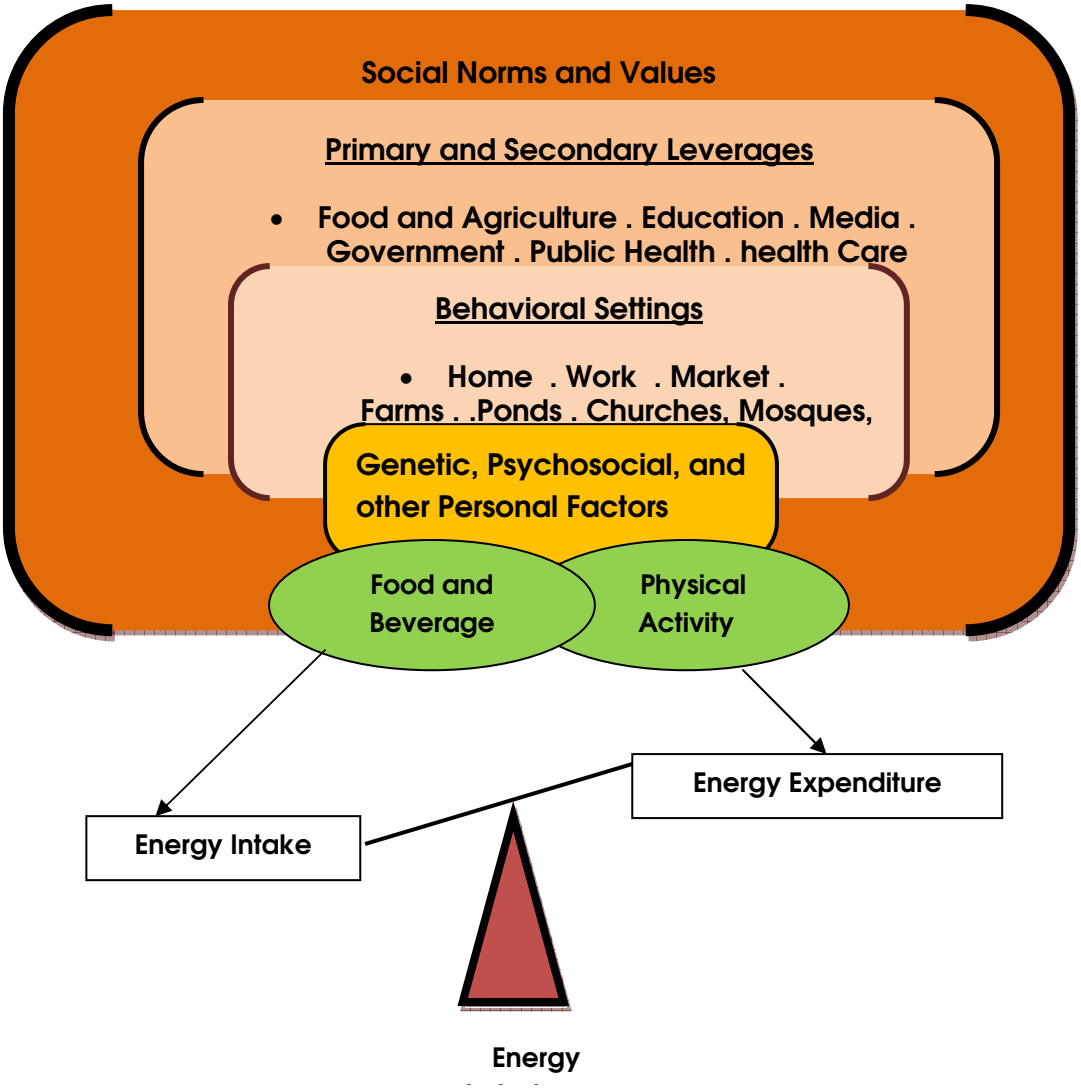
Socio-Ecological Model--Looking Beyond the Individual

What are ALL the Factors That Influence Your Weight? Is It JUST You?

The World We Live In Influences Us.

Taken from Jane Moore, Ph.D., RD Manager of Oregon Department of Human Services-Health Services, http://www.dhs.state.or.us/publichealth/hpcdp/about.cfm#why .

Figure 2: **Social Ecological model in a nutshell**



The socio-ecological model recognizes the interwoven relationship that exists between the individuals and their environment.

- While individuals are responsible for instituting and maintaining the lifestyle changes necessary to reduce risk and improve health, individual behavior is determined to a large extent by social environment, e.g. community norms and values, regulations, and policies.
- Barriers to healthy behaviors are shared among the community as a whole. As these barriers are lowered or removed, behavior change becomes more achievable and sustainable.
- The most effective approach leading to healthy behaviors is a combination of the efforts at all levels--individual, interpersonal, organizational, community, and public policy.

Many factors may influence Ghanaian women weight; they are described as (figure 2):

- Social norms and values in Ghanaian society. Example overweight labeled as beauty stereotype
- Political stability, development of Western and Global business. Example emergence of affordable fast food, improvement of living standard and the use of motorized transportation
- Behavioral factors including the person's values, culture, exposure as well as community life. Example consumption of fried food and sweet beverages, extensive TV viewing
- Intra-personal factors including biological and psycho-social factors. Example family history of diabetes, eating disorder etc

As a result, all these leverages may cause Ghanaian women to have either a balanced or an unbalance BMI.

- **Current status of Ghanaian women**

The last Friday in February each year, has been declared by The African Union Executive Council Africa Healthy Lifestyle Day. In 2006 the day was celebrated in Ghana under the theme ‘’Food, Fun, and Fitness: Health is Wealth. The day was celebrated within the World Health Organization (WHO) program for prevention and control of non-communicable disease (The Ghanaian Journal, 2010). Ghanaians have been encouraged to embrace behavioral changes for a new lifestyle including a healthy diet and physical activity in order “to stay healthy and live longer” (Amoah, spring 2003).

The research question in this thesis is grounded on this advertising slogan to find out sources of data as baselines to evaluate the association between environmental factors and risk behaviors in Ghanaian women in both urban and rural areas. This study is designed to provide further understanding of the socio-demographic factors that are associated with adiposity in child bearing women in Ghana. The analysis will compare the rates of adiposity and its associated factors in women in rural areas to those living in cities with the ultimate goal of suggesting public interventions to contain adiposity (obesity and overweight).

CHAPTER 2:

LITERATURE REVIEW

In order to better understand the Ghanaian specific adiposity problem, the literature will first, discuss obesity as a pandemic; next the paper will review the ongoing economic and nutritional transition in developing countries and its public health implications. Third, the literature will explain the Ghanaian current food situation, norms and values and how those factors are related to the prevalence of adiposity in women.

2.1 The pandemic of adiposity in the world

In 2003 the World Health Organization statistics declared more than one billion adults overweight worldwide with at least 300 million of them clinical clinically obese. About 75% of cardiovascular diseases (CVD) can be attributed to high cholesterol, high blood pressure, low fruit and vegetable intake, inactive lifestyle and tobacco (WHO, 2003).

In the USA

During the past 20 years there has been a dramatic increase in obesity in the United States. In 2008, only one state (Colorado) had a prevalence of obesity less than 20%. Thirty-two states had prevalence equal to or greater than 25%; six of these states (Alabama, Mississippi, Oklahoma, South Carolina, Tennessee, and West Virginia) had a prevalence of obesity equal to or greater than 30%. Results from the 2007-2008 National Health and Nutrition Examination Survey (NHANES), using measured heights and weights, indicate that an estimated 17 percent of children and adolescents ages 2-19 years are obese. The age-adjusted percentage of adults aged ≥20 years who were obese during 2003--2006 varied by race/ethnicity among women, ranging from 53.3% for non-Hispanic black women to 41.8% for Mexican-American women and 31.6% for non-Hispanic white women. Obesity levels were more similar for Mexican-American men (28.8%), non-Hispanic black men (35.0%), and non-Hispanic white men (32.0%) (CDC, 2008).

In 1999 the Center for Disease Control and Prevention (CDC, 2008) created a Division of Nutrition, Physical Activity, and Obesity (DNPAO) to address the obesity epidemic and other chronic diseases in the US. In 2010 the division funds about 25 states through efforts coordinated with multiple partners. The program main objective is to create policy and environment changes to improve the health places where Americans live, work, learn and play. The DNPAO is currently providing a variety of nutrition and physical activity strategies to the 25 states targeted (CDC, 2008).

In Europe

From 1958 to 1964 a survey was conducted on seven countries in northern and southern Europe on men aged 40 to 59. The cohort was followed up with a systematic analysis of ten year coronary heart disease incidence in order to produce a European coronary risk charts (Menotti, 2000). The Survey estimated between 15 to 20 % of European men to be obese (Kromhout, 2001). In 1995, the United Kingdom Department of Health showed that the prevalence of obesity in women had almost tripled from 8% to 21% between 1980 and 1998. In 1998, the Health Survey Unit for England found more than half the population to be overweight or obese. For those at risk of obesity-associated diseases with a body mass index equal or superior to 22kg.m $^{-2}$ interventions are designed to reduce the risk of coronary heart disease (Ashton, 2001).

In Australia

The most recent Australian National Health survey (NHS) data on overweight and obesity for adults aged 18–75 was based on self-reported BMI data from 2004 to 2005. Self-reported data are considered less reliable than measured data because people tend to overestimate their height and underestimate their weight. However, the survey showed alarming results: 32.6% of adults were reported as overweight with 40.5% males and 24.9% females. 16.4% of adults were reported as obese with 17.8% male versus 15.1% females.

The NHS showed higher rates of overweight or obesity in older age groups. Those in the 55–64 age groups had the highest combined rates of overweight and obesity; 72% of males and 58% of females. The prevalence of overweight and obesity increased markedly between 1995 and 2004-2005, according to historical data presented in the 2004-2005 NHS. Levels of overweight increased from 29.5% reported in the 1995 NHS to 32.6% in 2004-2005. At the more severe end of the spectrum, the prevalence of obesity among Australian adults was 11.1% in 1995, rising to 16.4% from 2004 to 2005(Australian Bureau of Statistics, 2007).

2.2 The demographic and socio-economic transition in developing countries public health implications

Experts use the term ‘’epidemiological transition’’ to understand changing ecological relationships between humans, pathogens and other hazards. The first transition was characterized by ecological and social relationships that minimized the impact of infectious disease. Later a second epidemiological transition in which public health measures improved nutrition and medicine resulted in declines in infectious disease and a rise in non-infectious disease, chronic and degenerative diseases. Later again those populations (mainly in developed countries) who were at their second transition underwent a third transition with the emergence of new diseases and also reemergence of ancient infectious diseases (Armelagos, 2005). Most developing countries are undergoing, at the same time demographic, economic and epidemiologic transitions resulting in many threats. In 1997 the WHO Expert consultation on Obesity warned that the obesity epidemic was penetrating the poorest nations in the world, first, among urban middle-aged adults but increasingly affecting semi-urban and rural areas, and younger age groups (Prentice, 2006). Some nutritionists have tried to explain this trend by the shift in the overall structure of dietary patterns in Asian, Latin American, Northern African, Middle Eastern, and urban sub-African populations. Major dietary changes have included a large increase in the consumption of fat and added sugar in the diet, often a marked increase in animal food products contrasted with a fall in total cereal intake and fiber. In Asia for instance, a major component appears to be the increase in amount of edible oils in the diet (Popkin, 2001). Experts conclude their analyses saying that dietary fat has a determinant role in the development of obesity (Bray, 1998).

Experts highlight another determinant of obesity, that is, populations’ daily energy expenditure. They warn that several changes in physical activity patterns are occurring rapidly and jointly. One is a shift away from the high-energy expenditure activities such as farming, mining and forestry towards the service sector. Reduced energy expenditures in the same

occupation are the second change. Other major changes relate to the modes of transportation and activity patterns during leisure hours (Popkin, 2004). In either case, the statistics on excess dietary fats and insufficient energy expenditure or both, are alarming. In Ecuador, for instance, studies evaluating chronic disease associated with overweight and obesity have shown that death from heart disease remained stable among Ecuadorian women between 1970 and 200 at 21% to 22% of all deaths, whereas for men it climbed from 32% to 36% (Rodriguez, 2002).

Death from diabetes rose from 8% of all deaths to 18% for men between 1990 and 2000; for women during the same time period it rose from 11% to 22% (WHO, 2000). Metabolic syndrome (a condition associated with excess weight and increased risk for cardiovascular disease and defined by the presence of any three of the following: hypertension, hyper-triglycidemia, central obesity, low level of high density lipoprotein cholesterol, and elevated fasting glucose) among post-menopausal women in the city of Guayaquil was recently estimated at 41% (Hidalgo, 2006). Trends in obesity-related cancer mortality such as postmenopausal breast cancer and endometrial cancer were difficult to estimate (Bosetti, 2005). Martorell et al. (2000) estimated obesity in women aged 14 to 49 from developing countries from 38 nationally representative surveys carried out in the last decade. A total of 147,938 non-pregnant women were included in the analyses. The percentage of obese 0.1 % in South Asia, 2.5% in sub-Sahara Africa, 9.6% in Latin America and the Caribbean, 17.2% in the Middle East and North Africa. Levels of obesity in countries increased sharply until a gross national product of $ 1500 per capita (1992 values) was reached and changed little thereafter. In very poor countries, such as in Sub-Saharan Africa, obesity levels were greatly concentrated among urban and higher educated women. The study of Belahsen in Morocco and some others in Cameroon and The Ivory Coast had the same results of higher prevalence of adiposity in childbearing women living in urban areas (2003). In Cameroon, more than 25% of urban men and almost half of urban women were

either overweight or obese. The prevalence of obesity showed considerable variation with age in both genders. Among women, using waist-to-hip ratio and waist circumference yielded the highest prevalence of obesity (28%) and body mass index the lowest (19.5%). There was a trend towards an increase in age-adjusted odd ratios of being overweight or obese with duration of education in both sexes (Kamadjeu, 2006). The Ivory Coast and Ghana are close to each other and share a border on the eastern side of Ghana. Akan populations, the main ethnic group in Ghana, are also found in The Ivory Coast. They have in common the same diet and socio-cultural customs. The results of a study on 3180 non-pregnant women from the Ivory Coast determine the prevalence of 11% overweight and 7.4 % obese (Martorell, 2000).

2.3 Ghanaian current food situation, norms and values and impact women

Nutritionists assert that the cultural background determines what is eaten as well as when and how. People's culture influences the kind of foods they eat. What the African communities eat can be viewed in the context of the diverse socio-cultural and economic environment. Traditionally, Africans eat more grain foods, but most of them consume less than one serving of fruits per day. West African populations, like Ghanaians' communities, rely on one or two staple crops generally maize, teff, cassava, yam, sweet potato, plantain, and enset. The crops provide the bulk of energy intake of the household members. To balance their diet, consumers complement staple food with legumes or foods from animal sources that are rich in proteins and fat/oil. With a few exceptions, all sub-Saharan ethnic groups' cuisine has the basic format that consists of a starchy food eaten with a sauce or dip, which may or may not be spicy (Oniang, 2003). However, in Ghana like in most countries in Africa rapid urbanization amidst poorly performing economies has resulted into a large proportion of urban residents being poor with limited access to social amenities (UN, 2006; Cohen, 2004). In spite of rampant poverty in urban areas, access to cheap foods with high content of fat and sugar among the urban poor is easier than among the rural population (Njelekela, 2003; Mathe, 1985). Social pressures are also

responsible for increasing rates of adiposity in Ghana. Ghanaians view fatness as beauty and sign of prosperity therefore, men generally prefer looking bigger and choose obese –like women to thinner ones (Amoah, June 2003). On the National Lifestyle Day 2005 The Head of NCDs of Ghana Health Service (GHS) said in an interview ‘’Younger and younger people are now suffering from hypertension, stroke and certain cancers. Non-Communicable Diseases (NCDs) are often costly to treat and require lifelong treatment as many are not curable and so ‘’the best approach is prevention,” (the Ghanaian Journal, 2010).

CHAPTER 3:

METHODS AND PROCEDURES

3.1 Data Source

The 2008 Ghana Demographic Health Survey (GDHS) was used for this study. The GDHS was carried out by the Ghana Statistical Service and the Ghana Health Survey. The cost of the Survey was shared by the Ghanaian Ministry of Health (MOH), the Ghanaian Statistical Service and AIDS commission, UNICEF, and UNFPA. The survey provides current information on the population and health situation in the country. Data collected include total Ghanaian population, urban and rural populations, fertility, family planning, maternal and child health and nutrition, childhood mortality, HIV/AIDS-related knowledge and behavior and domestic violence. The GDHS used data from a Ghanaian representative sample including rural and urban regions throughout the country. 11,778 households were interviewed with a 97% response rate in 4,916 women aged 15 to 49

3.2 Study variables

The setting for this study is restricted to women of child bearing ages ranging from 14 to 49 years. In the DHS data, up to 4551 women were interviewed among whom we excluded n=315 pregnant women. The studied population was then divided in two categories. The first category comprises 2023 women living in urban areas while the second category comprises 2528 women from rural areas. Independent variables as well as dependent variable are analyzed accordingly.

Socio-demographic variables include age, level of education, ethnic group, marital status, wealth index, job, religion, and residence place. Diet is assessed by daily fruit, vegetable and fluid intake. Physical activity level is estimated by hours of physical activity per day or per week.

a. **List of independent variables**

Socio-demographic variables that were used in this study include age, type of residence, level of education, ethnic groups, wealth index, marital status, physical activity and fruits and vegetables consumption. For the variable age, women were grouped into 5 years age-category groups. Of the 4236 women that were eligible for this study, their mean age ranged from 15 to 49 years. The type of residence was classified as urban or rural. Education level is categorized into four different groups including no education which is the lowest level to the highest level. Four subjects had no values on education. The variable ethnic group was recoded in two different groups. The first group comprises the most important ethnic group, the Akan, and the second group was a combination of other smaller ethnic groups. Wealth index is consists of five categories: poorest, poorer, middle, richer and then the richest. Marital status included was composed of six different groups : never been married, married, living together, widowed, divorced or not living together. The variable was recoded into four groups. The first groups composed of unmarried women which was a combination of never married and not living together. The second was a combination of widowed and divorced. The third group combining married women and those living with a partner. For variables entitle number of days eating fruits in a typical week, eating vegetables in a typical week and vigorous physical activity during a typical week all respondents who answered ‘’do not know ‘’ were added to the groups ‘’none’’ which are the groups who do not consume any fruit or any vegetable or do not exercise at all. Then variables were categorized into three categories: those who do not eat any fruit or vegetables at all, those who eat fruit and vegetables less than five days a week and those who eat more. The variable physical activity was recoded into two categories: women who had vigorous physical activity less than five days a week and those who exercised more than five days a week.

b. **Dependent variables**

The two main dependent variables for this study were expressed as: overweight and obesity defined as BMI of 18-24.99 $kg.m^2$, 25.00-29.99 $kg.m^2$and 30 $kg.m^2$and greater, respectively (CDC, 2008).

3.3 Statistical Analysis

All statistical analyses that were conducted for this study were done using SPSS 18.0. Tables and figures were created also created using SPSS 18.0.

Characteristics of study population were evaluated using demographic variables (age, education level, wealth index, marital status). Behavioral factors (physical activity, diet habit). Anthropometric measurements such as BMI were also computed to determine normal, overweight and obese women. Analysis was stratified according to ethnic group, and socio-economic status. Differences between continuous variables were tested at $p<.05$ level. Group ethnic stratification was computed (Akan and others).

Chi-square statistics were performed to describe the absolute values, the distribution of categorical variables and to determine any significant relationship between the variables across the two type of place of residence urban versus rural. P-values for Chi-square tests were reported for each categorical variable in the data set.

Odds ratio from binary logistic regression analyses was used to determine the association between independent and dependent variables. Appropriate 95% confidence intervals and $p < .05$ were used to determine statistical significance.

Finally, the stepwise multiple logistic regression forward LR was used to determine the most important predictors of outcome variables. Some of the variables were recoded to fit the model. They include fruit, vegetable, religion, marital status, and physical activity, ethnic. Other variables were not recoded, they include working status, wealth index and education level and

age categories. The ultimate goal of this analysis is to create a parsimonious model with the best predictors of adiposity (overweight or obese) by eliminating insignificant predictors for both urban and rural areas. A significant association is assumed for a given p-value less than or equal to 0.05.

CHAPTER 4:

RESULTS

Basic Characteristics of Eligible Women: Table 1

Table 1 shows the distribution of the dependent and independent variables stratified by residence (urban versus rural). Overall, the distribution of the population by age, ethnicity, working status, marital status, education, wealth index, religion, physical activity and diet vary according to urban- rural settings. Overall, 4551 women were eligible for this study; the majority of them (55.5%) lived in rural areas. In both urban and rural areas women aged between 14 and 19 accounted for more eligible women. The mean age of women living in rural areas was slightly higher (29.43 SD±10.07) than that of those in urban areas (28.64 SD±9.06). Akan was the most dominant ethnic group in urban as well as rural areas. There was a positive statistically significant difference between urban and rural women with respect to the distribution of adiposity defined by overweight ($p < .001$) with women in urban areas having higher levels of adiposity.

Age Distribution of Overweight and Obese Women by Residence: table 2

Table 2 shows age distribution of overweight and obese women stratified by residence (urban versus rural). As shown, distribution overweight women increased with age, from 15 to 29 years in both women living in urban and rural areas. However, more overweight women were represented in urban setting compared with rural settings ($p=.018$). Obesity was more prevalent in the 40-44 year old groups with values of 18.3% and 26.7% for urban and rural women, respectively. However, unlike overweight, there is no statistically significant in the distribution of obesity by age with respect rural or urban residence ($p= .557$).

Distribution of Overweight and Obese Women by Educational Level: table 3

Table 3 compares the distribution of overweight and obese women with respect to education level stratified by residence (urban versus rural). There was a statistically significant difference between urban and rural residences with respect to the distribution of overweight ($p<.001$). As shown, distribution of overweight increased with higher educational level in both urban and rural areas. However, overweight was more common in women living in urban areas (80%) compared to rural areas (48.7%). The distribution of obesity by education status was similar to overweight distribution. The distribution of obesity was higher in women living in urban areas (63.4%) compare to rural (49.4 %) in subjects with secondary education level. Overall, there is a statistically significant difference between urban and rural residences with respect of the distribution of obesity ($p<.001$).

Distribution of Overweight and Obese Women by Current Marital status: table 4

Table 4 shows the distribution of overweight and obesity by marital status stratified by place of residence. As shown, the distribution of overweight and obesity varied by marital status. Among overweight women, there were more married women in rural (70.6%) compared to urban (58.9) settings. A similar pattern of distribution was also observed for obese women, with married women accounting for 67.7% for rural women compared with 83.3% for rural women.

Distribution of Overweight and Obese women by Religion: table 5

Table 5 shows the distribution of overweight and obese subjects with respect to religion status as stratified by place of residence. Overall, there were statistically significant differences in the distribution of religious status of overweight and obese women with respect to residence. As shown, there were more overweight Christian subjects in both rural and urban settings compared

to other religious. Also, the distribution of overweight in Moslim subjects was higher in urban (17.8%) compared to rural areas (10.5%). In general, the distribution of overweight with respect to religion varies between urban and rural settings and the difference is statistically significant ($p < .001$). Overall, there was a statistically significant difference between urban and rural settings with respect to obesity ($p = .002$). The distribution of obese in Christian subjects was higher in rural (86.7%) compare to urban (80.3%) settings.

Distribution of Overweight and Obese women by Ethnicity: table 6

Table 6 shows the distribution of overweight with respect to ethnicity stratified by the place of residence. Overall, there was a statistically significant difference in the distribution of overweight between women living in urban areas compare to those in rural ($p=.014$). Compared to other ethnic groups, Akans presented with more overweight subjects in both rural and urban settings. Although the distribution of obese subjects with respect to ethnicity tended to be similar to overweight, the distribution by residence was not statistically significant.

Distribution of Overweight and Obese women by Work Status: table 7

The distribution of overweight and obese subjects with respect to working status stratified by the place of residence is shown in Table 7. As shown in the table the distribution of overweight is more important in the working force. However, the distribution of overweight was slightly higher in women living in rural areas, about 90.6% of the population, compare to 80.4% of women in urban areas. Overall, there is a statistically significant difference in the distribution of overweight between urban and rural areas with respect to working status. However, the

distribution of obesity was slightly higher in women living in rural areas, about 92.2% of the population, compare to urban 85.9%. However, there was no statistically significant difference in the distribution of obesity between urban and rural areas with respect of working status (p=.097).

Distribution of Overweight and Obese women by Wealth index: table 8

Table 8 shows the distribution of overweight and obese subjects with respect to wealth index stratified by the place of residence. As shown, overall, there is a positive statistically significant difference in the distribution of overweight and obese subjects according to wealth index between urban and rural areas (P<0.001). Wealthy women in urban areas are more likely to be overweight and obese.

Distribution of Overweight and obese women by Number of days eating fruits during a typical week: table 9

Table 9 shows the distribution of overweight and obese subjects with respect to the number of days of eating fruit during a typical week stratified by the place of residence (urban versus rural). Overall, the distribution of overweight and obesity did not differ with respect to the number of days of eating fruits during a typical week (P >.05).

Distribution of Overweight and obese women by Number of days eating vegetables during a typical week: table 10

As shown in Table 10, the distribution of overweight and obesity with respect of the number of days vegetables were consumed during a typical week stratified by the place of residence (urban versus rural). Overall, the distribution of overweight and obesity did not vary by residence (P >.05).

Distribution of Overweight and obese women by Vigorous physical activity Status: table 11

Table 11 shows the distribution of overweight and obese women with respect to vigorous physical activity during a typical week stratified by the place of residence. In general, the distribution of overweight was more common among women who exercise less than 5days per week compare to the rest of the population. However, the distribution of overweight was higher in women who exercise more than five days per week in rural areas (36.2 %) compare to urban (32.8 %). Overall, there is a statistically significant difference in the distribution of overweight with respect to vigorous physical activity (P< .001). A similar finding was observed in obese women.

Association between Selected Independent Variables with Overweight

Univariate Models: tables 12&13

The results of residence-specific univariate logistic regression analyses of the association between selected independent variables with overweight are shown in Table 12 and Table 13. Among rural and urban resident women, increased age, higher education, higher wealth, lack of job was each associated with decreased odds of overweight. Compared to Akan women, being of other ethnic group was also associated with decreased odds of overweight in women of urban and rural settings. As shown in Table 13, lack of fruits consumption and Muslim religion was each associated with decreased odds of overweight in women who live in rural settings. Consumption of less than 5 fruits in a day was also associated with decreased odds of overweight in urban resident women.

Stepwise Models: table14

Stepwise logistic regression method was used to determine the best variables that are associated with overweight (Table 14). For urban and rural resident women, wealth index and age were the best predictors for overweight. As shown, and similar to the results from the univariate analyses, increases in wealth index and age were associated with increase odds of overweight.

Association between Selected Independent Variables with Obesity

Univariate Models: tables 15&16

As shown in Table 15 and Table 16, older age, higher education, higher weight index, lack of jobs and being other than Akan ethnicity was each associated with increased odds of obesity in urban and rural settings. Similar to the result from overweight, engaging in less than 5 days a week physical activity was not significantly associated with obesity in urban and rural settings. Compared to married women, being unmarried was associated with decreased odds of obesity in urban and rural women. Analyses of effect of religion, fruits and vegetable consumptions (Table 16) indicate that compared with Christians, being of Muslim religion was associated with decreased odds of obesity, ''Consumption of less than 5 fruits a day'' was also associated with decreased odds of obesity in rural women. Consumption of vegetables was not significantly associated with obesity in both urban and rural women.

Stepwise Models: table 17

As shown in Table 17, age and weight index were the best predictors of obesity in urban women. There was a trend of increasing odds of obesity with older age for urban women, increasing from .129 for women in the 15-19 year old group to 1.048 for women who were 40-44 years of age. A similar trend of increasing odds of obesity was also apparent for increasing wealth index for urban women. For rural women, increased age, education wealth index, having a job and fruit consumptions were the best predictors of obesity. As with urban women, a linear trend in age, and wealth index were associated with decreased odds of obesity. A similar increased trend in odds of obesity was also observed for increased education, ranging from odds ratio of .30 for no education to .49 for having secondary education. Lack of job, and not consuming fruits were also associated with decreased odds of obesity in rural women.

CHAPTER 5:

DISCUSSION AND CONCLUSION

5.1 Discussion

The main objective of this study was to use cross-sectional data from the DHS to document factors associated with adiposity (overweight and obesity) in Ghanaian childbearing women comparing urban to rural settings. The study explored adiposity's association with socio-demographic development, urbanization, socio-cultural beliefs.

The results of the study demonstrate that there is a difference in the prevalence of overweight and obese between urban and rural areas (figure 3). Women in urban areas have a higher prevalence of adiposity than those in rural areas. The study is consistent with previous studies in developing countries especially in Morocco (Belahsen, 2003), sub-Sahara Africa (Garett, 2005), Benin (Sodjinou, 2008) and also in Ghana (Amoah, spring 2003). Another study on 430 women in the Capital City Accra indicates even a higher prevalence of obese: 34.8 percent and overweight 27.4 percent compare to this study. All those results suggest negative effects of urbanization on populations especially women. A plausible explanation to all these results would be possibly understood by higher energy expenditure in rural women compare to urban. Ghanaian populations, unlike other populations in West Africa, are traditionally farmers (Oniang, 2003). In rural areas, since they are generally households' food providers, women tend to work harder in their farms compared to women in urban areas. The study also suggests environmental contributors to adiposity in urban areas as hypothesized by James Hill's study (1998) and also the study of Ziraba (2009). They labeled adiposity contributors advances in technology and transportation that reduce the need for daily physical activity in urban settings. The theory of obesogenic environment is defended by Hill, suggesting food availability and portion size affordable in urban areas that promote obesity by providing more frequent

opportunities for the consumption of large quantities of food (2008). These findings call for educational programs at community and individual level as well as regulations on food markets.

The overall findings in this study that adiposity increases with age is consistent with the work of Albert Amoah in urban and rural Accra (Jun 2003). Amoah demonstrated that obesity increased with age up to 64 years. Other studies in China found that 4.3 % of women 20-45 had BMIs $\geq$ 27.3 $kg.m^{-2}$ and 13.1% had BMIs >25$kg.m^{-2.}$ The same studies conducted in 1992 Mauritius and in sub-Africa found an obesity prevalence of 15.1% in women aged 24-74years (Marotell, 2000). A potential reason for that could be more sedentary life in adults compare to young persons.

In this study also, high levels of adiposity are concentrated among urban and high educated women. Results consistent with the study of Marotell (2000) on socio-demographic factors associated with obesity in women in developing countries and also with a previous epidemiologic study on obesity in Ghana (Birtwum, 2005).

Another finding is the association between adiposity and high socio economic status in urban areas. The result is consistent with two other studies (Amoah, Jun 2003; Marotell, 2005 & Ziriba, 2009). However, they point out an important difference between developing countries and industrialized. While in developed countries low socioeconomic status and poor neighborhoods have been associated with a higher prevalence of obesity and chronic diseases (Lopez, 2007); in developing countries, namely in Africa, studies have demonstrated by contrast, a strong positive relationship between obesity and high socio-economic status (Christensen, 2008; Fezeu, 2006; Kuga,2002; Ziriba, 2009).

Marital status in this study like in previous (Amoah, Jun 2003; Birtwum, 2005 & Duba, 2007) was also associated with high levels of adiposity and also with urban place of residence. Albert Amoah in a study in Ghana explains the phenomenon by social pressures that associate fatness with beauty in women and success in both sexes. A possible explanation is that Ghanaian

men are known to prefer overweight and obese women to thin ones and this may conceivably contribute to the higher rates of overnutrition among females (Jun 2003). Amoah emphases that ''It is not surprising that some women are now going out of their way to put on weight in order to appear beautiful and or prosperous'' (p 755). This socio-cultural belief is also demonstrated in the current study by the prevalence of adiposity that appear among populations from higher socio-economic status.

On education level the current study is also consistent with Amoah. In the current study urban women labeled as high educated had significantly higher prevalence of Obesity (9.3 %) than no educated (9%). Amoah results were slightly higher than this study (less literate and illiterate subject: 12.5-13.8 % compare to highest 18%). However, the prevalence of overweight in this study was greater in no educated urban subjects (11.4%) than in high educated (7%). These results strongly suggest a need for socio- educational programs, at a community level; on adiposity as a risk factor for chronic diseases.

On physical activity, this study found a significantly higher prevalence of overweight among women with less physical activity which is consistent with current scientific knowledge on the side effects of a sedentary lifestyle (Dietz, 1996; WHO, 2003). However surprisingly, the prevalence of overweight among rural women is significantly higher than rural in the current study. These results could reveal a higher influence of peers' pressure, related to beauty, in rural women compare to urban. The same significantly higher prevalence in rural areas compare to urban is showed with religion. This result suggests more studies in order to better understand the impact of religion on women in rural areas and its influence on adiposity.

The multiple stepwise logistic regression after adjustment for other independent variables has found a strong positive association between age, wealth index and adiposity (both overweight and obesity) in urban as well as rural. However, in rural areas education, working status and also diet appear to be significant predictors for obesity. Therefore interventions should

be conducted to address customs and cultural belief and also promote consumption of more fruits and vegetables.

5.2 Study limitations

This study has several limitations: First, the survey questionnaire type may include bias in the answer to several questions. As an example the question on physical activity is not really clear mainly in rural areas. A lot of respondent answered no to the question. However, knowing that they are farmers, an appropriate question would be on work done at the farm in order to evaluate physical level or intensity. Physical inactivity in this study appears to be not significantly related to adiposity.

Second, the questionnaire on daily diet does not reflect WHO recommendations making it difficult to validate respondents' answers. For the population to consider their diet as healthy they must consume at least 5 servings of fruits and vegetables. The survey emphasized whether or not women eat fruits or vegetables. A respondent may answer yes and still be overweight or obese because of an insufficient number of servings of fruits and vegetables.

Another limitation is the use of secondary data, which has limited the investigators to the variables collected by the survey. The variable ''television'' or ''transportation ''might have been of interest to evaluate sedentary lifestyle.

This study was limited to a comparison between in urban and rural non-pregnant women populations. Some associations have not been analyzed such as relation between weight gain and pregnancy aftermath.

5.3 Recommendations

The results of this study showed that the prevalence of adiposity was higher among adults women, educated and mainly those living in urban areas compare to rural. More research is needed to better understand the discrepancies between rural and urban Ghanaian place of residence. The Demographic Health Survey is one of the most studies used in developing countries like Ghana; other organizations and researchers should test the reliability of such survey by using wider range of items to create a more valid questionnaire on diet and physical activity.

The increasing prevalence of overweight and obesity in developing countries like Ghana also calls for policies and public health interventions promoting healthy lifestyle that may be beneficial to populations already under the burden of infectious diseases.

5.4 Conclusion

Despite the limitations of the study, the results are significant enough to provide insight into the increasing prevalence of obesity in Ghana. To control the spread of the epidemic, it is crucial to address cultural believes and educate populations in the developing world on adiposity as a risk factor for chronic disease. As a result populations like Africans' namely Ghanaian would be less likely to praise overnutrition and overweight as criteria for beauty and therefore be more likely to address the increasing adiposity pandemic.

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Table1: Characteristics of the eligible population Variables	Urban		Rural		P-value
	N	%	N	%	
Age(years)	2023	28.64(9.6)	2528	29.43(10.1)	.018
Age-5years (%)					
15-19	435	21.5	562	22.2	
20-24	383	18.9	392	15.5	
25-29	339	16.8	392	15.5	
30-34	266	13.1	295	11.7	
35-39	247	12.2	349	13.8	
40-44	181	8.9	285	11.3	
45-49	172	8.5	253	10.0	
Adipose(BMI)					< .001
Normal	1194	60.0	2024	81.9	
Overweight	279	26.0	343	13.9	
Obese	829	14.0	105	4.2	
# of days of fruits					.397
No fruit	188	9.3	471	18.6	
<5days	1046	51.7	1220	48.3	
≥5 days	789	39.0	837	33.1	
#of days of vegetable					.595
No Veggie	72	3.6	102	4.0	
<5days	1300	64.3	1510	59.7	
≥5 days	651	32.2	916	36.2	
#of days of PA/week					
<5days	1719	85.0	1946	77.1	<.001
≥5 days	303	15.0	578	22.9	
H. Educ. Lev (%)					<.001
No Ed	242	12.0	890	35.2	
Primary	322	15.9	603	23.9	
Secondary	1328	65.6	1002	39.7	
Higher	130	6.4	30	1.2	
Marital Status (%)					<.05
Unmarried	918	45.4	773	30.6	
Widowed/Divorced	989	48.9	1626	64.3	
Married	116	5.7	129	5.1	
Religion (%)					<.05
No Religion	26	1.3	137	5.4	
Moslem	420	20.8	342	13.5	
Others	23	1.1	225	8.9	
Christians	1554	76.8	1823	72.1	
Working					<.05
N0	593	29.5	541	21.6	
Yes	1414	70.5	1968	78.4	

Table2: 5-years group *Type of place residence* adiposity defined using BMI cross tabulation

				Type of Residence		P-Value
				Urban	**Rural**	
Overweight	**5-years group**	15-19	Count	52	32	0.018
			%	10.0	9.3	
		20-24	Count	74	38	
			%	14.3	11.1	
		25-29	Count	116	61	
			%	22.4	17.8	
		30-34	Count	95	51	
			%	18.3	14.9	
		35-39	Count	68	70	
			%	13.1	20.24	
		40-44	Count	57	53	
			%	11.0	15.5	
		44-49	Count	56	38	
			%	10.8	11.1	
Total			Count	518	343	
			%	100	100	
Obese		15-19	Count	13	5	.557
			%	4.7	4.8	
		20-24	Count	16	5	
			%	5.7	4.8	
		25-29	Count	40	9	
			%	14.3	8.6	
		30-34	Count	48	18	
			%	17.2	17.1	
		35-39	Count	66	25	
			%	23.7	23.8	
		40-44	Count	51	28	
			%	18.3	26.7	
		44-49	Count	45	15	
			%	16.1	14.3	
Total		Count		279	105	
		%		100	100	

Table3: Educational level *Type of place residence* adiposity defined using BMI cross tabulation

				Type of Residence		P-Value
				Urban	**Rural**	
Overweight	**Education**	No education	Count	59	91	<0.001
			%	11.44	26.5	
		Primary	Count	88	85	
			%	17.0	24.8	
		Secondary	Count	330	155	
			%	63.7	45.2	
		Higher	Count	41	12	
			%	7.0	3.5	
Total			Count	518	343	
			%	100	100	
Obese		No education	Count	25	23	<0.001
			%	9.0	21.9	
		Primary	Count	51	27	
			%	18.3	25.7	
		Secondary	Count	177	52	
			%	63.4	49.5	
		Higher	Count	26	3	
			%	9.3	2.9	
Total		Count		279	105	
		%		100	100	

Table 4: Marital Status *Type of place residence* adiposity defined using BMI cross tabulation

			Type of Residence		P-Value
			Urban	**Rural**	
Overweight	Unmarried	Count	178	75	0.001
		%	34.6	21.9	
	Widowed / divorced	Count	34	26	
		%	6.6	7.6	
	Married/Concubine	Count	305	242	
		%	58.9	70.6	
Total		Count	518	343	
		%	100	100	
Obese	Unmarried	Count	61	12	0.007
		%	21.9	11.4	
	Widowed / divorced	Count	29	5	
		%	10.4	4.8	
	Married/Concubine	Count	189	88	
		%	67.7	83.3	
Total	Count		279	105	
	%		100	100	

Table 5: Religion *Type of place residence* adiposity defined using BMI cross tabulation

Religion			Type of Residence		P-Value
			Urban	**Rural**	
Overweight	No religion	Count	9	12	0.001
		%	1.7	3.5	
	Muslims	Count	92	36	
		%	17.8	10.5	
	Others	Count	6	24	
		%	1.2	7.0	
	Christians	Count	411	271	
		%	79.3	79.0	
Total		Count	518	343	
		%	100	100	
Obese	No religion	Count	3	2	0.002
		%	1.1	1.9	
	Muslims	Count	49	6	
		%	17.6	5.7	
	Others	Count	3	6	
		%	1.1	5.7	
	Christians	Count	224	91	
		%	80.3	86.7	
Total	Count		279	105	
	%		100	100	

Table 6: Ethnicity *Type of place residence* adiposity defined using BMI cross tabulation

	Ethnicity			Type of Residence		P-Value
				Urban	**Rural**	
Overweight	**Ethnicity**	Others	Count	101	181	0.014
			%	19.6	52.8	
		Akans	Count	413	162	
			%	80.4	47.2	
Total			Count	514	343	
			%	100	100	
Obese	**Ethnicity**	Others	Count	136	52	.892
			%	48.7	49.5	
		Akans	Count	143	53	
			%	51.3	50.5	
Total		Count		279	105	
		%		100	100	

Table7:Working status *Type of place residence* adiposity defined using BMI cross tabulation

Working status				Type of Residence		P-Value
				Urban	**Rural**	
Overweight	**Job**	No	Count	101	32	<0.001
			%	19.6	9.4	
		Yes	Count	413	308	
			%	80.4	90.6	
Total			Count	514	340	
			%	100	100	
Obese	**Job**	No	Count	39	8	<0.097
			%	14.1	7.8	
		Yes	Count	238	27	
			%	85.9	25.7	
Total		Count		277	103	
		%		100	100	

Table8:Wealth Index *Type of place residence* adiposity defined using BMI cross tabulation

Wealth index				Type of Residence		P-Value
				Urban	**Rural**	
Overweight	**Wealth index**	Poorest	Count	1	81	<0.001
			%	0.2	23.6	
		Poorer	Count	19	86	
			%	3.7	25.1	
		Middle	Count	72	74	
			%	13.9	21.6	
		Richer	Count	201	75	
			%	38.8	21.9	
		Richest	Count	225	27	
			%	43.4	7.9	
Total			Count	518	343	
			%	100	100	
Obese	**Wealth index**	Poorest	Count	1	19	<0.01
			%	0.4	18.1	
		Poorer	Count	9	19	
			%	3.2	18.1	
		Middle	Count	22	23	
			%	7.9	21.9	
		Richer	Count	84	32	
			%	30.1	30.5	
		Richest	Count	163	12	
			%	58.4	11.4	
Total		Count		279	105	
		%		100	100	

Table9: Numbers of days eating Fruits in a typical week *Type of place residence* adiposity defined using BMI cross tabulation

			Type of Residence		P-Value
			Urban	**Rural**	
Overweight	No fruits	Count	56	37	0.397
		%	10.8	10.8	
	Less than 5	Count	278	169	
		%	53.7	49.3	
	More than 5	Count	184	137	
		%	35.5	39.9	
Total		Count	518	343	
		%	100	100	
Obese	No fruits	Count	24	11	0.650
		%	8.6	10.5	
	Less than 5	Count	127	51	
		%	45.5	48.6	
	More than 5	Count	128	43	
		%	45.9	41.0	
Total	Count		279	105	
	%		100	100	

Table10: Numbers of days eating Vegetables in a typical week *Type of place residence* adiposity defined using BMI cross tabulation

Days eating Vegetables in a typical week			Type of Residence		P-Value
			Urban	Rural	
Overweight	No vegetables	Count	20	12	0.595
		%	3.9	3.5	
	Less than 5	Count	328	207	
		%	63.3	60.3	
	More than 5	Count	170	124	
		%	32.8	36.2	
Total		Count	518	343	
		%	100	100	
Obese	No vegetables	Count	7	4	0.680
		%	2.5	3.8	
	Less than 5	Count	183	71	
		%	65.6	67.6	
	More than 5	Count	89	30	
		%	31.9	28.6	
Total	Count		279	105	
	%		100	100	

Table11: Numbers of days with vigorous PA in a typical week *Type of place residence* adiposity defined using BMI cross tabulation

	adiposity defined using BMI		Type of place of residence		P-value
			Urban	**Rural**	<.001
less than 5	**overweight**	Count	435	255	
		% within Type of place of residence	64	75.7	
	obese	Count	239	82	
		% within Type of place of residence	35.5	24.3	
	Total	Count	674	337	
		% within Type of place of residence	100.0%	100.0	
5 or more	**overweight**	Count	83	87	
		within Type of place of residence	67.5	79.1	
	obese	Count	40	23	
		within Type of place of residence	32.5	20.9	
	Total	Count	123	110	
		within Type of place of residence	100.0	100.0	

Table 12: Univariate Analysis of Association between Selected Independent variables and Overweight

Variables	TYPE OF RESIDENCE					
	URBAN			RURAL		
	Odd Ratio	CI	P-Value	Odd Ratio	CI	P-Value
5-year age category						
45-49 Ref						
14-19	.056	(.029-0.109)	<.001	.128	.046-.358	<.001
20-24	.085	(.045-0.159)	<.001	.188	.067-0.524	<.001
25-29	.345	(.207-0.573)	<.001	.365	.157-0.851	0.020
30-34	.608	(.368-1.006)	.053	1.048	.514-2.136	0.897
35-39	.928	(.572-1.507)	.764	1.282	.658-2.497	0.466
40-44	1.133	(.673-1909)	.638	1.820	.943-3.512	0.074
Education						
High (Ref)						
No education	0.375	(0.201-0.700)	0.002	0.132	(0.35-0.494)	0.003
Primary	0.657	(0.377-1.146)	0.139	0.245	(0.66-0.911)	0.036
secondary	0.511	(0.313-0.832)	0.007	0.292	(0.081-1.055)	0.060
Wealth index						
Richest (ref)						
Poorest	.122	(.016-0.917)	0.041	.101	(.047-0.218)	<0.001
Poorer	.340	(.166-0.698)	0.003	.139	(.064-0.302)	<0.001
Middle	.209	(.131-0.335)	<0.001	.288	(.136-0.613)	0.001
Richer	.519	(.386-0.698)	<0.001	.973	(.467-2.025)	0.942
Working						
Job (Ref)						
No job	0.280	(0.196-0.401)	<0.001	0.264	(0.127-0.547)	<0.001
Ethnic						
Akan (ref)						
Others	1.017	(0.784-1.320)	0.899	0.512	(0.345-0.759)	0.001
Physical activity						
>5days (Ref)						
Less than 5 days	1.034	(0.713-1.499)	0.860	1.020	(0.635-1.639)	0.935
Marital status						
Married (Ref)						
Unmarried	0.236	(0.173-0.322)	<0.001	0.264	(0.143-0.485)	<0.001
	1.482	(0.910-2.413)	0.114	0.744	(0.295-1.875)	0.531

Table 13: Univariate Analysis of Association between religion, fruits, vegetables and Overweight

Variables	TYPE OF RESIDENCE					
	URBAN			RURAL		
	Odd Ratio	CI	P-Value	Odd Ratio	CI	P-Value
Religion						
Christian(Ref)						
No religion	0.857	(0.244-3.008)	0.810	0.268	(0.065-1.100)	0.068
Muslims	0.718	(0.512-1.006)	0.54	0.321	(0.139-0.740)	0.008
Others	1.091	(0.302-3.943)	0.894	0.500	(0.216-1.158)	0.106
Fruits						
5 day (Ref)						
0 Fruits	0.841	(0.518-1.367)	0.489	0.303	(0.200-0.771)	0.007
Less than 5 days	0.555	(0.377-0.998)	0.023	0.782	(0.515-1.188)	0.249
Vegetables						
5 day (Ref)						
0 vegetables	0.699	(0.304-1.605)	0.398	1.208	(0.415-3.515)	0.729
Less than 5 days	1.021	(0.771-1.353)	0.883	1.467	(0.948-2.269)	0.086

Table 14:Stepwise Analysis with Overweight

Variables	Type of place of residence	
	Urban	Rural

	OR	95% CI	P-value		OR	95% CI	P-value
Wealth index				**Wealth index**			
Richest (ref)				Richest (ref)			
Poorest	.067	(.09- 51)	.010	Poorest	.062	(.027-.14)	<.001
Poorer	.230	(.10-.49)	<.001	Poorer	.086	(.037-.20)	<.001
Middle	.164	(.09-.27)	<.001	Middle	.199	(.08-.45)	<.001
Richer	.476	(.34-.66)	<.001	Richer	.844	(.38-1.87)	.67
Age categories				**Age categories**			
45-49(ref)				45-49(ref)			
14-19	.045	(.02-.13)	<.001	14-19	.098	(.03-.28)	<.001
20-24	.068	(.03-.45)	<.001	20-24	.134	(.04-.38)	<.001
25-29	.268	(.15-.45)	<.001	25-29	.310	(.12-.74)	.009
30-34	.529	(.31-.89)	.019	30-34	.892	(.41-1.91)	.769
35-39	.828	(.49-1.38)	.472	35-39	1.14	(.55-2.32)	.720
40-44	1.037	(.59-1.8)	.899	40-44	2.22	(1.10-4.47)	.026

Table 15: Univariate Analysis of Association between Selected Independent variables and Obesity

Variables	TYPE OF RESIDENCE					
	URBAN			RURAL		
	Odd Ratio	CI	P-Value	Odd Ratio	CI	P-Value
5-year age category						
45-49 Ref						
14-19	0.144	(.097-0.213)	<.001	0.392	(0.264 -0.580)	<.001
20-24	0.215	(.146-0.315)	<.001	0.460	(0.303-0.697)	<.001
25-29	0.606	(.418-0.879)	0.008	0.761	(0.518-1.117)	0.163
30-34	0.803	(.544-1.184)	0.268	1.077	(0.728-1.593)	0.710
35-39	0.848	(.571-1.259)	0.414	1.256	(0.866-1.822)	0.230
40-44	1.087	(.709-1.668)	0.701	1.413	(0.963-2.075)	0.77
Education						
High (Ref)						
No education	0.490	(0.318-0.755)	0.001	0.134	(0.064-0.283)	<0.001
Primary	0.685	(0.455-1.031)	0.70	0.200	(0.095-0.423)	<0.001
secondary	0.566	(0.394-0.812)	0.002	0.227	(0.108-0.473)	<0.001
Wealth index						
Richest (ref)						
Poorest	0.099	(0.023-0.423)	0.002	0.209	(0.133-0.327)	<0.001
Poorer	0.472	(0.302-0.737)	0.001	0.268	(0.170-0.421)	<0.001
Middle	0.395	(0.303-0.514)	<0.001	0.380	(0.239-0.604)	<0.001
Richer	0.716	(0.585-0.877)	0.001	1.003	(0.622-2.618)	0.989
Working						
Job (Ref)						
No job	0.400	(0.324-0.493)	<0.001	0.388	(0.288-0.523)	<0.001
Ethnic						
Akan (ref)						
Others	0.901	(0.754-1.076)	0.248	0.647	(0.531-0.789)	<0.001
Physical activity						
>5days (Ref)						
Less than 5 days	0.957	(0.747-1.225)	0.725	0.834	(0.665-1.046)	0.115
Marital status						
Married (Ref)						
Unmarried	0.371	(0.307-0.449)	<0.001	0.630	(0.501-0.793)	<0.001
Widow /divorced	1.260	(0.855-1.857)	0.243	0.177	(0.776-1.785)	0.443

Table 16: Univariate Analysis of Association between religion, fruits, vegetables and Obesity

Variables	TYPE OF RESIDENCE					
	URBAN			RURAL		
	Odd Ratio	CI	P-Value	Odd Ratio	CI	P-Value
Religion						
Christian(Ref)						
No religion	1.167	(0.536-2.540)	0.697	0.612	(0.376-0.996)	0.048
Muslims	0.733	(0.586-0.918)	0.007	0.599	(0.434-0.826)	0.002
Others	1.485	(0.651-3.387)	0.347	0.705	(0.487-1.020)	0.063
Fruits						
5 day (Ref)						
0 Fruits	1.166	(0.846-1.606)	0.347	0.427	(0.309-0.990)	<0.001
Less than 5 days	0.937	(0.776-1.131)	0.495	0.836	(0.677-1.033)	0.097
Vegetables						
5 day (Ref)						
0 vegetables	0.958	(0.583-1.573)	0.865	1.048	(0.625-1.755)	0.860
Less than 5 days	0.981	(0.810-1.187)	0.841	1.114	(0.906-1.370)	0.307

Table 17:Stepwise Analysis with Obesity

Type of place of residence							
Urban				Rural			
variables	**OR**	**95% CI**	**P-value**	**variables**	**OR**	**95% CI**	**P-value**
Age categories				**Age categories**			
45-49(ref)				45-49(ref)			
14-19	.129	(.08-.19)	.000	14-19	.383	(.24-.61)	<.001
20-24	.192	(.12-.28)	.000	20-24	.357	(.22-.55)	<.001
25-29	.526	(.35-.77)	.001	25-29	.609	(.40-.91)	.01
30-34	.740	(.49-1.1)	.140	30-34	.932	(.61-1.41)	.73
35-40	.789	(.52-1.18)	.254	35-39	1.100	(.74-1.63)	.63
40-44	1.048	(.67-1.6)	.836	40-44	1.379	(.91-2.06)	.12
Wealth index				**Education level**			
Richest (ref)				High(ref)			
Poorest	.06	(.01-.28)	<.001	No Education	.30	(.13-.73)	.008
Poorer	.39	(.24-.64)	<.001	Primary	.49	(.20-1.16)	.10
Middle	.35	(.26-.47)	<.001	Secondary	.49	(.21-1.14)	.10
Richer	.67	(.54-.84)	.001				
				Wealth index			
				Richest (ref)			
				Poorest	.26	(.15-.44)	<.001
				Poorer	.28	(.17-.47)	<.001
				Middle	.39	(.23-.67)	<.001
				Richer	1.05	(.62-.67)	.834
				Working status			
				Work (ref)			
				No work	.54	(.37-.78)	.001
				Fruits			
				>5 days (ref)			
				No fruit	.58	(.40-.82)	.003
				< 5days	.97	(.77-1.21)	.79