MULTIPLE LINEAR REGRESSION ANALYSES OF OBESITY IN PATIENTS OF SEVENTH DAY ADVENTIST HOSPITAL ON VALLEY VIEW UNIVERSITY CAMPUS OF TECHIMAN MUNICIPALITY.

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Abstract – The study sought to assess the prevalence of overweight and obesity in people who visit the Seventh Day Adventist Hospital of the Techiman municipality in the Brong Ahafo region of Ghana. Both the prevalence, cross tabulation and the strength of correlation were employed in the survey using Statistical Package for Social Sciences (SPSS) version 20. The findings of the study are: the prevalence of obesity and overweight were high. Some of the people were even ignorant about the condition and the multiple positive relationships it has with the health problems they come to the hospital with.

This is because obesity and overweight are major risk factors for increasing co-morbidity and mortality from non-communicable diseases. The main objective of the study was to identify the association between obesity and weight, height and age coupled with other lifestyle factors associated with obesity among 17-60 years old who visited the hospital. It was established that, 36.5% of the respondents were in the category of normal weight within the range (18-24.5), 190 respondents representing 37.3% of the total population were overweight (25-29.9) whiles few (5.3%) representing 27 participants were underweight. However, this was as a result of the fact that, there were more female 141 participants than their male counterparts who were 49. In line with WHO BMI-for-age z-score classification, 20.8% of the population was obese, while 36.5% were normal weight. Obesity was higher in females and also overweight was higher in females. More females were overweight and obese than males.

Keywords: Obesity, Multiple Linear Regression, serial correlation, multi-colinearity, homogeneity, Weight, Height and Age

Introduction

Throughout the history of mankind, increase in weight has been viewed as an indication of health and wellbeing. During times of food shortage, ensuring adequate energy intake to meet the requirements of the human body has been a major nutritional concern. Today however, obesity threatens to become the 21st century's leading health problem (Grundy, 1998). The cause of this increasing prevalence of obesity is in two folds: firstly, food is more readily available to everyone, and secondly, the physical activity of people has reduced with increasing urbanization and economic development. When energy intake exceeds energy expenditure, the excess energy is stored as fat, in the form of triglycerides, in the body. This is an efficient way of storing energy so that it is available in times of need. However, when the energy being stored exceeds the energy exerted for a considerable period of time, obesity sets in and brings increasing risks.

Not only that, but the patterns of obesity, central obesity (Abdominal accumulation of adipose tissue), have an added risk to some of the chronic non-communicable diseases.

One of the major public health concerns in the 21st century is excess body fat (Ezzati et al., 2002). Excess body fat also known as obesity is of developmental concern because of the numerous diseases that are associated with excess weight gained within populations (Wang et al., 2011). Globally, obesity is rising at an alarming rate. Prevalence of obesity and overweight in low and middle income countries have approached levels found in developed countries, often coexisting with under nutrition. Moreover, the problem is increasing across all age groups, and the health consequences are already obvious. Obesity is associated with increased cardiovascular morbidity and mortality (Amato et al., 2013; Finucane et al., 2011; Van gaal & Maggioni, 2014). The prevalence of metabolic syndrome was 6.8 percent among overweight adolescents and 28.7 percent among obese adolescents

(Cook et al., 2003).
Obesity is a central risk factor for Non-Communicable Diseases (NCDs), which are now the leading cause of deaths globally and now symbolizes the biggest threat to human health and economic growth (Marrero & Adashi,2015) and has become a key public health challenge globally (Khuwaja et al.,2011). Non-communicable diseases accounted for 63% of the 57 million deaths that occurred in 2008 (WHO, 2010) and this increased to 65% of 52.8 million deaths in 2010 (Lozano et al., 2012). Obesity and blood pressure are major risk factors (WHO, 2011) for NCDs mortality. Non-communicable diseases are estimated to cause four times as many deaths as infectious diseases, maternal, prenatal and malnutrition-related conditions combined by 2030 (Mathers & Loncar, 2006). The increase of NCDs presents a global crisis in almost all countries regardless of income levels (WHO, 2005). Sadly, more than three-quarters of these deaths currently occur in low and middle income countries (Lozano et al., 2012; WHO, 2011) and in people younger than 60 years (Beaglehole et al., 2011) with limited facilities to manage them. The increase in cardiovascular diseases contributed 48% of these deaths in 2008 (WHO, 2010). The global burden of NCDs increased from 47% in 1990 to 54% in 2010 (Murray et al., 2012) contributing to poverty and it is a main obstacle to achieving sustainable development (Beaglehole et al., 2011; Horton, 2013). It is estimated that deaths from chronic diseases will increase by 17% between 2005 and 2015, implying 35 million to 41 million (WHO, 2005). The World Health Organization has already indicated increasing NCDs among adolescents as a main public health challenge (Michaud et al., 2007). However, on the face of these serious negative effects, NCDs remain the slightest recognized group of conditions that endanger the future of human health and development (Horton, 2013). Obesity is an independent risk factor for cardiovascular diseases (Klein et al., 2004). Obesity, mostly co-morbidity is considered the key risk factor for cardiovascular diseases globally, especially in relation to stroke and heart attack (WHO, 2012).
Evidence exist indicates that, the world is experiencing a decreasing trend in physical activity levels (Swinburne et al., 2011). In 2009, physical inactivity accounted for more than 3 million preventable deaths and was identified as the fourth leading risk factor for non-communicable diseases (Booth et al., 2008).
This number increased to 3.2 million and became the third top risk factor for non-communicable diseases according to report in 2011 (WHO, 2011). Physical inactivity and dietary risk factors jointly accounted for 10.0% of global Disability-Adjusted Life Years (DALYs) in 2010, with the top dietary risks being diet low in fruits and also high in sodium (Lim et al., 2012). Physical activity prevalence for Ghanaian adolescents aged 11-17 years was 87% as seen in global status report on NCDs, 2014 (WHO,2014).
Adolescence characterizes a time of clear physical changes that are associated with changes in body image perception (Ramberan et al, 2006). Body image emphasizes on both how one feels about the size and shape of one's body. One of the main determinants for the management of weight and diet among adolescents is perception towards body weight (Brener et al., 2004). Eating disorder tendencies are linked with perception towards overweight rather than actually being overweight (Rinderknecht & Smith, 2002). Addressing body image issues are essential since body image disturbances persist through the stages of childhood, adolescence and adulthood which can result in eating disorders (Littleton &Ollendick, 2003) if not well managed.
Considering the many consequences associated with obesity and hypertension, availability of data on this age group is imperative to reversing the many negative effects associated with it.

1.2 Problem statement

Obesity and overweight have grave consequences and are spreading across the globe regardless of economic growth. Globally, there have been increases in prevalence of obesity with high income countries as frontrunners and low and middle income countries joining the pandemic since the 1980s (Finucane et al., 2011; WHO, 2002, 2008).The global rise of obesity has serious health effects. Rise Body Mass Index (BMI) is a well known risk factor for diseases such as type 2 diabetes, cardiovascular disease, and many cancers (AIHW, 2004; Wiseman, 2008).

By 2008, an estimated 502 million adult globally were obese and 1.46 billion were overweight (Finucane et al., 2011) and increased to 2.1 billion in 2014 (MGI, 2014). Obesity is the third social burden generated by human beings after smoking and war (MGI, 2014). It is estimated that almost half of the world's adult population would be overweight or obese by 2030 if the growth rate in the prevalence of obesity continues on its present trajectory (MGI, 2014).

That's nearly 2.5 times the number of children and adults who are undernourished (MGI, 2014). In addition, estimated 170 million children aged 18 years were classified as obese or overweight globally (Lobstein et al., 2004). Obesity during childhood and adolescence is a major risk factor for metabolic syndrome (Weiss et al., 2004).

Aside the major health consequences, obesity and NCDs pose a major economic burden to countries which

includes; reduced earning capacity, lowered productivity and increased house hold costs (Lobstein & Brinsden, 2014; MGI, 2014). The health of adolescents has mostly been ignored in global public health issues because, this age group is assumed to be healthy (Gore et al., 2011) and so little research is done on them. However, the significance of this age group is that many serious diseases in adulthood have their backgrounds in adolescence (Khuwaja et al., 2003) which makes it critical and fertile time to intervene in order to reduce disease burden in adulthood.

The study is geared towards finding the prevalence of obesity and overweight in the study population of the patients of Seventh Day Adventist Hospital on Valley View University campus of Techiman municipality .

1.3 Main objective of study

The main objective of the study is to identify the association between obesity and weight, height and age coupled with other lifestyle factors associated with obesity among adults.

1.4 The specific objectives are:

1. To determine the prevalence of both obesity and overweight among adults and adolescents in the study population.

2. To find out dietary intake and other lifestyle factors that promotes excess fat deposition and obesity.

3. To determine the strength of relationship between obesity, age, weight and height.

1.5 Research hypotheses:

1. Null hypotheses

There is no association between obesity, age, weight and height

Alternative hypothesis

2. There is an association between obesity, age, weight and height.

1.6 The research questions:

1. What are the prevalence of obesity among people between the ages of 16 and 61?

2. What are the dietary and other lifestyle factors that promote fat deposition and obesity?

3. What is the strength of relationship between obesity and weight, age, height?

1.7 Significance of the Study:

The study is particularly important because it has the potential of benefiting almost everybody in society both within and without Ghana. Some of the primary beneficiaries of this work are: government, academicians, health professionals, NGOs et cetera.

This study is especially targeted at drawing home some policies that will inure to the benefits of the citizenry. The government of Ghana's spending has recently hit the roof tops in the importation of drugs worth billions of Ghanaian cedis for the treatment of ailments related to obesity. If this study proves indeed the canker is serious, it will in a way commune to government to target preventions rather than cure. In this case government budgetary allocation to health will see a decline.

Also, it is no doubt that, much work is needed in the areas related to obesity and overweight. This work is expected to serve as the basis for academicians to build on it.

Nowadays, many NGOs offering health services are trying hard to eradicate malnutrition. This work will crave their indulgence to the fact that obesity is more perverted in some jurisdictions than others as to draw the attention of the association of NGOs on health to map up strategies to tackle obesity as well.

The prevalence of obesity in people especially those between the ages of 16 and 61 has increased across the globe especially in the last three decades (Ogden et al., 2006) as evident by an increased in mean BMI since 1980 (Finucane et al., 2011). According to styne (2001), about 50-80% of obese children become obese adults. This predicts an increase possibility of obesity-related morbidity in childhood and subsequent increase in disease burden in economies if nothing is done to reverse the trend (Lobstein et al., 2004).

However, Ghana demographic and health and multiple indicator cluster surveys over the years did not include adolescents' and adults' nutritional assessment; only nutritional data on children less than 5 years and women of reproductive age were collected. Considering the immense importance of good health maintenance in all age groups, this research will add to the international assessment literature, bridging the research and data gap regarding prevalence and risk factors for obesity and hypertension especially in developing countries for adolescents. This would help in the development of policies and programs, specifically targeting the youth in order to monitor progress and reduce the global burden of obesity and hypertension among adults and adolescents. This would contribute immensely to achieving the global target of 25% relative reduction in mortality from cardiovascular diseases by 2025 as set by the world health assembly.

Literature review

2.1 Obesity hypotheses

Historically, two competing hypotheses existed about the possible causes of obesity, the energy balance and the endocrinology hypotheses. The energy balance hypothesis as pioneered by Newburgh considers positive caloric balance as the cause of obesity. Those who believe in these hypotheses blamed it on either a "perverted appetite"(excessive energy consumption) or a "lessened outflow of energy" (insufficient expenditure) (Newburgh &Johnson, 1930).

Endocrinology hypothesis suggested biological underpinning of lipoma genetics. The proponents of this hypothesis believe fattening can take place even in conditions of extreme under nutrition. These two competing hypotheses define obesity differently and combining them gives different perspectives of the possible cause of obesity and should form the basis for public health education and management of the epidemic.

2.2 Prevalence of obesity

At least 208 million people die each year attributable to overweight or obesity (Ogden et al., 2006). It is also a major risk factor for heart disease, stroke and type two diabetes (Guh et al., 2009) and increase the risk of certain cancers (WHO, 2010). Globally, the proportion of adults with body mass index (BMI) of 25kg/m^2 or greater increased between 1980 and 2013 from 28.8% to 36.9% in men and from 29.8% to 38.0% in women (Ng et al., 2014). Prevalence of obesity has also increased significantly in children and adolescents in both developed and developing countries; 23.8% of boys and 22.6% of girls were overweight or obese in 2013 in developed countries (Ng et al., 2014). Obesity prevalence increase significantly among both adolescents and adults between 1999 and 2004 in United State. Adolescent overweight prevalence from the National Health and Nutrition Examination Survey (NHANES) increase to 16.0% from 13.8% among female and to 18.2% from 14.0% in male adolescents from 1999-2000 to 2003-2004 respectively. In developing countries, overweight and obesity prevalence has increased in children and adolescents to 12.9% from 8.1% in 2013 for boys and from 8.4% to 13.4% in girls between 1980 and 2013 (Ng et al., 2014). There are clear, consistent and convincing evidence that show that obesity increases the risk of morbidity mortality and reduces the quality of life of all people (Klein et al., 2004). Increase in obesity prevalence has the potential of adding significantly to the future health burden of cardiovascular and metabolic disease. Research done in Ghana and Nigeria in 2012 showed that obesity prevalence among adolescents was high; 10.9% and 9.4% respectively (Mohammed &Vuvor, 2012; Oduwole et al, 2012).

2.3 Drivers of obesity epidemic

A driver of the global obesity epidemic is defined as an environmental factor that has changed significantly during the past 40 years and is global in nature (affecting almost all countries with enabling economic conditions), it is also quickly transmissible (Swinburne et al., 2011). The changes in the food system clearly show evident that, there has been an increment in the supply of cheap energy-dense and relatively tasty foods which seems to be the main driver of the epidemic in the last 3-4 decades (Cutler et al., 2003).

2.4 The consequences of obesity

Some of the consequences of obesity include the following; development of metabolic syndrome, cancers, type 2 diabetes, hypertension, hyper lipidemia and stroke.

2.4.1.1 Metabolic syndrome

Metabolic syndrome is defined as a cluster of interconnected factors that directly increase the risk of coronary heart diseases (CHDs), major components are dyslipidemia (elevated triglycerides and apolipoprotein B (apo B) containing lipoproteins, and low High-Density Lipoproteins (HDL)), elevated arterial blood pressure (BP) and hyper lipidemia obesity and/or insulin resistance (IR) have gained increasing attention as the core manifestations

of the syndrome (Zimmet et al., 2007). However, recently non-alcoholic fatty liver disease chronic pro inflammatory and pro thrombotic states and sleep apnea are the conditions that have been added as part of metabolic syndrome (Kassi et al., 2011). Diagnosing metabolic syndrome in children and adolescents require the presence of central obesity plus two or more of these other four factors; elevated triglycerides, High-Density Lipoprotein (HDL)- cholesterol, high blood pressure, and elevated plasma glucose (Zimmet et al., 2007). Globally, metabolic syndrome which is connected with poor health outcomes is a growing problem (Schlaich et al., 2015). The prevalence of metabolic syndrome was 6.8% among overweight adolescents and 28.7% among obese adolescents as reported in a research done in 2003 (Cook et al., 2003). A similar research revealed that metabolic syndrome increases with increasing severity of obesity and reaches 50% in several obese youngsters (Weiss et al., 2004).

Glucose intolerance and insulin resistance are common in obese children, adolescents and lead to a significant increase risk for type 2 diabetes, hypertension and cardiovascular diseases (Invitti et al., 2003). Another study found out that, one-third of obese children and adolescents have insulin resistance syndrome (Viner et al., 2005), while in another, prevalence of 23% of metabolic syndrome was recorded in obese adolescents in whom measurements of non-traditional cardiovascular disease risk factors were available (Invitti et al., 2006).

Research methodology

In multiple linear regression, there are **q** explanatory variables where the relationship between the dependent variable and explanatory variables is represented in an equation such as $y_i=\beta_o+\beta_1 xi_1+\beta_2 x_{2i}+\ldots+\beta_q x_{qi}$Where β_o is the constant term whiles B_o to β_q are the coefficients connecting the explanatory variables to the variable of interest. In our case **obesity**

Conditions Where Multiple Linear Regression Is More Appropriate Include:

1. When trying to predict someone's income given many socio-economic factors.

2. In trying to predict the overall examination performance of students in WASSCE

3. When one is trying to estimate systolic or diastolic blood pressure given a variety of socio-economic and behavioral attributes like occupation, drinking, smoking, age etc.

Multiple linear regression allows us to investigate how each of the set of explanatory variables is related to a dependent variable of interest.

The researcher used BMI, weight, age, height which are the main factors for determining obesity to analyses the data in the research. According to (Anthony Ngminkuma Kullah KNUST, 2015), a research that was carried out in Wa municipality of the Upper West region of Ghana, waist circumference (WC) was one of the factors used in predicting obesity.

Though, WC is a good predictor of obesity, the limitation of this factor is that, it is used for measuring central obesity which is the abdominal accumulation of adipose tissue. WC is more appropriate for predicting obesity in children and adolescents.

In Ghana, the practice in health facilities is that, BP of patients less than the ages of 17 is often not taking. In fact, persons below the ages of 17 with higher BP is a condition for other diseases such as heart failures, liver disorders and not a clinical condition on its own. In the case of (Anthony Ngminkuma Kullah KNUST, 2015) 53.4% of the study participants were below the ages of 17 years. This could be explained to mean more than half of the sampled population had other health related issues like heart failures, liver malfunctioning rather than obesity.

Many researchers have reported that, abdominal obesity, defined by waist circumference (WC) measurement, is a better predictor of many cardiovascular disease and type two diabetes in comparison to traditional obesity definition, based on Body Mass-Index (BMI) measurement, (Folson et al., 2000: Janssene et al., 2002,2004: Rexrode et al;2001; Zhu et al.,2002).

Assumptions of Multiple Linear Regressions

Multiple linear regression analysis makes several key assumptions:

A Linear Relationship between the outcome variable and the independent variables. A plot of the standardized residuals verses the predicted Y' values show whether there is a linear or curvilinear relationship.

Multivariate Normality--Multiple regression assumes that the variables are normally distributed.

No Multi-collinearity--This assumption stipulates that the independent variables are not highly correlated with each other. This assumption is tested by the Variance Inflation Factor (VIF) statistic.

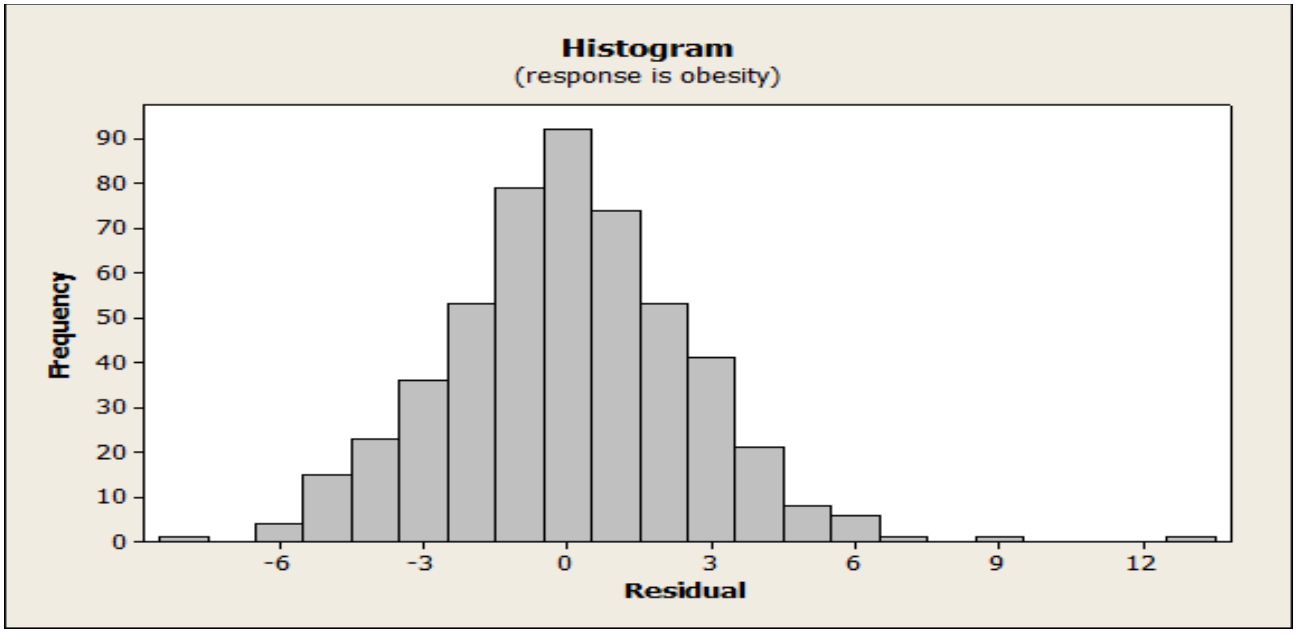
Homoscedasticity--This assumption requires that the variances of error terms are similar across the independent variables. As with the linear relationship assumption, Intellectus Statistics plot the standardized residuals verses the predicted Y' values can show whether points are equally distributed across all values of the independent variables or not.

Multiple Linear Regression Assumptions

First, multiple linear regression needs the relationship between the independent and dependent variables to be linear. It is also important to check for outliers since multiple linear regression is sensitive to outlier effects. The linearity assumption can best be tested with scatter plots. The following two examples depict a curvilinear relationship and a hetroscedastic relationship.

Second, the multiple linear regression analysis requires that the error between observed and predicted values (i.e., the residuals of the regression) should be normally distributed. This assumption can best be checked by plotting residual values on a histogram with a fitted normal curve or by reviewing a Q-Q-Plot. Normality can also be checked with a goodness of fit test (e.g., the Kolmogorov-Smirnov test), though this test must be conducted on the residuals themselves. When the data is not normally distributed, a non-linear transformation (e.g., log-transformation) might correct this issue if one or more of the individual predictor variables are to blame, though this does not directly respond to the normality of the residuals.

Third, multiple linear regression assumes that there is little or no multi-collinearity in the data. Multi-collinearity occurs when the independent variables are not independent from each other.



3.6 Data Analysis

The data was analyzed to predict the pattern of obesity cases in the municipality using MINITAB software and Statistical Package for Social Science (SPSS) software version 17.0. The model that was identified and used in analyzing the data was (Multiple Linear Regression Analyses).

The Multiple Linear Regression is a technique used in predicting a dependent variable using two or more independent variables. This project for instance used three independent variables such as age, height and weight to predict obesity. The regression analysis helps to understand importantly how the value of the dependent variable changes when any one of the independent variables is varied whiles the other Independent variables are held fixed.

In multiple regression, the size of the coefficients for each of the independent variables gives us the magnitude of

the effect that variable is having on the dependent variable (obesity), and the sign of the coefficient negative or positive gives the direction of the effect. Under Multiple linear regression, the coefficient tells how much the dependent variable is expected to increase or decrease when the independent variable increases or decreases by one unit, holding all the other independent variables constant. The slope in a regression analysis indicates to us how steep the regression line is. A slope of zero shows a horizontal line and a slope of unity is a diagonal line from the lower left to upper right, and a vertical line has an infinite slope. The intercept is where the regression line touches the Y axis when the independent variable has a value of zero (0).

The multiple linear regression models are given as:

$Y=b_o+b_1X_1+b_2X_2$

Where b_1 is estimated regression coefficient that quantifies the association between the risk factor X_1 and the outcome, adjusted for X_2 , b_2 is the estimated regression coefficient

Results and discussions

3.0 Introduction

In this study, results refer to the outcome of the various statistical procedures used in analyzing the data collated and coded. The results served as the foundation for interpretation, discussion and drawing conclusion for the purpose of achieving the objectives.

Demographic Data

Table3.1: Gender of Respondent

Gender	Number of Respondent	Percentage
Male	145	28.5
Female	364	71.5
Total	509	100

From Table 3.1 above, 364 respondent were female representing 71.5% and 145 respondents were male representing 28.5%. It is clear that, majority of respondent selected were female.

TABLE 3.2: CROSS TABULATION OF GENDER AND BODY MASS INDEX (BMI)

BMI CATEGORY	GENDER			%
	MALE	FEMALE	TOTAL	
Underweight(<18.5)	12	15	27	5.3
Normal (18.5-24.9)	65	121	186	36.5
Overweight (25-29.9)	49	141	190	37.3
OBESITY (30+)	19	87	106	20.8
TOTAL	145	364	509	100

From the table above, 36.5% of the respondents were in the category of normal weight within the range (18-24.5), 190 respondents representing 37.3% of the total population were overweight (25-29.9) whiles the few (5.3%) representing 27 participants were underweight. In addition majority of female were overweight at the time of the study however, this was as a results of the fact that, there were more female 141 participants than their male counterparts who were 49. According to Table 3.2, using WHO BMI-for-age z-score classification, 20.8% of the population was obese, while 36.5% were normal weight. Obesity was higher in females and also overweight was higher in females, as shown in Table 2 above. As indicated in the Table, more females were overweight and obese than males.

TABLE 3 REGRESSION ANALYSIS: OBESITY VERSUS AGE, WEIGHT, HEIGHT

Predictor	Coefficient	SE	T	P-Value
Constant	5.5217	0.6851	8.06	0.000
Age	0.025939	0.008346	3.11	0.002
Weight	0.333640	0.007966	41.89	0.000
Height	-0.019107	0.001760	-10.86	0.000
S = 2.48396 R-Sq = 79.6% R-Sq(adj) = 79.5%				

From the table above, it is clear that all the variables such as age, height, weight are significantly related to obesity since their various probability values are less than 0.05. There is positive relationship between the obesity and independent variables as the correlation coefficient value is 0.795 and the standard error of the regression equation is 2.48396 and the coefficient of determination 79.6%.

The regression equation is obesity = 5.52 + 0.0259 AGE + 0.334 WEIGHT - 0.0191 HEIGHT, however managing obesity one must consider the height as important variable since an increase in height leads to decrease in the risk of being obese.

Analysis of Variance

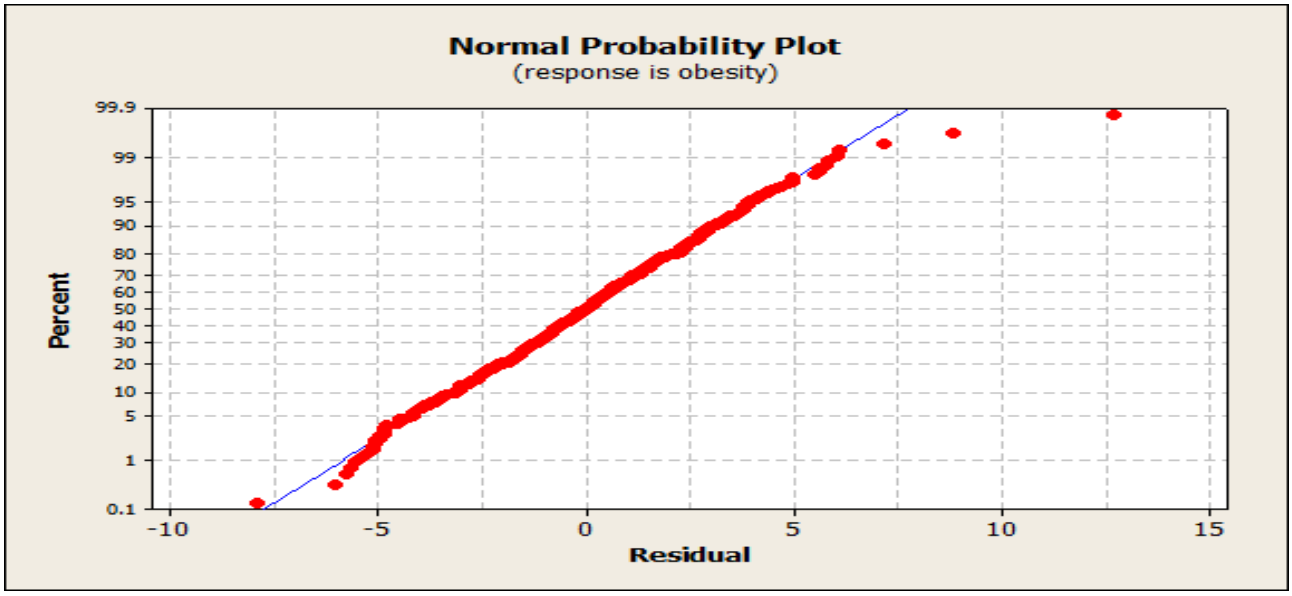
Source	DF	SS	MS	F	P-value
Regression	3	12169.4	4056.5	657.44	0.000
Residual	505	3115.9	6.2		
Total	508	15285.3			

From the analysis of variance table if the $p<0.05$ reject H_O or otherwise fail to reject Ho. it is clear from the table that, the p-value which is 0.000 is far less than 0.05 we reject Ho and conclude that, there is a significant relationship between obesity and weight, age and height. The best predictors of obesity are weight and height.

Correlation between obesity and weight

	OBESITY	*WEIGHT*
obesity	1	0.862957
WEIGHT	0.862957	1

The correlation coefficient value is 0.862957 which indicates that, there is a strong relationship between obesity and weight thus weight increases the risk of being obesity is being increases.



SUMMARY OUTPUT	
Regression Statistics	
Multiple R	0.892272973
R Square	0.796151059
Adjusted R Square	0.794940075
Standard Error	2.483964847
Observations	509

There were 509 observations used. The multiple correlation coefficient value is 0.8923 which indicates there is a strong relationship between obesity and age, weight and height and the coefficient of determination 79.6% which indicates that age, weight and height contribute about 79.6% of the variation in obesity is accounted or explained by the independent variables

Summery

Overweight and obesity are global phenomenon. It is a condition that leads to many dangerous diseases which eventually causes premature deaths the world over. At least 208 million people die each year attributable to overweight or obesity (Ogden et al., 2006). It is also a major risk factor for heart disease, stroke and type two diabetes between (Guh et al., 2009) and increase the risk of certain cancers (WHO, 2010). Globally, the proportion of adults with body mass index (BMI) of 25kg/m^2 or greater increased between 1980 and 2013 from 28.8% to 36.9% in men and from 29.8% to 38.0% in women (Ng et al., 2014). Prevalence of obesity has also increased significantly in children and adolescents in both developed and developing countries; 23.8% of boys and 22.6% of girls were overweight or obese in 2013 in developed countries (Ng et al., 2014). This study in particular revealed higher prevalence of obesity and overweight amongst female participants of the study as compared to their male counterparts in the same study. We could deduce from table 2 above that 49 representing 9.6% of males were overweight lower than their female counterparts who were 141 representing 27.7% overweight for the entire study population. In the case of obesity it could be observed that, again, the females had a greater number 87 representing 17% as compare to male who were 19 representing 3.7% of the entire population for the study. Another study done in China revealed higher prevalence among the male gender for both obesity and overweight

(Zhu et al., 2015). The difference of prevalence of obesity among adolescents across studies can be explained by the difference in the methodology adopted, definition criteria and the age categories within study subjects. This study considered all patients who visited the Seventh Day Adventist hospital in the Techiman municipality within the period the researcher was there. For one to meet the criteria for inclusion in the study, one needed to be between the ages of 16 and 61 exclusive and also not pregnant or extremely dehydrated and weak.
The magnitude of obesity and overweight is known in the study population. This makes it impossible to solve the health, economic and psychological consequences it carries. Adequate knowledge through research on the burden of the problem will inform decisions and actions to deal with it.

5.2 findings of the study
The study was carried out to ascertain the prevalence of overweight and obesity in Techiman municipality in the Brong Ahafo region of Ghana. There was a strong positive relationship between obesity and weight, height and age. The prevalence of overweight amongst the study population was 37.3% indicating a more than quarter of the study population. In the same vein, 20.8% of the population representing 106 was obese.
The prevalence of obesity and overweight is very high similar to some studies done in Ghana, Nigeria and China (Mohammed &Vuvor, 2012; Oduwole et al., 2012; Zhu et al., 2015). This study revealed higher overweight prevalence among females but higher obesity prevalence in males even though their numerical strengths are not the same. However, females have higher prevalence for combined obesity and overweight prevalence as indicated in table 2 above.

From table 3 above, it is clear that all the variables such as age, height, weight are significantly related to obesity since their various probability values are less than 0.05. There is positive relationship between the obesity and independent variables as the correlation coefficient value is 0.795 and the standard error of the regression equation is 2.48396 and the coefficient of determination 79.6%.
The regression equation is obesity = 5.52 + 0.0259 AGE + 0.334 WEIGHT - 0.0191 HEIGHT, however managing obesity one must considered the height as important variable since an increase in height leads to decrease in the risk of being obese.
From the analysis of variance table if the $p<0.05$ reject H_O or otherwise fail to reject Ho. it is clear from the table that, the p-value which is 0.000 is far less than 0.05 we reject Ho and conclude that, there is a significant relationship between obesity and weight, age and height. The best predictors of obesity are weight and height.

5.3 conclusions
This study sought to find the prevalence of obesity and overweight in the people of Techiman municipality especially communities that surround the Seventh Day Adventist Hospital located in the Valley View University Techiman campus. The study attempted to identify the relationship between the various factors such as weight, height, age and obesity and the body mass index of a sample of patients who visited the Seventh Day Adventist Hospital for consultations in various ailments. From this study, the prevalence of obesity and overweight was 20.8% and 37.8% respectively. Weight, height and age were independent predictors of obesity and overweight and were significantly associated with higher BMI-for-age z-score. Considering the environmental factors identified as risk factors for obesity and hypertension, an increased prevalence and associated co-morbidities are expected in adolescents and adult population if nothing is done about them.

One of the major public health concerns in the 21st century is excess body fat (Ezzati et al., 2002). Excess body fat also known as obesity is of developmental concern because of the numerous diseases that are associated with excess weight gained within populations (Wang et al., 2011). Globally, obesity is rising at an alarming rate. Prevalence of obesity and overweight in low and middle income countries have approached levels found in developed countries, often coexisting with under nutrition. Moreover, the problem is increasing across all age groups, and the health consequences are already obvious. Obesity is associated with increased cardiovascular morbidity and mortality (Amato et al., 2013; Finucane et al., 2011; Van gaal & Maggioni, 2014). The prevalence of metabolic syndrome was 6.8 percent among overweight adolescents and 28.7 percent among obese adolescents (Cook et al., 2003).

Obesity is a central risk factor for Non-Communicable Diseases (NCDs), which are now the leading cause of deaths globally and now symbolizes the biggest threat to human health and economic growth (Marrero & Adashi,2015) and has become a key public health challenge globally (Khuwaja et al.,2011).

5.4 Recommendations

For health promotion although the number of Ghanaians who attend hospitals for consultations in various health conditions is very low, the prevalence of obesity is very alarming and if the potential groups with overweight is added the figure becomes so high leaving one to wonder whether if all of Ghanaians were to visit health facilities for medical cheek ups how the outcome would be like. The magnitude of obesity and overweight is known in the study population. This makes it impossible to solve the health, economic and psychological consequences it carries. Adequate knowledge through research on the burden of the problem will inform decisions and actions to deal with it.

This high prevalence of obesity and overweight are clear indications of national burden as this is a measure of increasing risk for disease especially cardiovascular diseases and some cancers. If attention is not paid to this group, they would become obese in the near future since those obese now were once overweight. Hence, health programs for obesity prevention should be promoted continuously in all health facilities across the length and breadth of Ghana.

The researcher wish to recommend that, all health facilities in the country should as a matter of agency add to their programs outreach sessions to reach out to people in the cottages and hinterlands to educate inhabitants about the dangers associated with overweight and obesity.

The researcher wish to categorically state that, a greater proportion of our populace has no knowledge about the nutritional components of the food stuffs coupled with the emergence of industrial products. Since the changes in the food system clearly show evident that, there has been an increment in the supply of cheap energy-dense and relatively tasty foods which seems to be the main driver of the epidemic in the last 3-4 decades (Cutler et al., 2003)

The researcher wish to call on all stakeholders in health, the government of Ghana to allow for a larger sample size to be selected if possible from all 216 districts to allow for a comprehensive study to be conducted so as to provide current and- up-to date information about the pandemic of obesity and overweight who eventually become obese and initiate national policies on health to curtail the menace.

It is an undeniable fact that one of the causes of obesity and overweight are hereditary therefore the researcher would like to reiterate the need for anthropometry of parents and their wards to establish parental association with obesity and overweight especially where government could make it a policy for a large sample size from all metropolitans municipalities and districts to be covered. Lipid profile and fatting blood sugar should be measured for further biochemical correlation with cardiovascular risk to be established.

In fact, physical activity level of people of all ages has reduced drastically in recent years. Even farming in Africa and the rest of the world which used to be physically intensive driven cannot be said today since everything is now either mechanical or electrical in nature. Children no longer trek on many kilometers to attend schools. Where they even go on longer distances to attend school or farm there are motor cycles or bicycle for them to ease their hardship which in long run affect their physical exercise level. The researcher based on this vein, would like to recommend that governments of Africa should institute a mandatory exercise day to keep their populace active.

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