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SCHOOL OF PUBLIC HEALTH

COLLEGE OF HEALTH SCIENCES

UNIVERSITY OF GHANA

THE ASSOCIATION BETWEEN HEALTH LITERACY AND OBESITY AMONG ADOLESCENTS IN SELECTED SCHOOLS IN ADENTAN MUNICIPALITY

BY

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DECLARATION

I, Claudia Vesilka Ewa declare that apart from other researchers' works, which have been duly acknowledged by means of referencing, this work is the result of my own original research, and this thesis, either in whole or in part has not been presented elsewhere.

---------- ……..

Claudia V. Ewa Date

(Student)

---------- ……..

Dr. Amos Laar Date

(Academic Supervisor)

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DEDICATION

First of all, this is dedicated to God Our Heavenly Father for His constant blessings, and guidance. For their selfless and constant support, this work is dedicated to my parents, Mr. Claude Ewa and Mrs. Moira Ewa, and to my sister, Sharon Ewa.

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LIST OF ABBREVIATIONS

Abbreviation	Meaning
AFHC	Adolescents' Food Habit Checklist
BMI	Body Mass Index
CHPS	Community Based Health Planning Services Compound
HL	Health Literacy
NVS	Newest Vital Sign
PA	Physical Activity
PAQ-A	Physical Activity Questionnaire for Adolescents
SES	Socioeconomic Status
TBA	Traditional Birth Attendant
TOFHLA	Test of Functional Health Literacy
WHO	World Health Organization

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ABSTRACT

Background: Obesity is a growing public health issue even in low and middle income countries which are usually associated with issues of undernutrition. The growing prevalence is leading to what is known as the "double burden" of malnutrition (Manyanga, El-Sayed, Doku, & Randall, 2014). Adolescents are a group that are particularly vulnerable with respect to obesity because they are likely to carry obesity into their later years (Manyanga et al., 2014; Teshome, Singh, & Debebe, 2013). This is a big issue because obesity is associated with poor health outcomes. Health literacy appears to have some association with obesity.

Objectives: The aim of this study was to assess health literacy, determine obesity prevalence among adolescents and then determine health literacy in relation to obesity among adolescents. The study also sought to determine associations between adolescents' HL and behavioural risk factors for obesity.

Method: This was a cross-sectional analytical study. 292 students between the ages of 10 and 15 years were randomly selected from 4 schools within the Adentan Municipality. The Newest Vital Sign (NVS) which has been developed as a tool to quickly measure health literacy and has been validated for use among adolescents was used in this study.

Results: Prevalence of obesity among respondents was 9.9%. 46.6% of respondents were categorized as having adequate health literacy while 53.4% were categorized as having limited health literacy. There were no significant associations between health literacy and overweight and obesity.

Conclusion: Prevalence for obesity among adolescents is high. Health literacy among adolescents warrants some improvement.

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CHAPTER ONE

1.0 INTRODUCTION

1.1 Background

Overweight and obesity are considered a public health issue because of their growing prevalence all over the world with an estimated 1 out of 10 children (5-17 years) being considered overweight or obese (WHO, 2016). Now, many developing countries suffer from the "double burden" of both under- and over nutrition. In Africa, the prevalence of childhood overweight has risen from 4% in 1990 to 7% in 2011 and is projected to become much higher in the near future (Manyanga et al., 2014; Teshome et al., 2013). WHO (2016) estimated that the number of children considered overweight/obese in Africa has doubled from 5.4 million in 1990 to 10.6 million in 2014. In Ghana alone, the national average of overweight among adolescents was recorded at 8.9% (Manyanga et al., 2014). In a selected school in a sub region of Accra, prevalence of obesity was calculated as 10.9% (Mohammed & Vuvor, 2012). All this illustrates the fact that obesity is a growing problem that needs to be addressed. Public health workers and all stakeholders must work hard to find solutions to reduce global and national prevalence as obesity is associated with several poor health outcomes such as diabetes, cardiovascular disease (including high blood pressure, coronary heart disease), musculoskeletal disorders (arthritis) and some cancers (WHO, 2016; Dixon, 2010; Ebbeling, Pawlak, & Ludwig, 2002; O'Brien & Dixon, 2002; Reilly & Kelly, 2010).

Research has illustrated that there is usually some relationship between health literacy and health outcomes in adults (Manganello, DeVellis, Davis, & Schottler-Thal, 2015). Health

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literacy is defined as the "degree to which individuals have the capacity to read, process, and understand health information" needed to make health decisions (Ratzan and Parker, 2000; Manganello et al., 2015). Therefore, improving individual health literacy levels could improve healthcare outcomes and reduce persistent health problems (Driessnack, Chung, Perkhounkova, & Hein, 2014).

Recently, adolescents' health literacy is being measured as well to determine whether adolescent health literacy has some relationship with obesity. Shih, Liu, Liao, & Osborne (2016) in Taiwan, Lam and Yang (2014) in China and Chari, Warsh, Ketterer, Hossain, & Sharif (2014) in the United States have discovered a strong relationship between health literacy and body weight in young adults. Shih et al. (2016) conducted a population based study with children aged 11-12 years old in Taiwan and found that even after controlling for confounders, there was a strong link between adolescent health literacy and obesity. The study by Lam and Yang (2014) was a cross-sectional population based study with adolescents aged between 12 and 16 years old. The researchers revealed that low health literacy was significantly associated with obesity among the adolescents. Chari et al. (2014) conducted a study with participants attending the outpatient departments of two healthcare facilities across two states in the United States. Results from their study illustrated the fact that adolescent health literacy was associated with adolescent obesity. There are several tests used to measure health literacy. However, according to Driessnack et al. (2014) the Newest Vital Sign is one of the shortest and most precise ways to measure health literacy in young adults and children. This test was developed in 2005 by Weiss B.D.,Mays M.Z.,MartzW.,Merrium Castro K.,DeWalt D.E.,Pignone M.P.,Mockbee J. & Hale, F.A (2005) as a means to quickly and accurately test for limited health literacy. Shah, West,

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Bremmeyr, & Savoy-Moore (2010), Driessnack et al. (2014), Duell, Wright, Renzaho, & Bhattacharya (2015) have all concluded that the Newest Vital Sign is one of the easiest tests of health literacy to use. Therefore, this study used the Newest Vital Sign to measure health literacy.

It is important to note that majority of the studies conducted on the prevalence of adolescent overweight and obesity look at its association with level of physical activity and eating behaviour because those are the main factors that ultimately cause the energy imbalance which leads to overweight and obesity (WHO, 2016). Nonetheless, health literacy brings about an interesting facet to the mix because it can also have some influence on these main factors.

1.2 Problem Statement

With increasing obesity trends, it is prudent to identify whether there are also some associations between health literacy and health outcomes for adolescents in Ghana. This is because studies have suggested an association between the two. This suggests that increasing health literacy may be a strategy to addressing the growing prevalence of obesity. Perhaps by understanding this relationship, public health workers and stakeholders could add improving health literacy as a way to fight adolescent obesity. There is limited data on health literacy and adolescent overweight and obesity in Ghana. Therefore, it is important to find out what health literacy rates are in adolescents in Ghana in the first place. It is especially important in Ghana and Sub-Saharan Africa because we also struggle with high undernutrition rates. Therefore, increasing prevalence in obesity leads to the "double burden". Unfortunately, the double burden places more pressure on the health sector as they struggle to address both under and overnutrition. This is even more alarming since

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projections for prevalence of overweight and obesity in Sub-Saharan Africa indicate that more adolescents in the near future are going to be affected by it. Furthermore, an overweight or obese adolescent is likely to carry it into adulthood which in turn places them at increased risk of heart disease and generally poorer health outcomes. Subsequently, a greater percentage of adults with heart disease and generally poor health outcomes could spell doom for the country since having a significant amount of the population being sick means that the country's productivity would decrease and there would be a high burden on the already burdened health system.

This work illustrates whether it is necessary to incorporate some more health education into the basic school curriculum or implement policies that are geared towards improving health literacy among adolescents and perhaps the general public.

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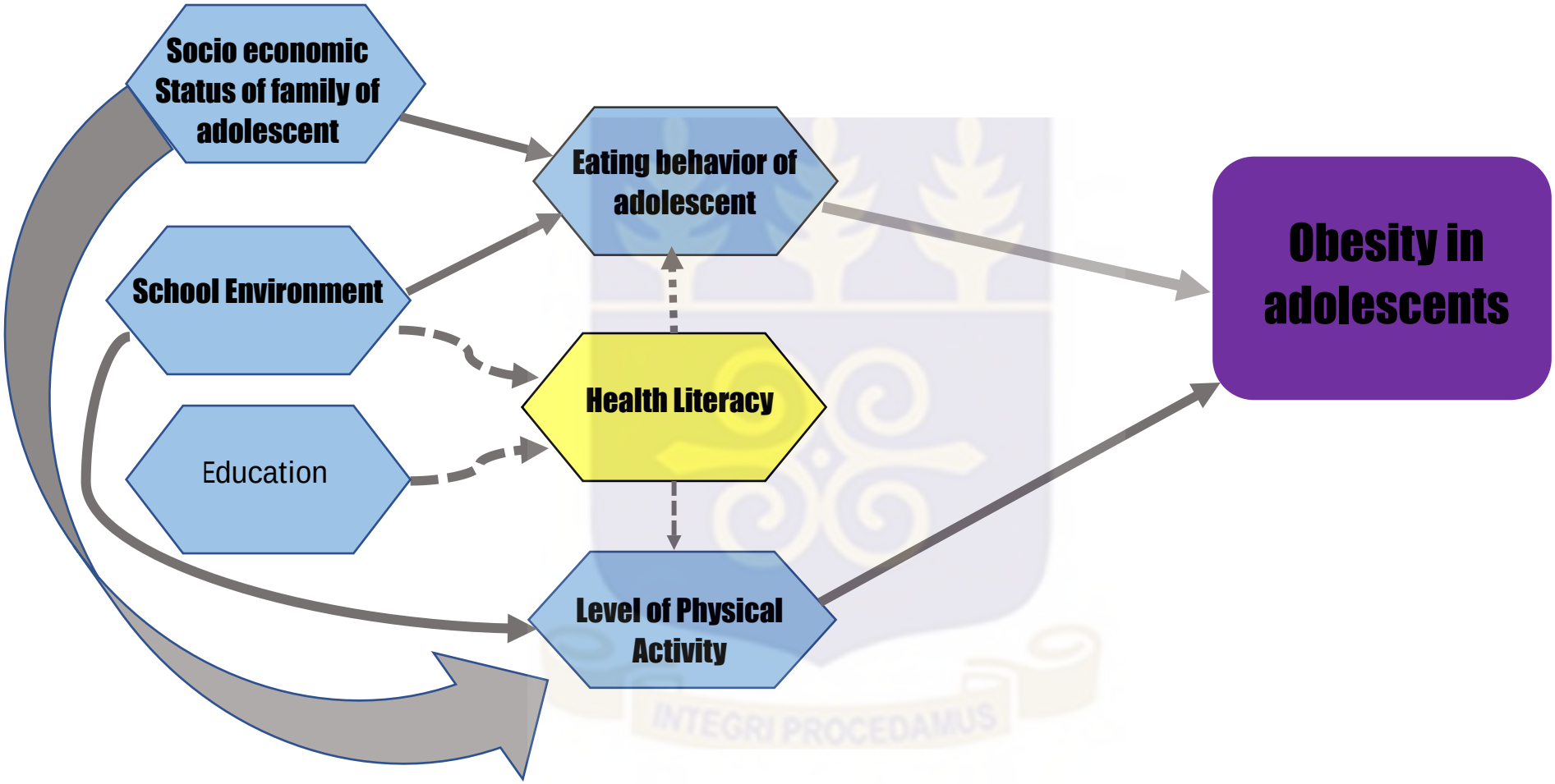
1.2 Conceptual Framework

Figure 1. Framework for factors that affect obesity in Adolescents



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1.2.1 Narrative for Conceptual Framework

The conceptual framework illustrates the complexity of the factors that influence obesity in adolescents. Studies indicate that socio-economic status, level of physical activity, eating behaviour, the school environment and health literacy all have some influence on obesity in adolescents (Fairbrother, Curtis, & Goyder, 2016; Koirala, Khatri, Khanal, & Amatya, 2015; Manyanga et al., 2014; Mohammed & Vuvor, 2012; Wechsler, McKenna, Lee, & Dietz, 2006).

Socio economic status of an adolescent's family can affect obesity. In addition, the socio-economic status has an influence on the eating behaviour of the adolescent especially in developing countries, where more affluent families tend to eat high fat foods as these are considered the "fancy" foods and their consumption is attributed to wealth and high class (Amidu et al., 2013; Mohammed & Vuvor, 2012). Consumption of such high fat/ energy dense foods could lead to weight gain especially when physical activity is also low. Thus, level of physical activity also influences the outcome of adolescent obesity (Mohammed & Vuvor, 2012).

The school environment encompasses a number of components which include facilities for physical activity, policies on foods sold in the cafeteria or canteen, a student's access to whole nutritious foods, policies for physical activity and so on. Therefore, the school environment can also influence an adolescent's level of physical activity and eating behaviour (Wechsler et al., 2006). For example, if the school has a policy where all students must engage in physical activity at least twice a week, this would essentially increase the physical activity of adolescents which then decreases the likelihood of adolescents becoming obese, however if there is not a policy or the school does not have the facilities available for students to engage in physical activity, the students are at a greater risk of

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gaining weight. In addition, if students do not have access to junk foods in the school, they are less likely to eat poorly (Wechsler et al., 2006). However, if they have access to such foods in schools (as a result of the lack of a school policy to ban or minimize junk foods on their premises) they are likely to develop poor eating habits.

Research has suggested that there is a strong relationship between health literacy and an adolescent's body weight (Chari et al., 2014; Lam & Yang, 2014; Shih et al., 2016). Thus, in the framework, health literacy has an influence on obesity in adolescents. Education could influence how well someone can understand information they receive. Therefore, health literacy is also influenced by education. Education may also directly influence obesity in adolescents which is why a broken line is used to link education to obesity in adolescents. Health literacy could also influence the eating behaviour because low health literacy indicates inability to process or understand health information to influence decisions which means that even if an adolescent has received any nutrition advice, they may not be able to apply or put it into practice which implies that they may continue with whatever poor food choices they may be making.

1.3 Objectives

1.3.1 Main Objective

Assess health literacy in relation to obesity among adolescents

1.3.2 Specific Objectives

1. Assess health literacy of adolescents in selected schools
2. Determine the prevalence of obesity among adolescents
3. Determine associations between adolescents' HL and obesity
4. Determine associations between adolescents' HL and behavioural risk factors for obesity such as level of physical activity and food habits.

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1.4 Justification for Study

Ghana, like most low and middle income countries now have the "double burden" situation where there is a high prevalence of both under and overnutrition (WHO, 2014). This is an issue that we as public health workers must address as soon as possible. It is of utmost importance given the increasing trend of overweight and obesity (increased prevalence in African countries from 5.6 million in 1990 to 10.6 million in 2014 (WHO, 2014)). This study will provide ideas for public health workers and stakeholders on how best to address this issue. In addition, results from this study would add to the limited pool of data on the prevalence of adolescent overweight and obesity as well as provide insight on health literacy rates among adolescents in Ghana.

Furthermore, it is well known that level of physical activity and eating behaviour affect weight. However, according to Wechsler, McKenna, Lee, & Dietz, (2006) these factors are influenced in part by several sectors of our society including our schools. They advocate that schools play a significant role and thus to address the obesity problem among adolescents, some strong school based policies should be put in place (Wechsler et al., 2006). It would be interesting to apply some of these theories to the Ghanaian setting. We would be able to conclude whether the best solutions to addressing adolescent overweight and obesity would involve implementing new school polices about health education. Finally, this study could draw attention to the importance of considering health literacy when developing health promotion campaigns about obesity and could encourage more research into this area. It is possible that by understanding the relationship between obesity and health literacy, health workers can strongly consider whether improving health literacy would be a useful strategy to address the prevalence of obesity especially in adolescents.

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CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Adolescent Overweight/Obesity

Childhood and adolescent obesity is considered a growing public health issue because it is associated with several non-communicable diseases (Dixon, 2010; Koirala et al., 2015; Manyanga et al., 2014; Medehouenou et al., 2015; O'Brien & Dixon, 2002). Therefore, increasing rates of overweight/obesity give rise for concern because it eventually will place a larger burden on health systems and result in less productive societies. According to Teshome et al. (2013) there is an increasing trend of overweight and obesity in adolescents recently. The study conducted in Ethiopia sampled 554 high school students and found that the prevalence of adolescent overweight/obesity in an urban city was as high as 12.9% (Teshome et al., 2013). Although this value was lower than the prevalence in developed countries, it still indicates that adolescent obesity is becoming a growing issue in developing countries. A study conducted in Kuwait by Al-Haifi et al. (2013) found the prevalence of overweight and obesity in their survey to be as high as 50.5% for boys and 46.5% for girls. They also discovered that level of physical activity influenced overweight and obesity in the males whereas food choices could explain some of the differences for the females (Al-Haifi et al., 2013). A study conducted in Ghana by Mohammed and Vuvor (2012) sampled 270 students of the University Primary School between the ages of 5 and 15 years and found the prevalence of obesity among this group to be 10.9%. In addition, it appears that there are significant differences in the prevalence of overweight and obesity between males and females with more females being overweight/obese than their male counterparts in some studies (Teshome et al., 2013). This could be explained by the fact

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that males and females have slightly different body compositions and energy needs (Sweeting, 2008). Males tend to have more muscle than females and thus are more likely to burn more fat. In addition, females appear to be less physically active because they are usually required to stay at home especially in some low and middle income areas because of cultural norms (Kruger, Kruger, & Macintyre, 2006; Teshome et al., 2013).

2.2 Health Literacy and the Adolescent

Health literacy is defined as an individual's ability to obtain, understand and communicate health related information. Studies have indicated that health literacy has some influence on an individual's overall health status (Driessnack et al., 2014). Several measures of health literacy exist. Some of these measures include, the Test of Functional Health Literacy and the Rapid Estimate of Adult Literacy in Medicine. However these popular tests can be time consuming (Shah et al., 2010). In 2005, Weiss and his colleagues set out to create a health literacy tool that was simple, easy to use and an accurate measure of health literacy. This was the birth of the Newest Vital Sign. Weiss et al. (2005) tested the tool and found that it took significantly less time to administer this test while still maintaining the integrity of measuring an individual's numeracy, comprehension and reading skills. Since its creation, the Newest Vital Sign has been validated for use for adults and adolescents (Driessnack et al., 2014; Duell et al., 2015; Manganello et al., 2015; Shah et al., 2010). The Newest Vital Sign comprises of a food label and 6 questions that take an average of 3 minutes to answer. It is simple enough that it can be used to measure literacy in adolescents as well. The studies by Linnebur &Linnebur (2016) as well as by Warsh (2014) indicated that the newest vital sign was a reliable test of health literacy in adolescents. Both studies administered the NVS to adolescent and determined that the mean NVS score for adolescents and thus concluded

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that the NVS was "valid for use" in children as young as 10 years. (Linnebur & Linnebur, 2016; Warsh, Chari, Badaczewski, Hossain, & Sharif, 2014). Both studies used, categorized the NVS scores as 0-1 as having "limited health literacy", 2-3 as having " likely limited health literacy" and scores 4-6 as having "adequate health literacy" (Linnebur & Linnebur, 2016; Warsh et al., 2014). This study employed these categories as well.

According to a study by (Cha et al., 2014) health literacy was found to be a predictor of food label use which in turn predicts diet quality. The study was conducted with a group of young adults living in the metropolitan area of Atlanta, Georgia. They concluded that it was important for strategies to be developed to enhance health literacy in order to improve diet quality and health outcomes in young adults. Another study by Chang (2010), sought to analyze the association between health literacy, health status and health promoting behaviour among Taiwanese adolescents. The author discovered that adolescents with low health literacy were more likely to exhibit poor health promoting behaviour especially with respect to nutrition (author reported an Adjusted Odds Ratio (AOR)=0.62 with a 95% confidence interval,0.42-0.89). Thus, he concluded that health literacy was important for promoting health in adolescents especially with respect to nutrition.

2.3 Overweight/Obesity and Health Literacy

Several studies have indicated that there is a possible link between health literacy and overweight and obesity (Chari et al., 2014; Lam & Yang, 2014; Sharif & Blank, 2010; Shih et al., 2016). Child health literacy scores were negatively correlated to BMI. According to Sharif and Blank (2010) for every 1 point increase in health literacy score, BMI decreased by 0.02 points (Sharif & Blank, 2010). However, the study encouraged that this relationship be explored some more to understand why and how health literacy influenced BMI scores.

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Sharif and Blank (2010) concluded by asking the following questions: Could it be that health literacy encourages the children to make healthier choices? Or is it that high BMI scores cause some brain deficits? They suggested that these questions be further explored in future studies.

In addition, a systematic review by Carbone and Zoellner (2012) sought to summarize all the literature on nutrition and health literacy as they explained that there was increasing knowledge that health literacy was related to some diet-related and lifestyle diseases including cardiovascular disease and hypertension (Carbone & Zoellner, 2012).

Studies were conducted by Chari et al. (2014) in the United States, Lam & Yang (2014) in China and Shih et al. (2016) in Taiwan to explore the relationship between an adolescent's health literacy and their weight. Chari et al. (2014) conducted a study with participants in two health facilities across two states in the United States. They interviewed parents and children that attended an outpatient healthcare facility in Pennsylvania and then another healthcare facility in Delaware. They hypothesized that adolescent health literacy would drive adolescent obesity. Their findings were consistent with their hypothesis. Adolescents with lower health literacy scores appeared to have higher BMIs as compared to those that had adequate health literacy scores. The researchers however concluded that it would be ideal to also consider school environment and level of physical activity as they did not look at these aspects of adolescent behaviour (Chari et al., 2014). This study will take into consideration these aspects of level of physical activity and school environment. Lam and Yang (2014) conducted a population based cross-sectional survey of adolescents aged 12-16 years of age in Nanning, China. The researchers chose to use the Test of Functional Health Literacy for Adolescents (TOFHLA). They determined that low health literacy was

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significantly associated with overweight and obesity in adolescents ($where\ X^2 = 8.83, p = 0.0017$). The proportion of adolescents that had low health literacy and were overweight or obese was 0.675 while adolescents that had high health literacy and were obese was 0.50 (Lam & Yang, 2014). The study by Shih et al (2016) was conducted in Taiwan. It was also a population based study looking at adolescents between the ages of 11 and 12 years of age. They discovered that 43.02% of children in the bottom quartile for health literacy were classified as overweight or obese. They also revealed that after controlling for sex and ethnicity, adolescents in the highest quartile for health literacy score were less likely to be obese or underweight. However, it appeared that these children were more likely to be overweight. According to Shi et al (2016), they were unclear about why this was happening but then attributed it to the fact that the survey was web-based and was solely self-reported therefore the respondents may have over-estimated or underestimated their weights. They concluded that there was still a significant amount of evidence to illustrate the importance of adopting policies to incorporate some health literacy education in schools. All of these studies suggest that health literacy plays a key role in adolescent obesity. However, none of these studies were in an African setting. Therefore, this study will provide insight to whether these findings are similar in the Ghanaian setting, in addition actual body measurements were taken to eliminate any possible confusion that might arise with self-reporting.

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2.4 Risk Factors for Obesity

2.4.1 School Environment and Obesity

Many adolescents spend a large portion of their days in a school setting. This implies that the school environment can have some influence on some of their behaviours. Wechsler et al. (2006) describes some strategies that schools can adopt to improve adolescents' level of physical activity and eating behaviours. Some of the strategies include, "addressing physical activity and nutrition through a coordinated school health program", strengthening school's nutrition and physical activity policies, implementing high quality physical education and health education as well as increasing students' opportunities to engage in physical activity and providing appealing healthy food choices to students (Wechsler et al., 2006). The authors believe that if some of these strategies are employed by schools, it could improve child and adolescent health outcomes especially with respect to obesity. Again, this is would be an interesting component to explore in the Ghanaian setting.

Nonetheless, a study by Fairbrother et al. (2016) determined that the role of schools may have been over-estimated over the years. In their study, the researchers conducted interviews with children aged 9-10 years in England and then conducted in-depth interviews with a subset of eight families to receive the family's perspective and experience on the relationship between food and health. They found that children consistently down played the roles of the schools in influencing a student's eating behaviour. They concluded that even though schools were traditionally thought to be the best sites for public health interventions, children value parents as moral guides with respect to the adoption of food practices.

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2.4.2 Adolescents and Physical Activity

Physical activity is defined as "any bodily movement produced by skeletal muscles that requires energy expenditure –including activities undertaken while working, playing, carrying out household chores, travelling, and engaging in recreational pursuits" (WHO, 2017). Moreover, according to WHO (2017), the lack of physical activity or physical inactivity is associated with several leading causes of mortality all over the world. As at 2010, WHO found that over 80% of adolescents between the ages of 11 and 17 years were not meeting the minimum amount of physical activity that was recommended for them. In addition, findings suggested that adolescent girls were less physically active than their male counterparts (WHO, 2017).

Studies have indicated a decline in physical activity in adolescents, especially in adolescent girls. This decline is of public health importance because sedentary lifestyles are associated with increased risks in lifestyle diseases and poor health outcomes in general (Al-Haifi et al., 2013; Badr, Lakha, & Pennefather, 2017; Leech, McNaughton, & Timperio, 2014; Lenhart et al., 2012; Okely et al., 2017; Teshome et al., 2013).

This study employed the use of the Physical Activity Questionnaire for Adolescents (PAQ-A) which was developed by Kowalski, Crocker and Donen in 2004. Their aim was to develop a quick, reliable and low cost way to asses physical activity of young children and adolescents (Kowalski, Crocker, & Donen, 2004).

2.4.3 Adolescents and Food Habits

Eating behaviour or food habits is considered a risk factor for overweight and obesity in adolescents (Winkvist et al., 2016). Winkvist et al. (2016) conducted a study in Sweden among adolescents and discovered that a little under half (49.5%) of female adolescent respondents were consuming at least one fruit and vegetable daily as compared to 34.4 %

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of their male counterparts. They concluded that this may be a result of the fact that adolescent girls were more likely to be concerned about their appearance than their male counterparts. According to Johnson, Wardle and Griffith (2002) many research approaches to assess dietary intake of adolescents take a more traditional route by measuring the nutrient intake of adolescents or using one or more specific eating behaviours such as "snacking or skipping breakfast" as a way to measure their eating habits (Johnson, Wardle, & Griffith, 2002). Therefore this team came up with another way of assessing the food habits or eating behaviour of adolescents especially in situations where they might have some control over what they are eating (Johnson et al., 2002). This study uses this Adolescent Food Habits Checklist created by Johnson et al. in 2002. Their findings indicated a slight relationship between gender and food habit score which they explained could be because more females are more likely to place a higher value on their looks than their male counterparts and therefore would make better food choices (Johnson et al., 2002).

This study takes into consideration some of the gaps that literature reviewed suggested. First of all, there is minimal information about this association between health literacy and obesity in Ghana and no information about health literacy in the Adentan Municipality. Therefore, this study attempts to address that gap. In addition, researchers Chari et al. (2014) who conducted a study on this association between health literacy and obesity in adolescents in the United States concluded that it would be ideal or helpful to also consider school environment and level of physical activity of the adolescent. This study attempts to provide information about the level of physical activity (using the PAQ-A by Kowalski et

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al. (2004)) and the food habits of the adolescent (using the AFHC by Johnson et al. (2002)) as well in relation to health literacy.

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CHAPTER THREE

3.0 METHODOLOGY

3.1 Study Design

This was a cross-sectional study.

3.2 Study Site

Participant selection was done in the Adentan Municipality of Accra. This municipality is considered a growing urban area with a wide range of socio-economic status. This municipality shares borders with the Ashaiman Muncipality, Kpong Akatamanso District and the La Nkwantanang Municipality. Adentan was selected because of its growing urban/suburban base. In addition, there is limited data on adolescent's and their lifestyles in this area. Thus, the study provides valuable information on adolescents at the district level. The Adentan Municipality has Eighteen (18) health facilities, 14 of which are private. The remaining 4 include 1 community clinic, a Community based Health Planning Services compound (CHPS) and one traditional birth attendant (TBA). There are 160 basic schools within the municipality. Eight (8) of these schools are public basic schools while the remaining one hundred and forty-four (144) are private schools.

3.4 Sample Size Calculation

Sample size is based on sample size calculation:

The sample size for each group is given by

$$n = \frac{\left\{Z_{1-\beta}\sqrt{[p_1(1-p_1)+p_2(1-p_2)]} + Z_{1-\alpha/2}\sqrt{[2\bar{p}(1-\bar{p})]}\right\}^2}{(p_1-p_2)^2}$$

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Where $\bar{p} = \frac{p_1+p_2}{2}$

Where $Z_{1-\beta}$=power (0.8),

$p_{1=}proportion\ of\ adolescents\ with\ high\ health\ literacy\ and\ overweight/\ obesity$ (0.50) (Lam & Yang, 2014)

$p_{2=}proportion\ of\ adolescents\ with\ low\ health\ literacy\ and\ overweight/\ obesity$ (0.675 (Lam & Yang, 2014))

$Z_{(1-\alpha)}$ = 1.96

Following the equation, the total sample size is calculated to be **270**.

However, to account for non-response to specific questions, size was increased by approximately 10% to **300**

3.5 Sampling Technique

Two (2) public basic school and two (2) private basic schools were randomly selected out of the list of basic schools provided. A total of 292 adolescents between the ages of 10 and 15 years were selected. Most students aged 10-15 were in classes 5 to JHS 3. At the time of the study however, many of the schools no longer had students in JHS 3 because they had all written the Basic Education Certification Exam (B.E.C.E) before data collection began.

The total number of students selected per school was weighted depending on the total school population. With the sample size calculated to be 300, it was split such that 180 students (60%) of the total sample was from the 2 public schools and the remaining 120 students (40%) were from the private basic schools selected. This weighting was determined as the public schools had a much greater population of students than the private

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schools. Then, in each school, classes 5- JHS 3 were selected and then a random sample of students was collected from each class based on the total number of students in classes. This was done using the class register as a sampling frame and then using an interval determined by the total class number and by the number of students needed in each class. Once the interval was determined, selection began at a randomly selected starting point and then every 5th student interested in participating was selected.

Inclusion/Exclusion Criteria

All participants had to be between the ages of 10 and 15 years and could only be in the selected schools.

3.6 Data Collection

Questionnaire: A structured questionnaire was administered to willing participants. These questionnaires included general socio-demographic information from the students and a Newest Vital Sign test (to measure health literacy) as well as questions about physical activity (the PAQ-A) and an Adolescents' Food Habit Checklist (AFHC). These questionnaires were pre-tested before data collection begun. Type of school and amount of money spent in school served as a proxy for socioeconomic status. All questionnaires were administered in the English language.

Health Literacy Categorization

Health literacy (HL) scores were categorized into limited HL and adequate HL based on literature available for classifying health literacy when using the newest vital sign (Driessnack et al., 2014; Warsh et al., 2014)

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Physical Activity Score

Physical activity score was calculated for each based on calculation instructions by the PAQ-A developers, Kowalski et al. (2004)

Anthropometry: Weight, and height measurements were taken based on the WHO standards for weight and height measurements and then were used to determine whether selected students fell in the overweight/obese category or not. Measurements were categorized based on the WHO growth reference charts for BMI for age of children aged 5-19 years. The section on anthropometry was used to collect data on weight in kg and height in cm of participants which were used to calculate the Body Mass Index (BMI) of each participant by dividing weight in kilograms by height in meters squared (kg/m^2).

Weight measurement

The SECA digital scale was placed on a hard, flat surface. Researchers ensured that prior to the measurements, the scale was in working condition and was set to zero before participants stood on it. Participants were asked to remove objects such as shoes, jewellery, belts and any other heavy objects they may have been carrying and made to stand on the centre of the scale with their feet slightly apart ensuring that their weight was evenly distributed on both feet. Participants were then made to look straight ahead and then the weight was read to the nearest 0.01 kilogram. Weight measurements were taken in duplicates.

Height measurement

The Tanita Height Rod was placed against a wall and on an even surfaced floor. Participants were asked to remove their footwear. They were asked to stand with their back to the height rule, with their head, back, buttocks, calves and heels touching the upright

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height rule with feet slightly apart. The participants were asked to look straight ahead ensuring heads were placed in the Frankfort horizontal plane and asked to take in a deep breath while the measurement was taken. The movable headboard was lowered so that hair was pressed flat. The measurement was done in duplicate to the nearest 0.5cm.

3.7 Quality Assurance and Data Processing

Questionnaire was pre-tested before data collection begun. Data collected was reviewed for completeness before leaving each school to avoid the occurrence of missing data. Once data collected was checked and was complete, data was entered into SPSS version 16 for analysis.

3.8 Data Analysis

Univariate analysis was performed on relevant variables such as age, sex and class/grade while the Chi-squared test was used to determine associations between categorical variables and the T-test was used for continuous variables. The main outcome variables of interest included health literacy score, overweight and obesity. Multiple logistic regression was run controlling for sex and age. All multivariate analysis was measured at a statistical significance of 0.05

3.9 Ethical Considerations

This study posed no risk to the participants. Before data collection, a proposal was submitted for ethical clearance from the GHS Ethics Review Committee. Ethical clearance was given with protocol number GHS-ERC 93/02/17 (clearance letter attached) before data collection began. Informed consent and assent forms were prepared and presented to participants. The details were explained clearly to each participant at the beginning of the

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process and it was only after consent and assent was given that students answered any questions. Data was stored on a laptop that only the investigator had access to.

3.9.1 Conflict of Interest

There was no conflict of interest by the researcher.

3.9.2 Consent

Informed consent and assent forms were provided to the teachers and the students respectively. Assent forms are given to persons under the age of 18 years. Therefore, both consent and assent forms had to be provided since the target population of the study was below the age of 18 years. After consent was given, the student still had the choice to participate or not. If the child accepted, the child signed the assent form indicating that they were willing to participate. The details of the study were explained clearly to all participants including the fact that they (the participants) would be answering a series of questions and that their weight and height would be recorded. In addition, it was explained to each participant that they had the right to refuse to participate or stop participation at any point of the data collection process. Therefore, participants were free at any point in time during the data collection process to stop, pause or skip any questions they were not comfortable answering. Furthermore, each participant received a copy of their assent forms and were encouraged to call the principal investigator or the Ghana Health Service Ethics Review Committee representative if they felt that their rights had been infringed upon.

3.9.3 Data Storage, Usage and Confidentiality

Participants were assured that their details would be kept completely confidential and any identifiers would be removed before the work would be published. Participant personal information would be kept in a locked drawer that no one, but the investigator had access to.

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3.9.4 Risk and Benefits

This study posed no risk to the individual whatsoever.

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CHAPTER FOUR

4.0 RESULTS

4.1 Socio-demographic Characteristics of Participants

A total of 292 students participated in this study. Out of this, 124 (42.5%) were males and 168 (57.5%) were females. The mean age of participants was 12.92± 1.41 with no significant differences in mean age between males and females. There were 123 (42.1%) participants from private schools and 169 (57.9%) participants from public schools. Other socio-demographic and background information of participants are shown in Table 4.1 below.

Table 4.1 Socio-demographic and background information of participants

Variables	Male n=124 n (%)	Female n=168 n (%)	Total N=292 N (%)	p-value[1]
Mean Age (±SD)	12.90 (1.48)	12.95 (1.27)	12.92 (1.41)	0.751
Age Brackets				
10-12 years	58 (19.9)	63 (21.6)	121 (41.4)	
13-15 years	66 (22.6)	105 (36.0)	171 (58.6)	0.112
Ethnicity				0.672
Ga	19 (6.5)	32 (11.0)	51 (17.5)	
Ewe	38 (13.0)	43 (14.7)	81 (27.7)	
Akan	53 (18.2)	68 (23.3)	121 (41.4)	
Northern	10 (3.4)	20 (6.9)	30 (10.3)	
Other[2]	4 (1.4)	5 (1.7)	9 (3.1)	
Class				
5	23 (7.9)	30 (10.3)	53 (18.2)	0.786
6	24 (8.2)	35 (12.0)	59 (20.2)	
JHS 1	39 (13.4)	45 (15.4)	84 (28.8)	
JHS 2	36 (12.3)	57 (19.5)	93 (31.8)	
JHS 3	2 (0.7)	1 (0.3)	3 (1.0)	

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Table 4.1 continued

Variables	Male n=124 n (%)	Female n=168 n (%)	Total N=292 N (%)	p-value[1]
Money spent on food (GHC)				
None[3]	7 (2.4)	19 (6.5)	26 (8.9)	0.070
1 to ≤ 5	99 (33.9)	114 (39.0)	213 (72.9)	
> 5 to 10	18 (6.2)	32 (11.0)	35 (17.1)	
>10	0 (0)	3 (1)	3 (1.0)	
Religion				
Christian	114 (39.0)	150 (51.4)	174 (90.4)	0.447
Muslim	10 (3.4)	18 (6.2)	19 (9.6)	
Type of School				
Public	76 (26.0)	93 (31.8)	169 (57.9)	0.310
Private	48 (16.4)	75 (25.7)	123 (42.1)	

Note: All values are n (%)
[1]Pearson's chi-square for categorical values, independent t-test for continuous variables (*significance at p-value <0.05)
[2] "Other" category included Krobo, Nigerian, Liberian and Lebanese
[3] None here means that these students bring food from home

4.2 Health Literacy and BMI of Participants

The prevalence of obesity was determined to be 9.9% (Table 4.2). BMI appeared to be significantly different between the public and private schools (19.4 and 21.2 respectively; p<0.001) See table 4.3. Prevalence for adequate health literacy was calculated to be 46.6% while prevalence of low health literacy was determined to be 53.4% (Table 4.2). Public school children appeared to have significantly lower health literacy scores as compared to their private school counterparts (Table 4.3). Interestingly, the mean physical activity score appeared to be significantly different among the groups. However, when physical activity scores were grouped into low and high physical activity levels, there appeared to be no significant difference between the groups. See table 4.3 below.

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Table 4.2 Prevalence of Obesity, Health Literacy, Physical Activity Score and AFHC Score

Variables	Total N=292 N (%)
BMI	
Mean BMI (±SD)	20.2 (± 4.2)
Underweight	13 (4.5)
Normal	219 (75.0)
Overweight	31 (10.6)
Obese	29 (9.9)
Health Literacy (HL) Score	
Mean HL Score (± SD)	3.2 (±1.5)
Limited HL (0-3)	156 (53.4)
Adequate HL (4-6)	136 (46.6)
Physical Activity (PA)	
Mean PA (± SD)	2.2 (±0.5)
Low PA	192 (65.8)
High PA	100 (34.2)
Mean AFHC Score (± SD)	10.7 (±4.2)

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Table 4.3 Health Literacy, Categorized BMI and Physical Activity Score in Relation to School Type

Variables	Public School n=169 n (%)	Private School n=123 n (%)	p-value[1,2]
BMI			
Mean BMI (±SD)	19.4 (±3.7)	21.2 (±4.7)	**<0.001**
Underweight	10 (76.9)	3 (23.1)	**<0.001**
Normal	139 (63.5)	80 (36.5)	
Overweight	13 (41.9)	18 (58.1)	
Obese	7(24.1)	22 (75.9)	
Health Literacy (HL) Score			
Mean HL Score ± SD	2.9 (±1.4)	3.7 (±1.6)	**<0.001**
Limited HL (0-3)	113 (72.4)	43 (27.6)	**<0.001**
Adequate HL (4-6)	56 (41.2)	80 (58.8)	
Physical Activity (PA)			
Mean PA (± SD)	2.2±0.5	2.4±0.6	**0.001**
Low PA	116 (72.4)	76 (39.6)	0.223
High PA	53 (53.0)	47 (47.0)	

Note: All values are n (%) unless otherwise stated.
[1]Pearson's chi-square for categorical values, independent t-test for continuous variables (*significance at p-value <0.05)

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Table 4.4 Multivariate analysis between BMI status and independent variables of interest

Variables	BMI Status		
	Underweight	Overweight	Obese
	Odds ratio (95% CI)		
Health Literacy			
Limited HL	0.26 (0.57-4.39)	1.02 (0.44-2.35)	1.77 (0.73 - 4.28)
Adequate HL (ref)			
AFHC Score	0.92 (0.78-1.08)	1.10 (1.00-1.21) *	1.02 (0.93 - 1.12)
Physical Activity			
Low PA	0.51 (0.10-2.65)	1.19 (0.50-2.82)	1.43 (0.55-3.75)
High PA			
Age	0.59 (0.36-0.97) *	0.99 (0.70-1.40)	0.57(0.39-0.83) **
Sex			
Male	1.60 (0.46-5.54)	0.32 (0.13-0.81) *	0.32 (0.12-0.86) *
Female (ref)			
Type of School			
Public	4.25 (0.93-19.38)	0.36 (0.14-0.92) *	0.28 (0.10-0.81) *
Private (ref)			

Reference category for categorical dependent variable is normal weight
(ref) is the reference category *p<0.05 and **p<0.01

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4.3 Associations between BMI status and some variables of interest

Multinomial regression was performed between the main outcome variable (BMI status) and other independent variables of interest such as health literacy, age, sex, physical activity and type of school. The reference category for the outcome variable was normal weight. Interestingly, as a child's age increased, they were less likely to be classified as underweight or obese as compared to normal weight OR 0.57 [0.39-0.83]. Furthermore, being in public school was significantly less associated with being overweight or obese OR 0.36 [0.14-0.92], 0.28 [0.10-0.91]. A child in public school was also more likely to be underweight than normal weight than their counterparts in private school OR 4.25 [0.93-19.38] although, this association was not significant(Table 4.4). Another interesting finding was that a higher adolescent food habits score was significantly associated with being overweight as compared to being normal weight 1.10 [1.00-1.21].

Next, binary logistic regression was used to determine associations between the main outcome variables and independent variables. Table 4.5 describes the results of these associations. Gender was significantly associated with being overweight/obese. Males were more likely to be of normal weight compared to females OR 3.56 [1.69-7.62]. Meaning that more females were likely to be overweight than males. Again, school type was associated with being overweight/obese. Students in public school were more likely to be of normal weight than their counterparts in private school OR 3.33 [1.53-7.22]

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Table 4.5 Association between overweight/obese and independent variables of interest

Variables	Overweight/Obese Odds ratio (95% CI)
Health Literacy	
Limited HL	2.07 (0.54-7.85)
Adequate HL (ref)	
AFHC Score	.0.94 (0.85-1.02)
Physical Activity	
Low PA	1.19 (0.50-2.82)
High PA	
Age	1.27 (0.96-1.67)
Sex	
Male	3.56 (1.69-7.62) **
Female (ref)	
Type of School	
Public	3.33 (1.53-7.22) **
Private (ref)	

Reference category for categorical dependent variable is normal weight
(ref) is the reference category *p<0.05 and **p<0.01

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Table 4.6 Associations between Health Literacy Score and AFHC Score, Physical Activity Score and Money Spent in School

Variables	Limited HL=156 Mean(±SD)	Adequate HL=136 Mean(±SD)	p-value[1,2]
AFHC Score	11.0 (±4.0)	10.3 (±4.5)	0.185
Physical Activity (PA)	2.3(±0.6)	2.3(±0.6)	0.366
Money Spent in School			
0-5GHC n (%)	135 (46.2)	104(35.6)	**0.026**
>5-10 GHC n (%)	21 (7.2)	32 (11.0)	

[1] T-test used to compare mean AFHC scores and mean PA scores among the different HL groups[2] Chi-square used to compare categorical variable among the different HL groups

4.4 Associations between health literacy score and behavioural risk factors for obesity

The behavioural risk factors for obesity explored in this study were level of physical activity and food habits using the physical activity questionnaire for adolescents (PAQ-A) and the Adolescent Food Habits Checklist (AFHC) respectively. There were no significant differences between the mean AFHC score and PA score among those with low or adequate health literacy (Table 4.6). However, there was a significant difference between the proportions of those that spent less than 5 Ghana Cedis a day in school and those that spent more than 5 Ghana Cedis a day and health literacy (p= 0.026).

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CHAPTER FIVE

5.0 DISCUSSION

5.1 Background Characteristics of Participants

There were no significant differences between the proportions of males and females with respect to the background information collected. 42.5% of respondents were males and 57.5% were females. Participants were from 4 main ethnic groups, namely Ga, Ewe, Akan and Northern. Background characteristics were evenly distributed among participants.

The main findings for this study were that the prevalence of obesity was 9.9%, and the prevalence for adequate HL among adolescents between the ages of 10 and 15 years was 46.6%. Surprisingly, there were no significant associations between health literacy and obesity or overweight/obesity found in this study. There were also no significant associations between health literacy and the risk factors for obesity (level of physical activity and food habits) that were explored in this study. In addition, school type was associated with BMI. Adolescents in public school were more likely to be normal weight versus overweight than their counterparts in private school.

5.2 Prevalence of Obesity

Prevalence of obesity determined in this study (9.9%) was similar to findings by Mohammed and Vuvor (2012) who found prevalence of obesity of adolescents in a selected sub region of Accra to be at 10.9%. Prevalence calculated in this study is slightly lower than the 12.9% reported by Teshome et al. (2013) in Ethiopia. This difference could be as a result of slight variations between countries in the same region and possible changes over

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time. Males were less likely to be overweight or obese than females (OR 0.32[0.13-0.81]; OR 0.32[0.12-0.86]). This is also consistent with studies by Teshome et al. (2013) and Manyanga et al. (2014) where females were more likely to be overweight or obese than their male counterparts. This is because males tend to be more physically active than females during the period of adolescence and thus are at a lower risk of being overweight or obese (Lenhart et al., 2012). According to WHO (2014) young women were less likely to meet the requirements for physical activity. In addition, cultural norms exist in this part of our world where girls are expected to stay home and help with family chores which sometimes results in them not being as physically active as boys because they are limited in their movement from place to place (Kruger et al., 2006; Teshome et al., 2013). Furthermore, biological differences exist between males and females with regards to their body composition, energy needs and age of sexual maturation (Sweeting, 2008; Teshome et al., 2013). Females tend to have lower energy needs and mature faster than males, and this sometimes can contribute to weight gain (Sweeting, 2008).

There was also a significant association between age and BMI status. As a child increased in age, they were less likely to be classified as obese OR 0.57 [0.39-0.83]. This finding suggests that younger adolescents might be a group that public health workers consider when coming up with strategies to address the growing prevalence in overweight and obesity in Ghana.

5.3 Assessment of Health Literacy

Studies by Lam and Yang (2014) on health literacy and obesity classified 48.1% of respondents as having adequate or high health literacy while 51.9% of respondents were considered to have moderate or limited health literacy. Findings from this study for health

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literacy were slightly lower (46.6%, 53.4%) for adequate health literacy and limited health literacy respectively. It is possible that these slight differences exist because this study used a much smaller sample size. In addition, this study's age group was slightly different from those of the Lam and Yang study. That study used students between the ages of 12 and 16 years of age while this study sampled students between the ages of 10 and 15. It is possible that the differences in age of respondents could be responsible for the slight differences between these two studies.

5.4 Associations between Health Literacy and Obesity

Unlike studies by Chari et al. (2014), Lam and Yang (2014), Sharif and Blank (2010) and Shi et al. (2016) which all reported significant relationships between low health literacy and BMI status or weight, results from this study did not find any significant associations between health literacy and overweight or obesity. It is important to note however, that these studies were not conducted in an African setting. In addition, these studies used much larger samples sizes and one of the studies (the Lam and Yang study) used a Test of Functional Health Literacy for Adolescents which is different from the tool that was used in this study. Nonetheless, it is still possible that there is a significant relationship between health literacy and overweight and obesity since this study had a few limitations.

The final objective of this study was to assess or determine whether there were any associations between health literacy and some known behavioural risk factors for obesity. The two main risk factors that were suggested by Chari et al. (2014) were level of physical activity and food habits. This study found no significant associations between health literacy and the physical activity composite score or the composite score for the adolescent

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food habits checklist that was used. However, the amount of money spent on food in school was significantly different between those with limited health literacy and those with adequate health literacy.

The conceptual framework created from literature reviewed for the study illustrated that underlying factors such as socioeconomic status and education could influence level of physical activity and eating behaviours of adolescents which ultimately are considered risk factors for obesity in adolescents. However, the idea was based on literature, and based on the fact that, there was some evidence that health literacy would also have some influence on these two main risk factors and thus could have some effect on obesity in adolescents as well. Unfortunately, this study did not show any significant associations between health literacy and obesity. So, the conceptual framework designed for this study could not completely illustrate the findings of this study. Interestingly, there was a strong association between the type of school respondents attended and obesity. Students in public school were less likely to be overweight than students in private school OR 0.36 [0.14-0.92]. Majority of the respondents who were classified as obese were in private school (75.9% versus 24.1% in public school). School type was considered a proxy for socioeconomic status which suggests that just as in the conceptual framework, socioeconomic status can have some effect on obesity. This is also consistent with studies that found that in some countries, adolescents from higher SES backgrounds were more likely to be overweight (Koirala et al., 2015; Teshome et al., 2013).

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5.5 Study Limitations

Findings of this study cannot be generalized to settings outside of the Adentan Municipality. Nonetheless, this study is still useful as it provides insight on health literacy rates of adolescents between the ages of 10 and 15 years of age within the Adentan Municipality especially since it is the first study of its kind. The findings of this study also warrant more research into the concept of health literacy in an African setting. This study is the first of its kind in the Adentan Municipality and presents an opportunity for more research to be done if public health workers would like to use improving health literacy as a strategy to address the increasing prevalence of overweight and obesity among adolescents in Ghana.

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CHAPTER SIX

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusion

This study provides data on current prevalence of obesity among adolescents within the Adentan Municipality. The data show a high prevalence of obesity (9.9%). The combined prevalence of overweight and obesity was also determined to be high (20.5%). The study indicated that the proportion of adolescents that had adequate health literacy was 46.6%. There was no association between health literacy and obesity within the Adentan Municipality. Public school students were less likely to be overweight or obese. In addition, males were less likely to be categorized as overweight or obese than females. Mean health literacy score was higher in private schools than in public schools, implying that private school students were more health literate than their colleagues in public school. Older adolescents were less likely to be obese compared to normal weight which suggests that strategies to reduce the growing prevalence of overweight/obesity should start to target young adolescents.

6.2 Recommendations

6.2.1 Policy Recommendation

The Ghana Education Service and the Ghana Health Service should work with public health workers and researchers to determine ways to improve health literacy among adolescents and review physical education policies in order to increase adolescents' level of physical activity in schools.

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6.2.2 Research Recommendation

I recommend that more research is carried out looking at this area of health literacy and obesity. It would be ideal if something similar to this study is carried out on a larger scale where in addition to determining health literacy rates and prevalence of overweight and obesity, multiple risk factors for obesity are also explored. This study did not collect any data on direct socioeconomic status factors such as parent's education level, parent's occupation or parent's income level. It would be helpful to explore these factors in relation to health literacy rates in both adolescents and in their parents as well. It would also be interesting to compare parent health literacy scores to their adolescent's scores to see whether there is some sort of relationship.

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PARTICIPANT CODE: ……..…….. INTERVIEWER CODE: __ __ DATE:……../……./……

Appendix I: Study Questionnaire

UNIVERSITY OF GHANA

School of Public Health

Questionnaire for Study Titled: The Association Between Health Literacy and Overweight/Obesity Among Adolescents in Selected Schools

SECTION A: Background Information

1. What is your sex? (1). Male [ ] (2). Female [ ]
2. How old are you? …… years (age on your last birthday)
3. What is your ethnicity? (1). Ga [ ] (2). Ewe [ ] (3). Akan [ ] (4). Other ……..…….***specify***
4. What is your religious affiliation? (1). Christian [ ] (2). Muslim [ ] (3). Traditional [ ] (4) Other …….***specify***
5. What class are you in? (1). Class 5 [ ] (2). Class 6 [ ] (3). JHS1 [ ] (4). JHS2 [ ] (5) JHS 3[ ]
6. Type of school (1) Public [ ] (2) Private [ ]
7. How much do you spend on food in school a day? (1). None (I bring my food from home) [ ] (2). GHC 1-5 [ ] (3) GHC 5-10 [ ] (4) More than GHC 10[ ]

SECTION B: Diet and Lifestyle

<u>Lifestyle</u>

8. Do you engage in any form of exercise? 1. YES [ ] 2. NO [ ]
9. If yes, what exercises do you engage in?
   ……
   ……
   ……
10. How often is your exercise? 1. Daily [ ] 2. Weekly [ ] 3. Monthly [ ] 4. Rarely [ ]
11. How long do you exercise? 1. < 30 minutes [ ] 2. 30 minutes – 1 hour [ ]
    3. 1 to 2 hours [ ] 4. > 2 hours

Physical Activity

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PARTICIPANT CODE: ……..…….. INTERVIEWER CODE: __ __ DATE:……../……./……

We are trying to find out about your level of physical activity from the last seven days (in the last week). This includes sports or dancing that make you sweat or make your legs feel tired, or games that make you breathe hard, like skipping and running. Please remember that there is no wrong answer. Answer as honestly as you can.

1. Physical activity in your spare time: Have you done any of the following activities in the past 7 days (last week)? If yes, how many times? (Tick only 1 square per row.) If any of the activities are unclear, ask me and I will explain what they mean to you.

Code	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**
Activity	**No**	**1-2 times**	**3-4 times**	**5-6 times**	**7 times or more**
Skipping					
Walking for exercise					
Bicycling					
Jogging or running					
Aerobics					
Swimming					
Dancing					
Football					
Basketball					
Volleyball					
Other……..					

2. In the last 7 days, during your physical education (PE) classes, how often were you very active
(playing hard, running, jumping, throwing)? (Tick one)

I don't do PE	[ ] **(1)**
Hardly ever	[ ] **(2)**
Sometimes	[ ] **(3)**
Quite often	[ ] **(4)**
Always	[ ] **(5)**

3. In the last 7 days, what did you normally do at lunch (besides eating lunch)? (Check one only.)

Sat down (talking, reading, doing schoolwork)	[ ] **(1)**
Stood around or walked around	[ ] **(2)**
Ran or played a little bit	[ ] **(3)**
Ran around and played quite a bit	[ ] **(4)**
Ran and played hard most of the time	[ ] **(5)**

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4. In the last 7 days, on how many days right after school, did you do sports, dance, or play games in which you were very active? (Check one only.)

None	[ ] **(1)**
1 time last week	[ ] **(2)**
2 or 3 times last week	[ ] **(3)**
4 times last week	[ ] **(4)**
5 times last week	[ ] **(5)**

5. In the last 7 days, on how many evenings did you do sports, dance, or play games in which you were very active? (Check one only.)

None	[ ] **(1)**
1 time last week	[ ] **(2)**
2 or 3 times last week	[ ] **(3)**
4 times last week	[ ] **(4)**
5 times last week	[ ] **(5)**

6. On the last weekend, how many times did you do sports, dance, or play games in which you were very active? (Check one only.)

None	[ ] **(1)**
1 time	[ ] **(2)**
2 — 3 times	[ ] **(3)**
4 — 5 times	[ ] **(4)**
6 or more times	[ ] **(5)**

7. Which one of the following describes you best for the last 7 days? Read all five

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statements before deciding on the one answer that describes you.

All or most of my free time was spent doing things that involve little physical effort	[ ] **(1)**
I sometimes (1 — 2 times last week) did physical things in my free time (e.g. played sports, went running, swimming, bike riding, did aerobics)	[ ] **(2)**
I often (3 — 4 times last week) did physical things in my free time	[ ] **(3)**
I quite often (5 — 6 times last week) did physical things in my free time	[ ] **(4)**
I very often (7 or more times last week) did physical things in my free time	[ ] **(5)**

8. Mark how often you did physical activity (like playing sports, games, doing dance, or any other physical activity) for each day last week.

Code	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**
Days	None	Little bit	Medium	Often	Very Often
Monday					
Tuesday					
Wednesday					
Thursday					
Friday					
Saturday					
Sunday					

9. Were you sick last week, or did anything prevent you from doing your normal physical activities? (Check one.)

Yes	[ ] **(1)**
No	[ ] **(2)**

If Yes, what prevented you?.....

Lifestyle

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PARTICIPANT CODE: ……..…….. INTERVIEWER CODE: __ __ DATE:……../……./……

The Adolescent Food Habits Checklist

I am going to read out a list to you, answer with true or false. If the question does not apply to you, simply say this is not applicable to me.

1. If I am having lunch away from home, I often choose a low-fat option. *True/False/I never have lunch away from home*
2. I usually avoid eating fried foods. *True/False*
3. I usually eat a dessert or pudding if there is one available. *True/False*
4. I make sure I eat at least one serving of fruit a day. *True/False*
5. I try to keep my overall fat intake down. *True/False*
6. If I am buying crisps, I often choose a low-fat brand. *True/False/I never buy crisps*
7. I avoid eating lots of sausages and burgers. *True/False/I never eat sausages or burgers*
8. I often buy pastries or cakes. *True/False*
9. I try to keep my overall sugar intake down. *True/False*
10. I make sure I eat at least one serving of vegetables or salad a day. *True/False*
11. If I am having a dessert at home, I try to have something low in fat. *True/False/I don't eat desserts*
12. I rarely eat takeaway meals. *True/False*
13. I try to ensure I eat plenty of fruit and vegetables. *True/False*
14. I often eat sweet snacks between meals. *True/False*
15. I usually eat at least one serving of vegetables (excluding potatoes) or salad with my evening meal. *True/False*
16. When I am buying a soft drink, I usually choose a diet drink. *True/False/I never buy soft drinks*
17. When I put butter or margarine on bread, I usually spread it thinly. *True/False/I never have butter or margarine on bread*
18. If I have a packed lunch, I usually include some chocolate and/or biscuits. *True/False/I never have a packed lunch*
19. When I have a snack between meals, I often choose fruit. *True/False/I never eat snacks between meals*
20. If I am having a dessert or pudding in a restaurant, I usually choose the healthiest one. *True/False/I never have desserts in restaurants*
21. I often have cream on desserts. *True/False/I don't eat desserts*
22. I eat at least three servings of fruit most days. *True/False*
23. I generally try to have a healthy diet. *True/False*

Coding for above statements

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Statement	Code
True	**(1)**
False	**(2)**
Not Applicable/ Never/None	**(3)**

SECTION C: NVS Test Questions

I have handed you a food label. That is the information on the back of a container of a pint of ice cream. Now I am going to ask you some questions based on your understanding of the label. After I read the question out to you, I will give you some time to give me an answer.

Questions

1. If you eat the entire container, how many calories will you eat?
2. If you are allowed to eat 60 g of carbohydrates as a snack, how much ice cream could you have?
   Note: If patient answers "2 servings," ask "How much ice cream would that be if you were to measure it into a bowl?"
3. Your doctor advises you to reduce the amount of saturated fat in your diet. You usually have 42 g of saturated fat each day, which includes 1 serving of ice cream. If you stop eating ice cream, how many grams of saturated fat would you be consuming each day?
4. If you usually eat 2500 calories in a day, what percentage of your daily value of calories will you be eating if you eat one serving?
   Pretend that you are allergic to the following substances:
   Penicillin, peanuts, latex gloves, and bee stings.
5. Is it safe for you to eat this ice cream?
6. *(Ask only if the participant responds "no" to question 5):* Why not?

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PARTICIPANT CODE: ……..…….. INTERVIEWER CODE: __ __ DATE:……../……./……

Participant Answer ***(record the participant's answer)***	**Correct Answer**	**Participant answered correctly?** ***(write "1" if participant answered correctly, otherwise, write "0")***
	1,000 is the only correct answer	
	1 cup (or any amount up to 1 cup, half the container	
	33	
	10%	
	No	
	Because it has peanut oil	

SECTION D: Anthropometry

Parameter	**1st reading**	**2nd reading**
Weight (kg)		
Height (cm)		

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Appendix II: Newest Vital Sign Food Label

Nutrition Facts

Serving Size	½ cup
Servings per container	4
Amount per serving	
Calories 250	Fat Cal 120
	%DV
Total Fat 13g	20%
Sat Fat 9g	40%
Cholesterol 28mg	12%
Sodium 55mg	2%
Total Carbohydrate 30g	12%
Dietary Fiber 2g	
Sugars 23g	
Protein 4g	8%

*Percentage Daily Values (DV) are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs.

Ingredients: Cream, Skim Milk, Liquid Sugar, Water, Egg Yolks, Brown Sugar, Milkfat, Peanut Oil, Sugar, Butter, Salt, Carrageenan, Vanilla Extract.

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Appendix III: Consent Form

University of Ghana
School of Public Health
Consent Form

Title of project: The Association between Health Literacy and Obesity among Adolescents in Selected Schools in Accra

This project is being carried out by Claudia Ewa as part of her fulfilment for a Master's in Public Health. Information collected is mainly for research purposes.

Principal Investigator: Claudia Ewa

Introduction

My name is _____ and I am from the ***University of Ghana***. I am conducting a study with school children between the ages of 10 and 15 years to learn more about the health of adolescents in the Adenta Municipality. This includes good nutrition, proper growth, healthy eating, and doing well in school. With this information, public health people will be able to determine the needs of adolescents in Adenta.

This study will last for 6 months. 400 students between the ages of 10 and 15 years will be in this project. There is only one interview which will be done today.

If you grant permission for your child/ward to participate in this study, I will ask him/her some questions about the food he/she eats and the activities he/she does in school and at home. We will also take measurements of his/her weight and height. Everything will take no more than 30 minutes.

Risk/Benefits
There are no risks in participating in this study. At the end of the interview I may tell your ward if he/she has a healthy weight for his/her height. Another benefit would be that your ward would have contributed to important research for the future.

Voluntary Participation and Right to Leave the Research
It is entirely your decision to grant permission for your ward/child to participate in the study.
If you are not comfortable with your child participating, you can deny permission and your child will not be asked any questions.

Compensation
There is no payment and there are no costs to you or your ward for participating in the study. However, a small token will be given to your ward at the completion of the study.

Confidentiality
No one will be able to know how your responded to the questions. Their information will only have a study or ID number and not their name. All information will be kept safe and seen only by the researchers.

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Contacts for Additional Information
You may ask me any questions about this study now or the next time you see me.

You may also call or e-mail:

Claudia Ewa
0240 677 446
e-mail: cvewa@st.ug.edu.gh

or

Hannah Frimpong, GHS-ERC Administrator.
Office: +233 302 681109
Mobile: 233 (0) 243235225 or 0507041223.
Email: Hannah.Frimpong@ghsmail.org

VOLUNTARY AGREEMENT

Your signature or thumb print below means that you understand everything about the study and that you grant permission for your child to participate. If you do not want him/her to participate, please do not sign this form. You and your child/ ward will be given a copy of this form after you have signed it.

This consent form has been read and/or explained to me. I have been able to ask questions and they were all answered. I hereby grant permission to my child/ ward whose name is listed below to participate and I understand everything that has been written.

Child's Name: _____ **Date:** _____

Parent/Teacher's Name: _____ **Parent's Mark/Thumbprint**

Parent/Teacher's Signature: _____

I certify that the participant has been given ample time to read and learn about the study. All questions and clarifications raised by the participant have been addressed.

Researcher's Name: _____ **Date:** _____

Researcher's Signature: _____

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Appendix IV: Assent Form

University of Ghana
School of Public Health
Assent Form

Title of project: The Association between Health Literacy and Obesity among Adolescents in Selected Schools in Accra

This project is being carried out by Claudia Ewa as part of her fulfilment for a Master's in Public Health. Information collected is mainly for research purposes.

Principal Investigator: Claudia Ewa

Introduction

My name is _____ and I am from the ***University of Ghana***. I am conducting a study with school children between the ages of 10 and 15 years to learn more about the health of adolescents in the Adenta Municipality. This includes good nutrition, proper growth, healthy eating, and doing well in school. With this information, public health people will be able to determine the needs of adolescents in Adenta.

This study will last for 4 months. 400 students between the ages of 10 and 15 years will be in this project. There is only one interview which will be done today.

If you agree to be in this study, I will ask you some questions about the food you eat and the activities you do in school and at home. We will also take measurements of your weight and height. Everything will take no more than 30 minutes.

Risk/Benefits
There are no risks in participating in this study. At the end of the interview I will tell you if you have a healthy weight for your height. Another benefit would be that you would have contributed to important research for the future.

Voluntary Participation and Right to Leave the Research
It is only your decision to be part of this study. You can stop participating at any time if you feel uncomfortable. No one will be angry or upset with you if decide that you do not want to continue to participate.

I will ask permission from your teacher before you are enrolled into the study. Even if your parent/teacher says "yes", you can still decide not to participate.

Compensation
There is no payment and there are no costs to you for being in the study. However, a small token will be given to you at the completion of the study.

Confidentiality
No one will be able to know how you responded to the questions. Your information will only have a study or ID number and not your name. All information will be kept safe and seen only by the researchers.

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Contacts for Additional Information
You may ask me any questions about this study now or the next time you see me.

You may also call or e-mail:

Claudia Ewa
0240 677 446
e-mail: cvewa@st.ug.edu.gh

or

Hannah Frimpong, GHS-ERC Administrator.
Office: +233 302 681109
Mobile: 233 (0) 243235225 or 0507041223.
Email: Hannah.Frimpong@ghsmail.org

VOLUNTARY AGREEMENT

Your signature or thumb print below means that you understand everything about the study and that you agree to be a part of it. If you do not want to participate, please do not sign this form. You and your parent/ teacher will be given a copy of this form after you have signed it.

This assent form has been read and/or explained to me. I have been able to ask questions and they were all answered. I agree to participate and I understand everything that has been written.

Child's Name: _____ **Date:** _____

Child's Signature: _____ **Child's Mark**

I certify that the participant has been given ample time to read and learn about the study. All questions and clarifications raised by the participant have been addressed.

Researcher's Name: _____ **Date:** _____

Researcher's Signature: _____

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