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**DIETARY HABITS AND PHYSICAL INACTIVITY OF ADOLESCENTS DURING
COVID-19 PERIOD**

BY

FELICIA KABUKAI MENSAH

10245026

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OF MSC IN DIETETICS DEGREE**

SUPERVISED BY:

**DR FREDA INTIFUL
PROF. IRENE HATSU**

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DECLARATION

I declare that, this dissertation was written by me (Felicia Kabukai Mensah), under the supervision of Dr. Freda Dzifa Intiful and Prof. Irene Hatsu at the University of Ghana, School of Biomedical and Allied Health Sciences, College of Health Sciences, Department of Nutrition and Dietetics. All references are duly acknowledged.



Signature

Date.....04/07/22.....

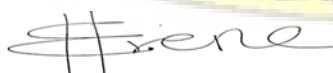
Felicia K. Mensah
(Student)



Signature...

Date.....06/07/22.....

Dr Freda Dzifa Intiful
(Supervisor)



Signature.....

Date.....06/07/22.....

Prof. Irene Hatsu
(co-supervisor)

DEDICATION

Firstly, I dedicate this work to my Lord and Saviour Jesus Christ for bringing me this far. In Him I live, move and have my being (Acts 17:28).

I dedicate this piece of work to myself. I congratulate myself for the bold step I took to further my education after eight (8) years of completing undergraduate studies. Amidst the numerous challenges, I trusted God whole heartedly and decided to take this course.



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I also want to express my appreciation to my supervisors, Dr Freda Dzifa Intiful and Prof. Irene Hatsu for their understanding and help towards this dissertation. God richly bless them.

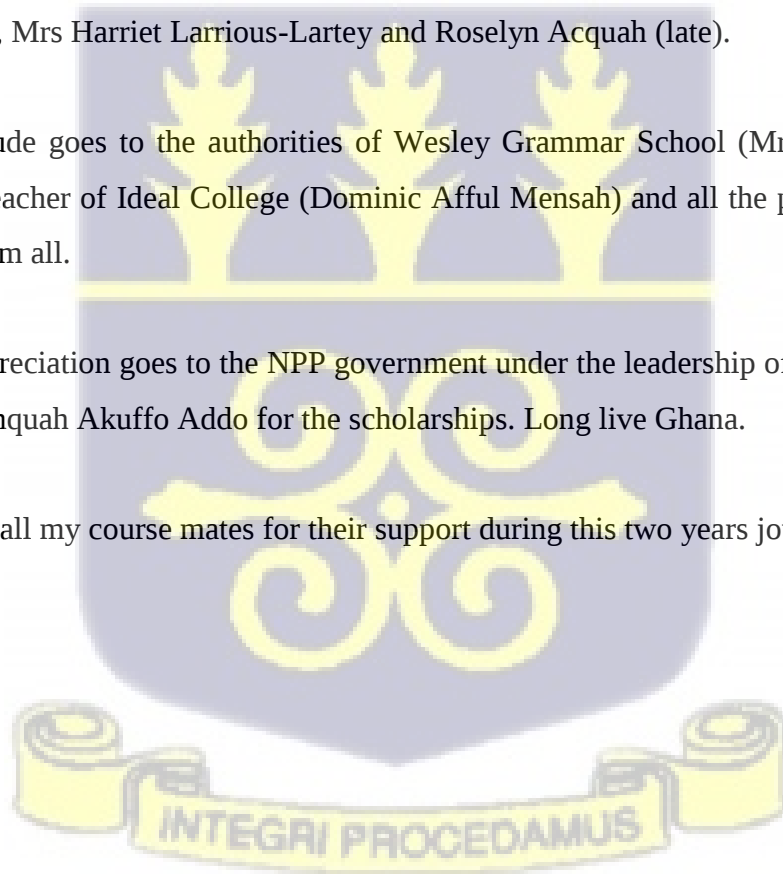
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I want to thank all my course mates for their support during this two years journey.



LIST OF ABBREVIATIONS

COVID-19: Corona Virus Disease 2019

SARS-CoV2: Severe Acute Respiratory Syndrome Coronavirus 2

WHO: World Health Organization

TFEQ: Three Factor Eating Questionnaire

TFEQ-R: Three Factor Eating Questionnaire- Restraint factor

TFEQ-D: Three Factor Eating Questionnaire- Disinhibition factor

TFEQ-H: Three Factor Eating Questionnaire- Hunger factor

IPAQ: International Physical Activity Questionnaire

FAO: Food & Agricultural Organization

UNICEF: United Nations Children's Fund

IFAD: International Fund for Agricultural Development

NCD's: Non-Communicable Diseases

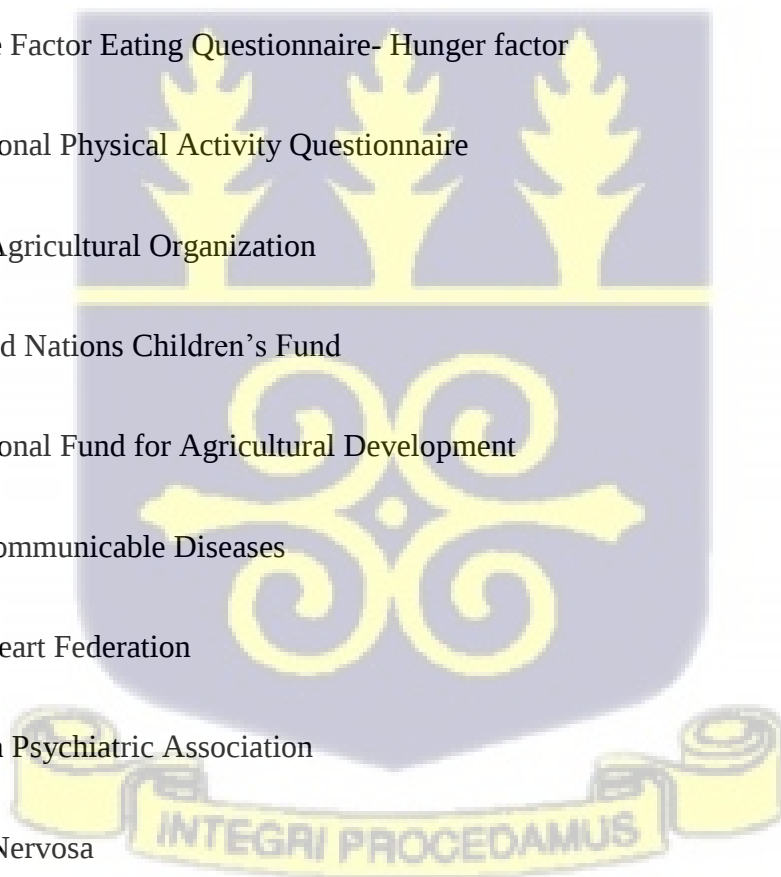
WHF: World Heart Federation

APA: American Psychiatric Association

AN: Anorexia Nervosa

BMD: Bone Mineral Density

PI: Physical Inactivity



PA: Physical Activity

METs: Metabolic Equivalent Tasks

MVPA: Moderate to Vigorous Physical Activity

HELENA: Healthy Lifestyle in Europe by Nutrition in Adolescence

TV: Television

SB: Sedentary Behaviour

CVDs: Cardio-Vascular Diseases

DM: Diabetes Mellitus



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ABSTRACT

Background: It is known that physical inactivity is highly prevalent and dietary habits are poor among adolescents. These are the major risk factors for obesity in adolescents. During the COVID-19 pandemic, physical inactivity habits has been shown to be influenced due to restriction in movement and dietary habits have also been affected due to stress accompanying the pandemic.

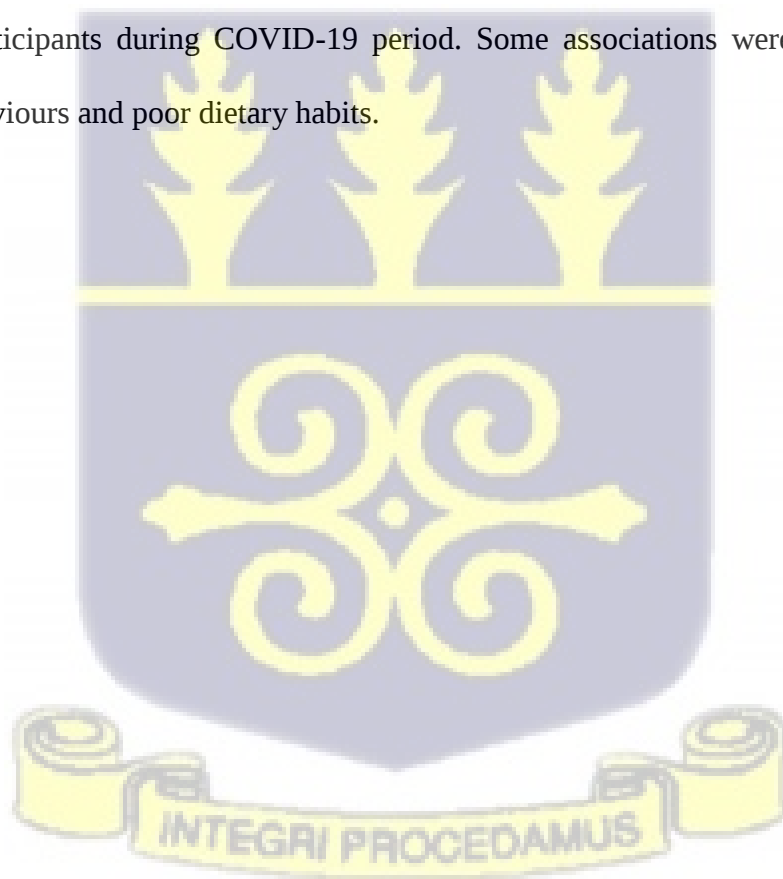
Aim: The aim of this study was to determine the association between poor dietary habits and physical inactivity of adolescents during the COVID-19 period.

Methodology: A cross-sectional study design was employed for this research. Balloting and systematic sampling techniques were used to recruit adolescents between 15-19 years from Wesley Grammar School and Ideal College. Data collection was carried out from June to August 2021 (after the COVID-19 lockdown period). The Three- Factor Eating Questionnaire and Food Frequency Questionnaire were used to collect information on dietary habits and the International Physical Activity Questionnaire assessed physical activity information. IBM Statistical Package for Social Sciences (SPSS) version 20 was used for analysis. Continuous variables such as age were analysed using descriptive statistics summarised into means and standards deviation. Categorical variables such as dietary habits and physical activity levels were summarized into frequencies and percentages.

Pearson chi-square test was employed to determine associations between dietary habits and physical inactivity.

Results: Skipping meals, snacking and immoderate fat intake (eating fried and oily foods often) showed higher prevalence of 69.3%, 67.1% and 56.1% respectively. Majority (89.2%) of the participants had low physical activity level. There was significant association between time spent watching TV and intake of unpolished cereals ($p = 0.018$), fast foods ($p = 0.001$) and pastries ($p = 0.050$). There was no significant association between time spent on the computer and the various food groups, except for intake of unpolished cereals ($p = 0.003$) and fast foods ($p = 0.013$). In addition, significant association was found for time spent reading and frequency of consumption of legumes ($p = 0.010$) and pastries consumption ($p \leq 0.001$).

Conclusion: Dietary habits were generally unhealthy (poor) and physical inactivity was high among the participants during COVID-19 period. Some associations were found between sedentary behaviours and poor dietary habits.



CHAPTER ONE

1.0 INTRODUCTION

1.1 BACKGROUND

Dietary habits and physical inactivity among adolescents have gained considerable interest over the past decade (Allafi *et al.*, 2013). This is because; these lifestyle behaviours have been identified as risk factors for obesity in adolescents (Al-domi *et al.*, 2019). Most importantly, about 80% of adolescents who become obese continue with the condition into adulthood (Al-haifi *et al.*, 2013).

Coronavirus disease 2019 (COVID- 19) is a new global pandemic caused by the Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV2). This microorganism affects the respiratory tract and it is transmitted from person to person by droplets through talking, sneezing, coughing, breathing and contact with infected material (Oni *et al.*, 2020). To control the rapid spread of the disease, the World Health Organisation (WHO), recommended several public health measures including ‘isolation, contact tracing, social distancing, quarantine and restriction in movement’ (WHO, 2020). Ghana has also adopted these measures since March 2020 till date. COVID-19 measures have been shown to encourage lifestyle and behavioural changes which include poor dietary and physical inactive habits (Arora & Grey, 2020).

Dietary habits can be classified into healthy and unhealthy dietary habits. Healthy dietary habits include daily eating breakfast (not skipping breakfast), consuming fruits, milk or dairy products and vegetables in a week (Allafi *et al.*, 2013). Subsequently, unhealthy dietary habits

include consumption of fast foods, fried potatoes, pastries, sweets, sugary and energy drinks or beverages, high energy dense foods, saturated fats, trans-fatty acids, refined carbohydrates and high glycemic index foods three times in a week or more (Allafi *et al*, 2013; Musaiger, *et al.*, 2015; El Achhab *et al.*, 2018).

Factors affecting unhealthy eating habits among adolescents are importation of food, the rapid expansion of fast food restaurants, inadequate information on the negative effects of consuming high energy foods and food marketing programmes and strategies (Zayed *et al*, 2017).

Screen time behaviours (especially time spent watching television) have been reported as the main marketing medium that influences dietary habits (Study & Swi, 2018). Wadolowska and colleagues reported that physical inactivity was related to unhealthy dietary habits (Wadolowska *et al*, 2018). Also in a meta-analysis, television watching was seen as the screen time activity that influenced unhealthy dietary intake (Hobbs *et al*, 2015). The study identified an association between watching television and dietary consumption. In moments of quarantine and social distancing, adolescents spend most time indoors watching television. This would decrease their physical activity level. Also, as adolescents watch television, they are introduced to various food commercials which influence their dietary habits.

Research on behavioural changes during COVID-19 lockdown has also identified negative behavioural changes among adolescents with physical inactivity and stress as factors influencing dietary changes (Ismail *et al*, 2020). A cross-sectional study among adolescents in Latin America reported a high prevalence of inactivity before and during COVID-19 which worsened during the lockdown (Renzo *et al.*, 2020). In addition, frequency of consumption of ultra-processed foods among the adolescents was high (Renzo *et al.*, 2020).

Elsewhere, association between eating habits, physical inactivity and body weight during COVID-19 confinement observed a positive correlation (Reyes-Olavarria *et al.*, 2020).

Obesity and chronic diseases have been associated with unhealthy dietary habits. In a study among adolescents, skipping breakfast and high consumption of sugar sweetened drinks were associated with obesity (Moreno *et al.*, 2013). On the other hand, vegetable consumption has been associated with a reduced risk of overweight among adolescent boys (Al-haifi *et al.*, 2013).

1.2 PROBLEM STATEMENT

Adolescents are group of individuals who are between childhood and adulthood, and of the age category of 10-19 years (WHO, 2020). Adolescence is also a stage of speedy growth characterised by a lot of changes including behavioural changes (Das *et al.*, 2017). This makes nutrient requirements during the adolescence stage higher compared to other life stages (Musaiger *et al.*, 2015). Healthy dietary habits are therefore vital to increase the intake of nutrients necessary for the speedy growth at this stage (Musaiger *et al.*, 2015). Dietary habit among Ghanaian adolescents has been reported to be unhealthy with prevalence of 62.8% (Buxton, 2014). Ideally, adolescents are supposed to form healthy dietary habits at this stage to reduce the risk of chronic diseases now and later in adulthood (Musaiger *et al.*, 2015).

According to Miquetichuc and colleagues, the prevalence of physical inactivity among Brazilian adolescents is 66.8% (Miquetichuc *et al.*, 2016). COVID-19 has influenced physical activity as a result of restriction in social activities. Inactive behaviours such as

screen exposure and electronic device usage encourage unhealthy dietary habits (Arora & Grey, 2020). As adolescents spend more time using screen, they are exposed to food commercials especially processed foods (Zayed, *et al.*, 2017).

In Ghana, most studies that have been conducted during COVID-19 periods focused on the lockdown periods (Owusu-Fordjour, Koomson, & Hanson, 2020; Ansah, Safo & Apaak, 2020). There has been restriction in movement, reduced social contacts and activities, home schooling and changes in eating habits (Owusu-Fordjour, Koomson, & Hanson, 2020). In a qualitative research, Ansah and colleagues reported that most people experienced undesirable eating habits and physical inactivity as a result of the reduction in social activities in Ghana during the COVID-19 lockdown period (Ansah, Safo & Apaak, 2020).

There is currently a dearth of research on the relationship between dietary habits and physical inactivity of adolescents during the COVID-19 pandemic (specifically after the COVID-19 lockdown period) in Ghana. It is therefore unclear the strength of influence that sedentarism has on dietary habits during COVID- 19.

1.3 SIGNIFICANCE OF THE STUDY

Knowledge on the association between dietary habits and physical inactivity will assist health professionals to ascertain the strength of influence that inactive lifestyle has on dietary habits. Thus, result from this study will guide dieticians and policy makers to design specific health interventions to control dietary habits of adolescents during future pandemic.

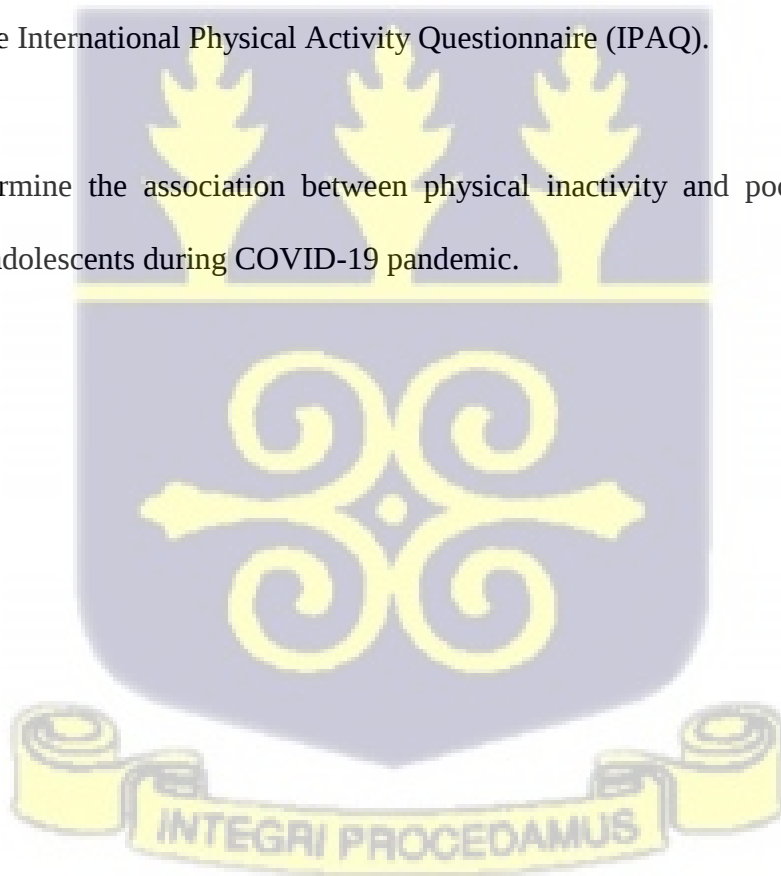
In addition, this study will provide baseline information and reference for future studies.

1.4 AIM OF THE STUDY

To assess the association between dietary habits and physical inactivity of adolescents during COVID-19 pandemic.

1.5 SPECIFIC OBJECTIVES

1. To assess the prevalence of poor dietary habits among adolescents during COVID-19 using the Three Factor Eating Questionnaire (TFEQ) and the Food frequency questionnaire by the Epic-Norfolk nutritional methods.
2. To assess the prevalence of physical inactivity among adolescents during COVID-19 using the International Physical Activity Questionnaire (IPAQ).
3. To determine the association between physical inactivity and poor dietary habits among adolescents during COVID-19 pandemic.



CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 DIETARY HABITS

2.1.1 Dietary habits among adolescents

Dietary habits refer to the habitual food that a person usually and frequently consumes, subconsciously (Bede *et al.*, 2020). Intiful *et al.* (2019) also defined dietary habits as the decisions and choices an individual makes regarding the food to eat, what to eat, where to eat, when to eat and how much to eat.

Practices of dietary habits can be grouped into two (2): healthy (good or desirable) and unhealthy (poor, undesirable) dietary habits. Unhealthy dietary habits include such practices as skipping of meals, skipping of breakfast, low intake of fruits and vegetables, high intake of sweets and soft drinks (Ottevaere *et al.*, 2011). Snacking, eating large portion of meals at a sitting, eating small portion of meals at a sitting (food restriction) and eating large portion of fast foods are not excluded (Intiful *et al.*, 2019). Disordered eating habits like binge eating, anorexia nervosa, bulimia nervosa, excluding meat, fish, milk and other animal protein (vegetarianism) are also examples of unhealthy dietary practices (Oddam, 2015). On the other hand, daily consumption of breakfast, fruits, vegetables, milk and other low fat dairy products is regarded as healthy dietary habits (Musaiger, Al-Mufty & Al-Hazaa, 2014).

It is known that dietary habits among adolescents are poor, unhealthy and undesirable with several factors influencing this habit (Buxton, 2014). For instance Buxton found out that, the major reason why Ghanaian adolescents skip breakfast was to use their breakfast money to browse the internet later in the day (Buxton, 2014). Others also skip meals due to economic

reasons, stress, time pressure from school, peer influence. Body image preference especially among adolescent females accounts for one of the reasons some practice anorexia nervosa (Oddam, 2015). Economic, health and religious factors also influences vegetarianism among some youth (Buxton, 2014; Oddam, 2015). In addition, it is believed that girls portray good knowledge about food, nutrition and health than boys (Wadolowska *et al.*, 2018).

Other factors that influence poor dietary habits are low education and economic levels of parents, rapid globalisation and easy access to food (Wadolowska *et al.*, 2018; Wadolowska *et al.*, 2019).

Adolescents undergo several changes during this transition stage, as such they are prone to nutrient deficiencies (Wadolowska *et al.*, 2018). This makes healthy dietary habits a necessity at this stage to maintain health and well-being of the adolescents. For instance, eating breakfast helps adolescents to be alert in class by mid-morning. On the other hand, studies have shown that people who skip breakfast end up snacking and consuming high salt, fat, sugar dense foods in the course of the day. However these foods are low in essential micronutrient (Buxton, 2014).

Other benefits of healthy dietary habits are good academic performance and cognitive ability (Buxton, 2014). Prevention of chronic diseases such as obesity, diabetes, cardiovascular diseases, some cancers (breast, prostate, colonic and endometrial cancers) as well as meeting dietary requirement cannot be left out (Buxton, 2014).

Healthy foods like fruits and vegetables are rich in micronutrients and antioxidants which serve as major regulators of the immune system and metabolism (Reyes-olavarr *et al.*, 2020).

A good dietary habit of adolescents influences their health today and has an impact on the next generation. As such adolescents who practice healthy dietary habits today could educate their children about same in their adult life (Ruíz-Roso *et al.*, 2020).

2.1.2. Dietary habits during COVID-19 period

COVID-19 outbreak caused a lot of psychological and other changes that affected dietary habits. These psychological and other changes include anxiety, sleep disturbances and economical changes (Reyes-olavarr *et al.*, 2020). For instance economical changes influence where, when and what people eat. Sleep disturbances and anxiety also affects unhealthy eating habit. In a study by Ismail and colleagues, it was reported that consumption of sweets increased and water intake decreased among adolescent during this period partly due to anxiety and stress (Ismail *et al.*, 2020).

During the COVID-19 pandemic, stay home confinement coupled with unhealthy dietary habit like frequent consumption of fried foods led to decline in energy expenditure and positive energy balance (Reyes-olavarr *et al.*, 2020). In a study by Reyes-olavarr and friends, it was reported that weight gain was observed among the participants who consumed fried foods more than three times per week as well as those who consumed less water (Reyes-olavarr *et al.*, 2020). Prolonged home stay would influence the health of adolescent today and increase their risk to chronic diseases in adulthood (Ruiz-Roso *et al.*, 2020).

As a result of restriction in movement and the stay-home confinement, ability of shopping for fresh foods decreased (Ruíz-Roso *et al.*, 2020). Economic changes, loss of jobs also influenced people to cook home foods rather than eating at restaurants. As a result, adolescents could gain more nutrition knowledge at home (Ruíz-Roso *et al.*, 2020). A cross-sectional study conducted between April and May, 2020 reported that vegetables, legumes and fruit consumption increased, fast food intake from restaurants also decreased among adolescents in Italy, Spain, Chile, Colombia and Brazil (Ruíz-Roso, *et al.*, 2020). Thus COVID-19 had a positive impact on dietary habit to some extent.

2.1.3 Assessment tools for dietary habits and physical inactivity

2.1.3.1 The Three-Factor Eating Questionnaire (TFEQ)

The three-Factor Eating Questionnaire (TFEQ) is a well-known psychological tool for measuring dietary behaviours. It was established by Stunkard and Messick in 1985 for assessing dietary behaviours for adolescents, young and older adults. TFEQ is a self-administered 51-items questionnaire with three factors or domains; ‘cognitive restraint’, ‘disinhibition’ and ‘hunger’ (Loffler *et al.*, 2015).

The ‘cognitive restraint’ scale (factor 1 or TFEQ-R) measures the ability of a person to have a mental control in daily food intake usually with the purpose of checking body weight and encouraging weight loss. It has 21-items and two subscales, namely: the rigid and flexible subscales (Aurélie *et al.*, 2012).

The ‘disinhibition’ scale (factor 2 or TFEQ-D) measures the loss of power during food consumption. It has 16-items with three subscales, namely: habitual, emotional and situational susceptibility (Loffler *et al.*, 2015). For instance the habitual subscale deals with frequency in overconsumption of fried foods. Examples of constructs relating to the emotional subgroups are ‘I feel blue’, ‘I feel nervous’ etc and that for the situational is overeating during family gathering or parties (Aurélie *et al.*, 2012).

The third factor is the ‘hunger scale’ (TFEQ-H) and it has 14-items (Loffler *et al.*, 2015). This factor deals with extent of vulnerability to outside and inside hunger signals. For instance the feeling of hunger at the smell of food aroma or the feeling of hunger during hypoglycaemia (Aurélie *et al.*, 2012).

The TFEQ is validated in most languages with versions like the German, French and Spanish versions (Aurélie *et al.*, 2012). The Spanish version is the 18-items revised questionnaire of

the initial 51-items. The Spanish version of the TFEQ (TFEQ-18) was developed by Karlsson *et al.* (2000) with the rationale to shorten the lengthy 51-items while maintaining its validity. TFEQ-18 has six (6), three (3) and nine (9) subscales respectively for 'cognitive restraint', 'hunger' and 'disinhibition' factors. (Jáuregui-lobera *et al.*, 2014).

TFEQ is commonly used to characterise the eating behaviours of a population with sensitivity to calculate dietary control changes irrespective of the approach employed. The TFEQ has also been used to indicate that the quantification of dietary control is a good signal of the intent of diet in cross-sectional studies (Aurélien *et al.*, 2012).

2.1.3.2 The Food Frequency Questionnaire (FFQ)

Food Frequency Questionnaire (FFQ) is one of the dietary assessment tools that is used to quantify dietary intake (Foster *et al.*, 2014). FFQ is retroactive in nature and requires frequency of consumption of certain list of foods over a long period of time (usually the past six or twelve months) (Foster *et al.*, 2014).

The questionnaire can be used to obtain dietary consumption over a long period in a single administration. It also offers the merit of being less complicated to complete and has been proven to have a great validity for estimating dietary intake (Foster *et al.*, 2014).

The Epic-Norfolk (European Prospective Investigation into Cancer and Nutrition) FFQ was designed for the international EPIC centres. Namely; London, Denmark, France, Germany, Italy, Greece, Norway, Spain, Sweden, the Netherlands and United Kingdom. It is therefore country-specific. That is, the list of foods in the questionnaire can be designed to suit a particular country (IARC, 2022).

The FFQ has two parts. The first part of the questionnaire is the main part that carries a list of 130 frequently consumed and less frequently consumed foods. Attached to each list is

frequency of consumption ranging from ‘never (less than once per month) to 6+ times per day. The second part has additional questions on the types, brand and quantities of the food items. The questionnaire also presents an average portion size of each item (Foster *et al.*, 2014).

2.1.3.4 The International Physical Activity Questionnaire (IPAQ)

IPAQ is an internationally validated and reliable self-reported instrument for assessing health related physical activities of adolescents and adults (IPAQ, 2002). It is used for monitoring and research purposes.

It consists of four parts. Each part or domain asked questions on the number of days and time (minutes/hours) spent on an activity. The first domain relates to transport related activities. This includes moving from one place to another at work, school, movies and other places. The question also relates to walking and or travelling in a vehicle or bicycle. The second concerns activities done in the house like gardening, sweeping, scrubbing, washing, digging, raking etc. The third part is on sports and recreational activities. This includes activities such as aerobics, running, fast bicycling, fast swimming, playing tennis etc while the last (fourth) part assesses sitting time. This involves time spent sitting on weekdays/weekends while at home, school, doing course work, reading, watching television etc (IPAQ, 2002).

In classifying physical activity level, the IPAQ assigns METs to each domain (with the exception of the fourth domain). The METs for a particular domain is then multiplied by the number of minutes per week spent on that domain. Total physical activity (which comprises summation of MET-minutes/week for all domains) is compared to the IPAQ categories for low, moderate and high PA levels. Low PA level is regarded as physical inactivity (IPAQ, 2005).

2.2 HEALTHY DIET & WELLBEING

The conscious practice of a healthy diet is considered as a healthy dietary habit. It is therefore important to understand what an actual healthy diet entails in order to know when, what, where and how to practice such a diet (Intiful *et al.*, 2019). Organizations such as the Food and Agricultural (FAO) of the United Nations, World Health Organisation, UNICEF and International Fund for Agricultural Development (IFAD) have come up with principles and guidelines to identify a healthy diet (FAO, IFAD, UNICEF, 2020).

One principle of a healthy diet is based on the extent of processing. A healthy diet consists of minimally processed or unprocessed foods (FAO, IFAD, UNICEF, 2020). Processing involves the deliberate addition of ingredients, chemicals, additives, packaging, processing methods such as vacuum packaging, canning, salting, fermentation to the natural foods. For a minimally processed food, the aim of processing is to make the food pleasant for consumption and the processing can usually be done in the home; example smoking, roasting (Monteiro *et al.*, 2019).

Healthy diet includes legumes, different kinds of fresh fruits and vegetables, whole grains, nuts and seeds. Protein sources of food such as dairy, fish, poultry, and eggs are in moderation with small amount of meat. These foods contain nutrients like fibre, vitamins (like folate, B-vitamins, Vitamin C, Vitamin D, and Vitamin A), minerals (such as calcium) and proteins which are essential for healthy growth and development. Fats are preferably unsaturated fat than saturated fat. Unsaturated fat can be found in foods such as olive oil, nuts, avocado pear, and fish like salmon while saturated fat can be obtained from coconut oil, palm oil, animal fats. The latter should be avoided. Highly or ultra-processed foods (indomie, pizza etc) are excluded from a healthy diet (WHO, 2019).

The kind of fluid consumed is another principle for identifying a healthy diet and the recommended fluid for a healthy diet is clean and safe water (FAO, IFAD, UNICEF, 2020).

Portion size is also critical in identifying a healthy diet. A healthy diet is enough to meet energy requirement and does not exceed that. Thus, energy intake does not exceed energy output (WHO, 2019). It is recommended that, portion size of fat should be less than 30 percent of the total energy intake to prevent overweight and obesity. Free sugars should be between 5-10 percent of total energy intake for health benefits. Iodated salt should be 5 grams or less per day to avoid hypertension and decrease the risk of heart related diseases. Fruits and vegetables should be 4-5 servings per day. Intake of red meat and poultry should be limited to '1-2 times per week' and '2-3 times per week' respectively (WHO, 2019).

Food safety is of concern in a healthy diet. A healthy diet should contain reduced (if not none) quantities of microorganisms which are responsible for causing food –borne diseases (FAO, IFAD, UNICEF, 2020).

A healthy diet is unique for every age group and population (WHO, 2019). For instance, for infants and young children (up to two years), a healthy diet recommends exclusive breastfeeding up to six months of age. Complementary foods which are safe, affordable, adequate, feasible and sustainable should be added to breast milk from 6 months while breastfeeding continues up to two years. For adolescents and adults, a healthy diet recommends daily consumption of breakfast and intake of foods such as dairy, fruits, and vegetables within a week. Reduced intake of added sugars, salt, fat are also encouraged (WHO, 2019).

Principles of a healthy diet aim to prevent malnutrition which comprises both undernutrition and overnutrition (over weight and obesity). In addition, non-communicable diseases (NCDs) such as hypertension, stroke, cancer, diabetes are avoided with the practice of a healthy diet.

In children, healthy diet encourages healthy growth and brain development. It also decreases the rate of overweight, obesity and NCDs later in life (WHO, 2019).

2.3. UNHEALTHY DIETARY HABITS AND HEALTH IMPLICATIONS

Unhealthy diet lacks the right kind of nutrients for optimal health. According to the World Heart Federation (WHF), poor or unhealthy diets are high in calories, salt, saturated and trans-fat, added sugars and low in fruits and vegetables (WHF, 2016). Such foods include ultra-processed foods like soft drinks, fast foods, pizza, indomie etc. Diseases such as diabetes, malnutrition (overweight and obesity), hypercholesterolemia, and hypertension have been associated with unhealthy diet (WHO, 2019).

High consumption of salt, saturated fat and trans-fat, as well as low consumption of vegetables and fruits have been attributed to hypertension and cardiovascular diseases (WHF, 2016). Unhealthy diets high in added sugars (such as soft drinks) are associated with insulin-resistance and diabetes, cancer, dental caries and cardiovascular diseases (WHO, 2016: WHO, 2019).

It has been reported elsewhere that, unhealthy dietary practices (skipping breakfast and main meals) contributes to psychological disorders such as depression and stress (Tajik et al., 2016). As adolescents skip main meals, they tend to lack nutrients such as vitamins, minerals, carbohydrates leading to decline in memory function. In addition eating out, has been linked with poor nutritional intake (Tajik et al., 2016).

Aside the effect of skipping meals and breakfast on health, snacking also poses health risk to adolescents. Snacking is an eating habit whereby extra foods are eaten aside the normal,

specified (traditional) meals of the day i.e breakfast, lunch, supper. Foods consumed as snacks are mostly small in amount, less costly, poor in nutrient quality, eaten alone within a short time (Hess, Jonnalagadda, & Slavin, 2016). In a study conducted among adolescent girls from an urban area in South India, the prevalence of snacking was found to be greater than 50% (Omidvar & Bengum, 2014).

Several factors influence snacking such as hunger, location of food, food environment and cognitive reasons (Hess, Jonnalagadda, & Slavin, 2016). For instance snacking in the absence of hunger or internal biological signals leads to excessive energy intake which can result in increase in weight. In addition, it can also lead to excessive intake of ultra-processed foods which are high in fat, salt, sugar and poor in micronutrients (Hess, Jonnalagadda, & Slavin, 2016). Where the food is consumed (location) also influences food choice, nutrient profile and quantity of food consumed. Foods taken as snacks outside the home (restaurants) are noted to be high in sugar, salt, fat and lower in micronutrients as well as fibre compared to foods taken at home or workplace (Hess, Jonnalagadda, & Slavin, 2016). As such frequent snacking outside the home contributes to weight gain. Food environment also refers to the social, cultural, economic and environmental context of snacking. Social environment for instance include eating meals with group of people or family or eating at an occasion (parties, funerals, festivals, weddings). Snacks consumed at special events are noted to be poor in nutrient quality and high in sugar and fat (Hess, Jonnalagadda, & Slavin, 2016). Certain people also snack because of the cultural context or the country of origin (Hess, Jonnalagadda, & Slavin, 2016).

Irrespective of the factor encouraging snacking, snacking imparts heart health and weight gain (Hess, Jonnalagadda, & Slavin, 2016). In addition, snacking also causes dental caries in children. The pain and inflammation associated with dental caries can affect food and nutrient intake thus impairing the nutritional status of children (Johansson, *et al.*, 2010).

Eating disorders such as anorexia nervosa, bulimia nervosa and binge eating are also unhealthy dietary behaviours with negative implications on health. According to the British Dietetics Association (BDA), eating disorders refers to mental conditions characterised by severe or persistent disturbances in eating behaviours that leads to physical, physiological, psychosocial impairment of health and sometimes death (Gandy, 2014).

Anorexia Nervosa (AN) is characterised by severe food rejection, low body weight and decreased basal metabolic rate. AN is also characterised by intense fear of gaining weight (though the individual's weight is less than normal) and strict dieting. It is commonly associated with females than males with a general population prevalence of less than 2% in the former (Mahan & Raymond, 2017). Though AN commonly occurs in adolescents, late onset, after age 40 has been identified (Mahan & Raymond, 2017). Athletes, actors, models and dancers are also considered to be at increased risk of anorexia as a result of their professional requirements (Mahan & Raymond, 2017). At onset, adolescent with AN will simply be malnourished (underweight). However, as the condition progresses he/she appears wasted. At this stage, some of the noticeable findings include edema, dry skin, dry hair, lanugo, alopecia (hair loss) etc. Patients with restricting type of anorexia nervosa show symptoms like depression reduced cognitive ability, social isolation (Yager *et al.*, 2010). Some complications of AN that affect the cardiovascular system are low blood pressure, slow heart rate, irregular heart beat and pericardial effusion. Some complications of the gastrointestinal system include constipation, reduce bowel movement, delayed gastric emptying and salivary gland enlargement. Low bone mineral density (BMD) is also associated with anorexia nervosa (Mahan & Raymond, 2017). There may also be hypoglycaemia, low potassium levels, low phosphorus levels, high cholesterol, increased Blood Urea Nitrogen (BUN) and creatinine (Mahan & Raymond, 2017).

The other eating disorder is bulimia nervosa (BN). BN is a disorder characterised by frequent episodes of binge eating followed by inappropriate compensatory behaviours in an attempt to prevent weight gain. These inappropriate compensatory behaviours include misuse of; diuretics, laxatives, enemas, some medications, self-induced vomiting, excessive exercise (Mahan & Raymond, 2017). Averagely, the binge eating and purging occur together at least once a week for a period of three months (Mahan & Raymond, 2017). BN is characterised by symptoms such as impulsive behaviours, depression, anxiousness etc. For instance, majority of patients with bulimia have been shown to have depression (Gandy, 2014). Other nutrition findings are dental caries, dehydration, esophageal tearing, enamel loss, salivary gland enlargement and esophagitis. It has also been found that families with BN have increased incidence of alcohol abuse (Gandy, 2014). It is important to note that, most patients exhibit a combination of AN and BN. For instance, more than half of people diagnosed of anorexia have bulimia symptoms as well. Guilt and shame are also noted with BN patients (Yager *et al.*, 2010).

In Bulimia Nervosa, the frequency and manner of purging is related to the complications. For example, the complication of self-induced vomiting manifest on the skin as alopecia (hair loss), xerosis (dry skin), hypertrichosis lanuginosa (unpigmented, soft hair that covers the entire body but not the mucous membrane, sole and palms), fragile nail, cheilosis (inflammation or cracks at the corner(s) of the mouth) (Mehler & Rylander, 2015). However, these effects are evident when patients are underweight with BMI below 16. Bulimia patients induce vomiting mechanically by thrusting their fingers into their mouth. This results in skin abrasions & callous formation on the back of the hand (called 'Russell's sign') (Mehler & Rylander, 2015). Subconjunctival haemorrhage is also associated with bulimia. It manifests as red spots in the white of the eye (Mehler & Rylander, 2015).

The third eating disorder which is of public health concern is binge eating disorder (BED). Individuals who engage in this disorder usually (twice a week for six months) consume excessive amount of food than a normal person will do at a sitting under the same conditions. It is not followed with inappropriate compensatory methods like in anorexia and bulimia nervosa. However, patients feel ashamed after engaging in the act (Hilbert *et al.*, 2012). In addition, it is associated with eating out of control like excessive eating when one is not hungry, eating in isolation to avoid embarrassment, eating very fast and consuming large quantities of food until uncomfortably full, followed by a feeling of guilt (Westerberg & Waitz, 2013).

Though the prevalence of BED is less than 5% in both men and women, the disorder has an effect on physical and mental health. The prevalence is also higher in women than men (Westerberg & Waitz, 2013). Psychologically, patients with this disorder show symptoms of depression and low-self-esteem. Without addressing the mental aspect of the condition, treatment of the condition (eating disorder) becomes difficult (Watson, 2020). BED patients may have normal body mass index (BMI), but majority are overweight and obese. This makes such patients prone to higher risk of heart diseases, diabetes, cancer, sleep apnea, arthritis and the like which are linked to obesity. Weight gain can also worsen low-self-esteem (Watson, 2020). Some complications associated with binge eating disorder include mood swings, clinical depression (characterised by loss of interest in activities), drug abuse and addiction, anxiety. Irritable bowel syndrome (IBS), fibrositis, body dysmorphia, urge to steal irrelevant things are also noted (Westerberg & Waitz, 2013).

2.4. PHYSICAL INACTIVITY (PI)

2.4.1 Physical inactivity and sedentary behaviours

Historically, physical inactivity (PI) was referred to as sedentary behaviours (Tremblay *et al.*, 2010). There is now emerging evidence suggesting that sedentary activity is different from physical inactivity (Tremblay *et al.*, 2010). However, both occur on the same energy expenditure spectrum or movement continuum. Using the movement continuum, physical inactivity and sedentary behaviours occur at the lower end while physical activity (PA) occurs at the other end. The movement continuum is a linear scale that describes the nature of different activities measured in Metabolic Equivalent of Tasks (METs). As one moves along the continuum from right to left, METs decreases (Tremblay *et al.*, 2010). Thus physical activities have higher METs (energy expenditure), whereas physical inactivity or sedentary behaviours have lower METs (energy expenditure) on the movement continuum.

PA ranges from moderate to vigorous activities (MVPA) to light activities. MVPA can be defined as engaging in activities with METs between 3-6 (Ploeg & Hillsdon, 2017). Light activities involve activities that utilize energy expenditure between 1.5-3 METs. Examples are standing and ambulatory (Ploeg & Hillsdon, 2017). It is recommended for adolescents to spend not less than 60 minutes (1 hour) of MVPA per day for at least 5 days in a week. However one-third of adolescents are not able to meet this expectation (Ottevaere *et al.*, 2011). According to (Peltzer & Pengpid, 2013), such adolescents are described as being physically inactive.

Sedentary behaviour (SB) is any waking behaviour characterised by energy expenditure $\leq$ 1.5 metabolic equivalents in a sitting, reclining, lying or supine position (Tremblay *et al.*, 2010; Thivel *et al.*, 2018). It includes sitting and engaging in activities such as watching television, learning, watching videos, playing computer games etc. Thus, physical inactivity is related to SB (Ploeg & Hillsdon, 2017). Sedentary behaviours talk about the habits and activities that adolescents engage in whilst being inactive.

Physical activity promotes health, quality of sleep and reduces risk of major chronic diseases. Physical inactivity and SB on the other hand, increases risk for chronic diseases such as obesity, Type 2 diabetes, cardiovascular diseases and metabolic syndrome (Pearson & Biddle, 2011).

2.4.2. Physical inactivity in adolescents

Miquetichuc *et al* defined adolescence as a ‘transition stage between childhood and adulthood (Miquetichuc *et al.*, 2016). Adolescents are individuals between 10-19 years within this transition (WHO, 2020). Adolescence stage is a crucial period for lifestyle changes (Wadolowska *et al.*, 2018). As such physical inactivity behaviour can be modified at this stage through the acquisition of physical activity habit (Miquetichue *et al.*, 2016).

Prevalence of physical inactivity among adolescents is mostly high. Miquetichue and colleagues confirmed this statement (Miquetichue *et al.*, 2016). They reported 66.8% of sedentary lifestyle among the Brazilian adolescent they studied using cross-sectional study and International Physical Activity Questionnaire (IPAQ) (Miquetichue *et al.*, 2016). Additionally, Saunders, Chaput & Tremblay (2014), reported that youth and children in developed countries utilized 40%- 60% of their waking hours in sedentary activities. Evidence regarding the high prevalence of inactive behaviours had been traced to the past fifty (50) years (Tremblay *et al.*, 2010).

Gender is associated with physical inactivity in adolescents. The HELENA (Healthy Lifestyle in Europe by Nutrition in Adolescence) study reported that, girls spent most time inactive and males engaged in increased MVPA (Moderate to Vigorous Physical Activity). The study employed self-reported questionnaire for assessment of SB (Ottevaere *et al.*, 2011). However, a study among Canadian adolescents using accelerometer tools for measurement reported that

adolescents boys spent more time being inactive and the girls utilised less time. (Saunders, Chaput & Tremblay, 2014). Literature is not consistent as to whether girls spent most time being inactive than boys or vice versa.

Physical inactivity increases with age (Saunders, Chaput & Tremblay, 2014). By the use of objective method, Ortega and colleagues supported this statement arguing that physical inactivity increases from childhood to adolescence. They reported that sedentary time increased from childhood to adolescence by fifteen minutes (or more) per day per year for girls and twenty minutes (or more) per day per year for boys. There was also a decrease in MVPA by 30mins/day from childhood to adolescence (Ortega *et al.*, 2013). These findings may be attributed to the high demand of studies as one climbs high on the academic ladder making adolescents spend more time reading and studying.

Screen time is the most common inactive behaviour among adolescents (Wadolowska *et al.*, 2019). Screen time refers to the time adolescents spend using television (TV), computers, tablets, phones and playing video games. It was reported that Canadian children spent 6 hours and 7.5 hours on weekdays and weekends respectively on screen time, playing video games, using computer and watching TV (Tremblay *et al.*, 2010). TV watching is the most researched and common inactivity among adolescents (Tremblay *et al.*, 2010). Pearson *et al* explained TV watching as the main measure of sedentarism (Pearson & Biddle, 2011). It was reviewed that Scottish adolescents spent about 'one -third to one-half' of their time watching TV (Pearson & Biddle, 2011). Similar finding was also found among British youth (Tremblay *et al.*, 2010). Watching TV increases consumption of caloric dense foods by 45%, influencing unhealthy dietary habits (Saunders, Chaput & Tremblay, 2014).

2.4.3. Prevalence of physical inactivity among adolescents in Ghana and other countries

Prevalence of physical inactivity is well researched in Ghana (Africa), Asia, Europe and globally. In a study that determined the level of physical activity among adolescents in the second cycle institution in Accra, Ghana, reported 17%, 49%, 34% of the participants engaged in low, moderate and high level of PA respectively (Nyawornota *et al.*, 2013). Nelson *et al.* (2015) observed that slightly above half (54.3%) of patients reporting for health care in a named hospital in Ghana were physically inactive. Concluding that, physical inactivity is one of the risk factors for NCD's (Nelson *et al.*, 2015). Another research in Ghana from the 2012 Global School-based Student Health Survey Data (GSHS) reported one quarter (25%), of senior High School (SHS) students met the WHO's recommendation for PA, leaving three-quarters (75%) of them to be physically inactive (Seidu *et al.*, 2020).

A study among Chinese adolescents in 18 schools, in 10 cities in China reported that, the prevalence of physical inactivity was 80% (Chen *et al.*, 2014). They also observed the prevalence of sedentary behaviours ie watching television and using computer were 43% and 30.2% respectively (Chen *et al.*, 2014). Elsewhere, the prevalence of physical inactivity was estimated to be 80.4% among school children in Southeast Asian Nations (ASEAN) (Peltzer & Pengpid, 2016).

A research conducted among European adolescents in 10 countries reported that, slightly above one quarter (28.5%) of the participants were physically active according to the WHO guidelines. Majority (71.4%) of the participants were physically inactive (McMahon *et al.*, 2017). Globally, Aubert *et al.* (2021) narrated in a review paper that level of PA was low among adolescents across the world (Aubert *et al.*, 2021). They also observed low PA among girls and reduction of PA levels as age increases (Aubert *et al.*, 2021).

2.4.4. Physical inactivity during COVID-19

Coronavirus disease 2019 (COVID-19) is a new global pandemic caused by Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV2) that emerged from Hubei Province, Wuhan City in China (Ruiz-Roso *et al.*, 2020). This microorganism affects the respiratory tract and it's transmitted from person to person by droplets through talking, sneezing, coughing, breathing and contact with infected material, (Oni *et al.*, 2020). To control the rapid spread of the disease, World Health Organisation (WHO), recommended public health measures. This included lockdown, isolation, contact tracing, social distancing and quarantine' (WHO, 2020: Ismail *et al.*, 2020). The purposes of these control measures were to eliminate or stop the spread of the virus, however, they also posed some health risks due to restrictions in movement.

COVID-19 caused an increase in physical inactivity and SB among adolescents due to restriction in movement (Pearl, 2020). Adolescents were exposed to screens such as tablets, TV, smartphones, computers either for studies or entertainment (Reyes-Olavarria *et al.*, 2020). Social media (facebook, whatsapp, twitter, Instagram) offered a sense of belonging to adolescents as they observed social distancing (Pearl, 2020). Physical inactivity thus increased and physical activity decreased. In a study by Ismail *et al* during the COVID-19, they reported that majority of the participants spent about quarter of a day on screen time and majority were not physical activity (Ismail *et al.*, 2020). Another supporting study concluded that physical inactivity was high among adolescents during the COVID-19 and worsened during the lockdown (Ruiz-Roso *et al.*, 2020).

2.5. RELATIONSHIP BETWEEN PHYSICAL INACTIVITY AND DIETARY HABITS

Physical inactive behaviours comprises of screen usage time, reading time, time spent sleeping (Musaiger, Nabag & Al-Mannai, 2016; Thivel, *et al.*, 2018).

Screen time usage (time spent using TV, computers, tablets) is the main measure of physical inactivity that influences unhealthy food choices and dietary habits such as skipping of breakfast, eating more sweets, increase intake of soft drinks and decrease intake of fruits and vegetables (Wadolowska *et al.*, 2019).

Association between inactive behaviours and unhealthy dietary habits had been identified with screen time (specifically TV watching) as the main cause (Ottevaera *et al.*, 2011; Study & Swi, 2018; Pearson & Biddle, 2011). Hobbs *et al.* (2015), explained the mechanism of the relationship between TV watching and unhealthy dietary habits. According to them, as adolescents are watching TV, they come across various food advertisements that influence their dietary intake. Sometimes, adolescents get distracted as they are watching TV and eating at the same time resulting in overconsumption.

2.5.1. Screen time usage and dietary habits

Time spent using the internet, phone and television watching time have been identified as the main screen time usage that account for the high prevalence of physical inactivity among both adolescents and college students (Musaiger *et al.*, 2015).

It has been reported that time spent using the internet, watching television and playing game on phones, are related to decreased consumption of vegetables and fruits, high consumption of ultra-processed foods and high caloric foods and drinks (Musaiger *et al.*, 2015). Elsewhere the association between screen time usage (TV watching, computer usage, video game usage) and dietary habits were found among school children (Soltero *et al.*, 2021 & A Ra Jo1,

2010). It was reported in a study that, poor dietary habits were positively correlated with TV watching, computer usage and playing video game (Soltero et al., 2021). However other co-variable such as income was also identified as an influence on screen time usage and not solely dietary habits (Soltero et al., 2021). A study (A Ra Jo1, 2010) conducted in Korea, among elementary school children found a contradictory report. They reported that children that spent less time using the internet and watching television had a good eating pattern than children that spent more time. Concluding that, good dietary habits are negatively associated with screen time usage (A Ra Jo1, 2010).

2.5.2. Reading time, academic performance and dietary habits

Though time spent sitting to read is regarded as a sedentary activity, reading time influences academic performance (Owusu-Acheaw & Larson., 2014). Academic performance is a measure of the knowledge acquired through formal education. Thus, higher academic performance and reading habits are dependent on each other (Owusu-Acheaw & Larson., 2014) .

Good dietary habits influence academic performance. Healthy dietary practices such as not skipping breakfast and meals have benefits of academic performance on adolescents (Buxton, 2014). In addition, World Health Organization agrees that, healthy diet promotes brain development (WHO, 2019). In a study, it was reported that good dietary habits was positively associated with good academic performance (Kim *et al.*, 2016). Frequent intake of milk, fruits, vegetables were reported to be positively correlated with academic performance whereas frequent intake of foods high in fat, sugar and salt negatively influenced academic

performance (Kristjánsson, Sigfúsdóttir, & Allegrante, 2010). The number of time spent reading is one of the factors used to determine academic performance (Cesar, *et al.*, 2011). Consequently, dietary habits (unhealthy or healthy) are also determinants of academic performance (Kim *et al.*, 2016).



CHAPTER THREE

3.0 MATERIALS AND METHODS

3.1 STUDY DESIGN

A cross-sectional study design was employed for this research. Participants were contacted once and data collected from them.

3.2 STUDY SITE

The study was conducted in one Public Secondary School (Wesley Grammar School) located in the Ablekuma West constituency and one Private Secondary School (Ideal College) located in the Ablekuma North constituency. A private and public schools were chosen because the quality of services provided in private schools are usually considered to be of high quality because fees are higher compared to services in public schools. In addition, Ablekuma West and North constituencies were chosen because the socio-economic activities of the people within the municipalities ranged from low, middle to high (Budget, 2019).

Wesley Grammar School is a Methodist school founded in 1956 at Dansoman. The school is located on about 20 acres of land sharing campuses with the headquarters of the Methodist church and the Methodist University Campuses. As a missionary school, the school aims to provide academic excellence coupled with Christian moral values. The school offers courses in general science, business, general arts, visual arts, home economics and agricultural science. It is a mixed school and has both day and boarding facilities. Currently, the student population is about 2009.

Ideal college (Mamprobi branch) is a private institution located at Mamprobi. The school was founded in 2019 with a current student population of about 500. The mission of the school is to encourage students to pursue their dreams and secure their future through quality education. The school offers courses in general arts, home economics, business and general science. It is a mixed school but runs only day facility.

3.3 STUDY POPULATION

Apparently healthy adolescents within the age group of 15-19 years attending Wesley Grammar School and Ideal College were recruited into this study.

3.3.1 Inclusion criteria

The inclusion criteria were:

1. Willingness to provide participation assent and parental consent for those less than 18 years.
2. Apparently healthy adolescents within 15-19 years.

3.3.2 Exclusion criteria

The exclusion criteria were:

1. Parental consent refusal
2. Unwillingness of adolescent to provide participation assent.
3. Students who were unwell.

3.4 SAMPLE SIZE DETERMINATION

Sample size was calculated using the formula:

$$\text{Sample size (n)} = \frac{P(1-P)Z^2}{E^2} \text{ (Taherdoost, 2020)}$$

Where:

Z equals value corresponding to level of confidence interval. For 95% confidence interval, Z is 1.96

P = expected proportion in population from previous studies. A probability of 50% (0.5) was estimated (Oddam, 2015).

E= absolute error of precision= 0.05 (Jaykaran & Tamoghna, 2013)

n= sample size

$$\text{Therefore } n = \frac{0.5 (1-0.5) (1.96)^2}{(0.05)^2}$$

$$n = \frac{0.5 * 0.5 * 3.8416}{0.0025}$$

$$n = \frac{0.9604}{0.0025}$$

$$n = 384.16$$

On this basis, a sample size of 384 was estimated. However, considering the possibility of obtaining incomplete data and drop out, the sample size was rounded to **400**.

For example, considering 5% drop out rate;

$$5/100 * 384 = 19.2 + 384 = 403. \text{ Approximated to } 400.$$

NB: 5% (0.05) error of precision was used in calculation because it is recommended for cross-sectional studies (Taherdoost, 2020).

In addition, sample for each school was calculated as follows:

$$\text{Sample from each school} = \frac{\text{Estimated total population of the school} * \text{calculated sample size}}{\text{Total population for the two schools}}$$

$$\text{Thus, Wesley Grammar School} = \frac{2009 * 400}{2509} = 320 \text{ students were recruited}$$

$$\text{And, Ideal College} = \frac{500 * 400}{2509} = 80 \text{ students were recruited}$$

3.5 SAMPLING TECHNIQUE

The first stage of sampling involved selection of the classes in each school. For instance in Wesley Grammar school, form 1 alone has 25 classes. Each class comprises an average of 40 students. Balloting was used to select 15 classes from both schools.

Systematic sampling was used to select students from each form to participate in the study.

The kth number for the selection of students in Wesley Grammar was;

$$\frac{2009}{384} = 5.2$$

The kth number for the selection of students in Ideal College was;

$$\frac{500}{384} = 1.3$$

-

Therefore, every 5th student in each class according to their sitting arrangements in Wesley Grammar School was invited to participate in the study.

At ideal college, every 1st person on each row, according to their sitting arrangement was invited to participate in the study.

NB: At the time of data collection, in Wesley Grammar school, forms one student were on vacation and form 2 students were writing the end of term examination. The only available and permitted form was form 3. This accounts for why majority of participants in the study were in form 3.

3.6 ETHICAL APPROVAL AND CONSIDERATIONS

Ethical approval was obtained from the College of Health Sciences Ethical and Protocol Review Committee on 26th May, 2021 (Appendix C). Permission was obtained from Wesley Grammar School and Ideal College authorities.

Consent was sought from interested and qualified adolescents in Wesley Grammar School and Ideal College. Adolescents who assented to the study were recruited. Parental consent was sought for those less than 18 years of age.

Consent letters addressed the procedures, benefits, risks of the study and confidentiality of respondent's information. There was no direct benefit in the form of cash or items given to participants. No risk was involved for participating in study. Contact number of principal researcher was provided in the letters for further questions.

No adolescent was forced to take part in this study. They were informed that participation in the study is voluntary and their decisions will be respected if they choose not to participate. They will not be penalised if they refused to join the study (Appendix A).

3.7 PRETESTING OF QUESTIONNAIRE

Prior to data collection using questionnaires, the questionnaires were tested on adolescents from Pan Africa Global Senior High School at Kokrobite within the first week of June, 2021. This was done to ensure that statements are well constructed, understood and answered in the questionnaires. After pretesting of Questionnaire, some sentences were re-constructed for clear understanding. For instance, 'GENDER:' was changed to 'what is your gender? Data from pre-test participants was not used in the final data analysis.

3.8 PROCEDURE FOR DATA COLLECTION

Data collection was carried out from 28th June to 23rd August 2021 (after the lockdown period). Data was collected using semi-structured questionnaires. Questionnaires were self-administered by participants to ensure minimal contacts between researcher and participants in adherence to the COVID-19 protocols.

3.8.1 Socio-demographic data

Semi-structured questionnaire was used to obtain adolescents' demographic details such as age, gender, class. Also information regarding parents or guardian's age, education, occupation was obtained. The International Standard Classification of Occupation was used to assess the questions on occupation (ISCO, 2012) (Appendix B).

3.8.2 Determination of dietary habits

The Three-Factor Eating Questionnaire (TFEQ) (Appendix B) was used to assess the dietary habits of the participants. The revised 18-item TFEQ with questions on cognitive restraint, emotional and uncontrolled eating was used (Karlson *et al.*, 2000). The first 4 questions on the questionnaire relate to cognitive restraint, the next 9 relates to uncontrolled eating and the last five relates to emotional eating (Karlson *et al.*, 2000). In addition, a structured questionnaire was used to assess certain dietary habits of the participants. Examples are consumption of breakfast, snacking, skipping meals, consuming fruits and vegetables, limiting food intake, eating varieties of food, eating fibre foods, immoderate sugar intake, immoderate fat intake, immoderate salt intake, binge eating etc.

Participants were asked to show how they felt and behaved with specific statements during the COVID-19 period on a scale of four ie ‘definitely true, mostly true, definitely false, mostly false’. All true responses were coded as ‘yes (1)’ and the false response were coded as ‘No (2)’ (Oddam, 2015). The same coding was used for the 3-domains of the TFEQ.

For instance, in calculating the binge score, the question on binge eating was identified. The response on the questionnaire was then entered into SPSS using the code assigned. This was done for all the dietary habits assessed. SPSS was then used to analyse the dietary habits responses into frequencies and percentages.

Food frequency questionnaire by the Epic-Norfolk nutritional methods was used to determine the frequency of consuming common food groups in Ghana (Welch *et al.*, 2005). The first part of the questionnaire was designed to suit common food groups consumed in Ghana. Frequency of food groups that were assessed in this study includes unpolished cereals, legumes (soya, cowpea, bambara beans), fruits, vegetables, fast foods (indomie, fried rice & chicken, pizza, burger etc), carbonated drinks (soft drinks), sweets/sugar/honey and fish. The

food frequency included never, 1-3 times per month, once per week, 2-4 times per week, 5-6 times per week, once per day, 2-3 times per day, 6 times per day. Participants were required to select the appropriate response by ticking.

The FFQ was coded on a scale of 7, with 'never' coded as 0 and '6 times per day' as 7. Frequencies and percentages of the various food groups were analysed using the SPSS.

The FFQ was also used to classified dietary habits into good (healthy) and poor (unhealthy) consumption. For unpolished cereals, legumes, fruits, vegetables, fish, milk and milk products food groups, good consumption refer to once/day and above. As such frequency of intakes less than once per day are poor (Allafi *et al*, 2013). For fast foods, soft drinks, sweets and pastries food groups, good consumption refers to consumption 3 times per week or less. Therefore frequencies of intakes ≥ 4 -6 times per week to 6 times per day are poor (Allafi *et al*, 2013; Musaiger, *et al.*, 2015; El Achhab *et al.*, 2018).

'Good consumptions' were coded as '1' and poor consumptions as '2'.

3.8.3 Determination of physical inactivity

The International Physical Activity Questionnaire (IPAQ) was modified to suit this study (Appendix B).

Questions on time spent engaging in transportation related, domestic and sport related physical activities were assessed. Number of days per week spent on each of the activities was also asked. Time spent on each activity was also assessed.

Physical activity levels of participants were calculated using the IPAQ procedure (IPAQ, 2005). The METs assigned for transportation, domestic and sport related activities were 3.3, 4.0 and 8.0 respectively (IPAQ, 2005). The activity level of each domain was calculated using the formula:

MET-minutes/week of an activity = MET score of an activity* the no of minutes*no of days (IPAQ, 2005). This formula was used to calculate the activity level of transportation, domestic and sport related activities. The total physical activity MET-min/week was then calculated by the summation of the METs for each domain.

Total MET-minutes/week = Transport (METs*min*days) + Domestic (METs*min*days) + Sport (METs*min*days) (IPAQ, 2005).

Results obtained from the total MET-minutes/week was then categorised as ‘high, moderate or low’.

‘**High**’ refers to total MET-minutes/week of at least 3000 min/week.

‘**Moderate**’ refers to total MET-minutes/week of at least 600 min/week.

‘**Low**’ refers to those not meeting criteria for moderate and high, also regarded as physical inactivity according to this study (IPAQ, 2005).

The IPAQ was also used to assess the time spent sitting while engaging in activities like watching television, playing games, reading, watching video games. Number of hours and or minutes spent by adolescents watching television, playing computer games, reading and watching videos were indicated in the questionnaire. Results on time spent sitting to watch television, play or watch video games on computer/phone and read were analysed for sedentary habits. Participants that spent 2 hours and more per day sitting were regarded as sedentary (Ottevaere *et al.*, 2011).

3.9 COVID -19 PROTOCOLS DURING DATA COLLECTION

All COVID-19 protocols were followed during data collection. Hand washing and sanitizing were observed by researcher before and after handling consent letters and questionnaires to

participants. Nose mark was also worn by researcher. Social distancing was observed between researcher and participants when distributing and collecting consent letters and questionnaires (MOF, 2020).

Participants were encouraged to wear nose marks properly, wash, dry and sanitize their hands before collecting and handing over consent letters and questionnaires.

3.10 DATA STORAGE

Questionnaires were handled by the researcher after completion of data collection and kept in personal lockers at researcher's room. Data entered into excel and SPSS on researcher's computer was kept under password. This was done to ensure confidentiality.

3.11 DATA ANALYSIS

Out of the 400 questionnaires that were administered, 390 questionnaires were completed and returned.

IBM Statistical Package for Social Sciences (SPSS) version 20 was used to analyse the data.

Variables were grouped into continuous and categorical data. Continuous variables such as age were analysed using descriptive statistics and summarised into mean and standard deviation. Categorical variables such as dietary habits, physical inactivity, gender, parent's education and occupation were summarized into frequency and percentages.

Pearson's Chi-square test was employed to determine associations between dietary habits variables and physical inactivity variables. Statistical significance was set at $P < 0.05$.

CHAPTER FOUR

4.0 RESULTS

4.1 SOCIO-DEMOGRAPHIC DATA OF THE ADOLESCENTS

Table 1: shows the demographic characteristics of the adolescents (15-19years) that participated in this study. A total of 390 adolescents participated in this study. Majority, 345 (88.7%) of them are in form three. Their ages ranges from 15-19 years with the mean age of 17.88 ± 0.88 . The 390 participants consisted of 151 (38.7%) males and 239 (61.3%) females. Majority, 196 (50.3%) of the adolescent were staying with both parents during COVID-19.

With reference to the education level of the parents or guardians, 364 of the fathers (95.8%) have some level of education than mothers, 359 (93%). About 7% and 4.2% of mothers and fathers have no formal education, respectively.

Slightly more than half (55.9%) of the participant's mothers are in the clerical, sales and services occupation. Almost half (45.8%) of the participant's fathers are in the professional and technical occupation.

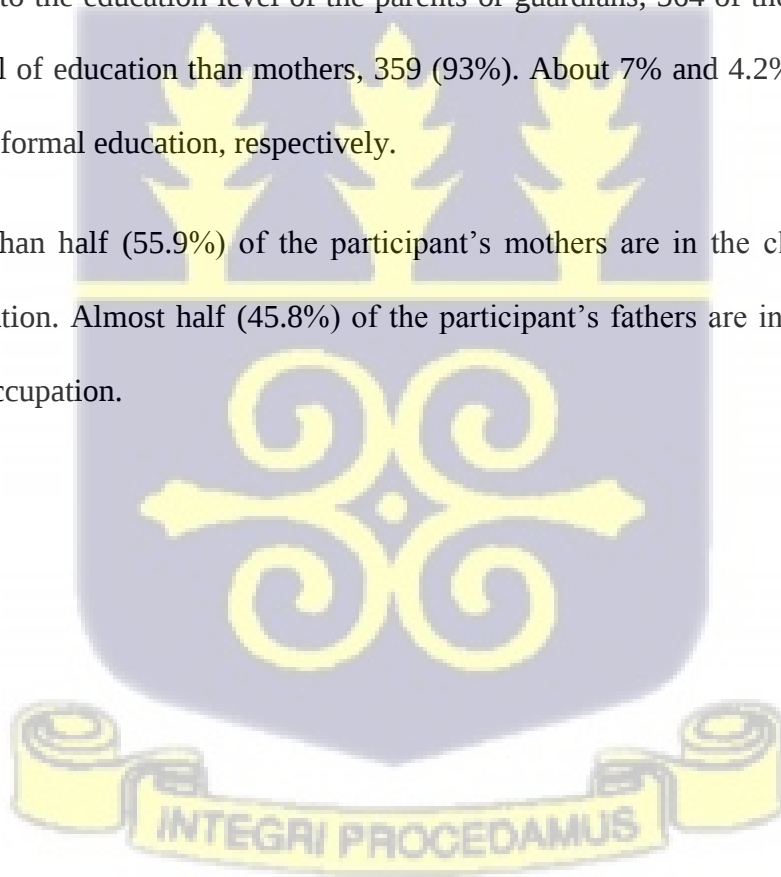


Table1: Socio-demographic characteristics of the participants

Variable	Male	Female	Total
	n (%)	n (%)	N (%)
Age (years)			
Range	15-19	15-19	390 (100)
Mean + SD	17.88 ± 0.88	17.88 ± 0.88	
Gender	151 (38.7)	239 (61.3)	390 (100)
Class/Form (n=389)	150 (38.6)	239 (61.4)	389 (100)
Form 1	12 (8)	5 (2.1)	17 (4.3)
Form 2	11 (7.3)	16 (6.7)	27 (6.9)
Form 3	127 (84.7)	218 (91.2)	345 (89.7)
Residence (n=389)	151 (38.8)	238 (61.2)	389 (100)
Dansoman	40 (26.5)	55 (23.1)	95 (24.4)
Other place outside Dansoman	111 (73.5)	183 (76.9)	294 (75.6)
Person staying with during COVID-19 (n=389)	150 (38.6)	239 (61.4)	389 (100)
Both mother & father	71 (47.3)	125 (52.3)	196 (50.4)
Only mother	24 (16)	61 (25.5)	85 (21.9)
Only father	16 (10.7)	12 (5.0)	28 (7.1)
Others	39 (26)	41 (17.2)	80 (20.6)
Mother's education (n=386)	151 (39.1)	235 (60.9)	386 (100)
Primary	12 (7.9)	24 (10.2)	36 (9.3)
Junior high	33 (21.9)	57 (24.3)	90 (23.3)
Senior high	52 (34.4)	63 (26.8)	115 (29.8)
Tertiary	45 (29.8)	73 (31.1)	118 (30.6)
No formal education	9 (6.0)	17 (7.2)	27 (7.0)

Table1:Sociodemographiccharacteristicsof the participant

Variable	Male	Female	Total
	n (%)	n (%)	N (%)
Father's education (n=380)	149 (39.2)	231 (60.8)	380 (100)
Primary	3 (2.0)	10 (4.3)	13 (3.4)
Junior high	22 (14.8)	36 (15.6)	58 (15.3)
Senior high	57 (38.3)	60 (26)	117 (30.8)
Tertiary	62 (41.6)	114 (49.3)	176 (46.3)
No formal education	5 (3.3)	11 (4.8)	16 (4.2)
Mother's occupation (n=372)	144 (38.7)	228 (61.3)	372 (100)
Managerial and supervisory occupation	21 (14.5)	23 (10.1)	44 (11.9)
Professional & technical occupation	27 (18.8)	49 (21.5)	76 (20.4)
Clerical,sales & services occupation	78 (54.2)	130 (57)	208 (55.9)
Occupation in agriculture, forestry and fisheries	18 (12.5)	26 (11.4)	44 (11.8)
Father's occupation (n=378)	146 (38.6)	232 (61.4)	378 (100)
Managerial and supervisory occupation	24 (16.4)	41 (17.7)	65 (17.2)
Professional & technical occupation	72 (49.3)	101 (43.5)	173 (45.8)
Clerical,sales & services occupation	33 (22.6)	57 (24.6)	90 (23.8)
Occupation in agriculture, forestry and fisheries	17 (11.7)	33 (14.2)	50 (13.2)

4.2 DIETARY HABITS OF THE PARTICIPANTS

Fig 1 shows the Three Factor Eating Questionnaire Scores (TFEQ) of the participants; cognitive restraint, uncontrolled eating and emotional eating. More than a quarter of the participants (37.7% and 41.7% for females and males respectively) scored high on emotional eating compared to cognitive restraint (26.4%, 34.4% for females and males respectively) and uncontrolled eating (23%, 29.1% respectively for females and males).

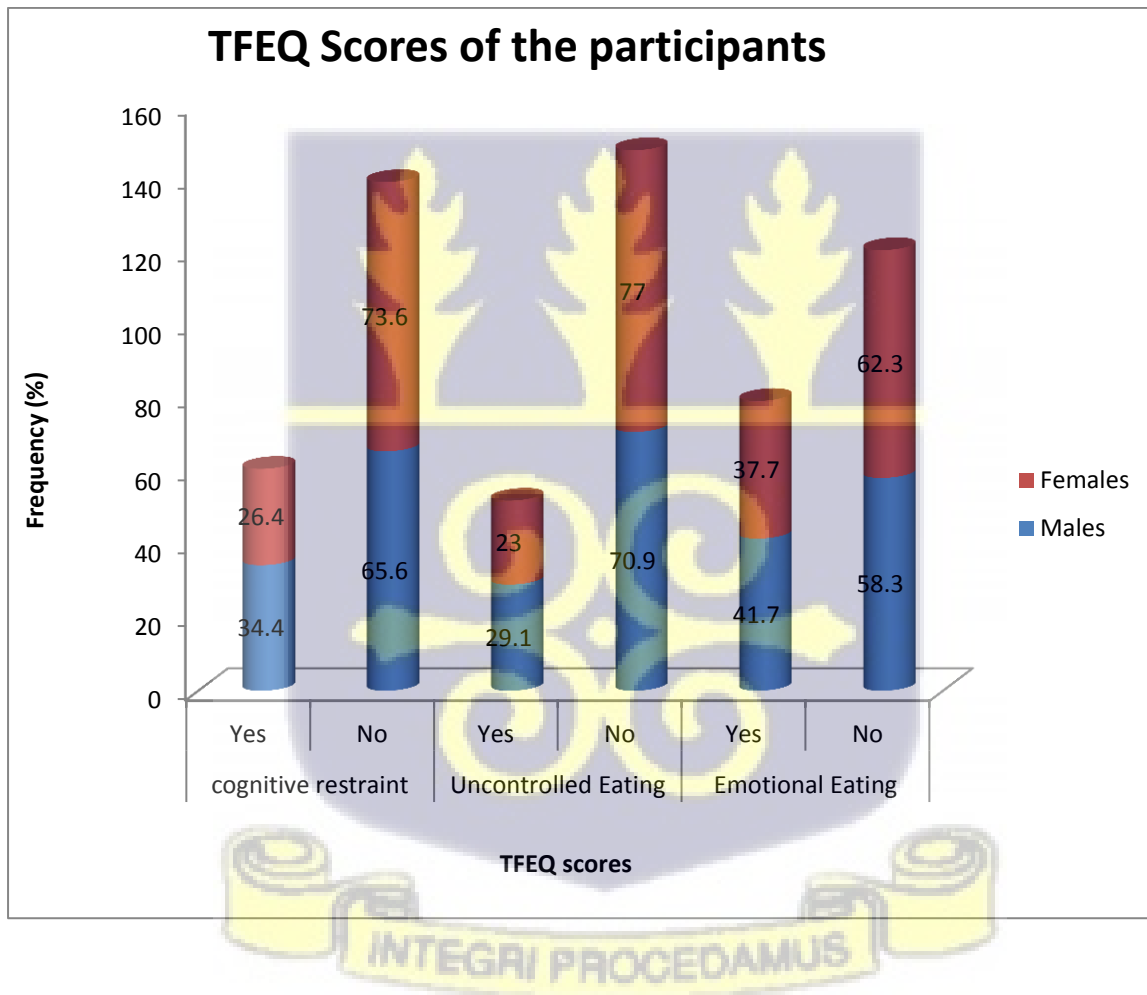


FIG 1: The Three Factor Eating Questionnaire (TFEQ) Scores of the participants

Fig 2 shows the prevalence of other dietary habits of the participants. Skipping meals, snacking and immoderate fat intake (eating fried and oily foods often) showed higher prevalence of 69.3%, 67.1% and 56.1%, respectively. Females reported higher prevalence for snacking, skipping meals and immoderate fat intake than males.

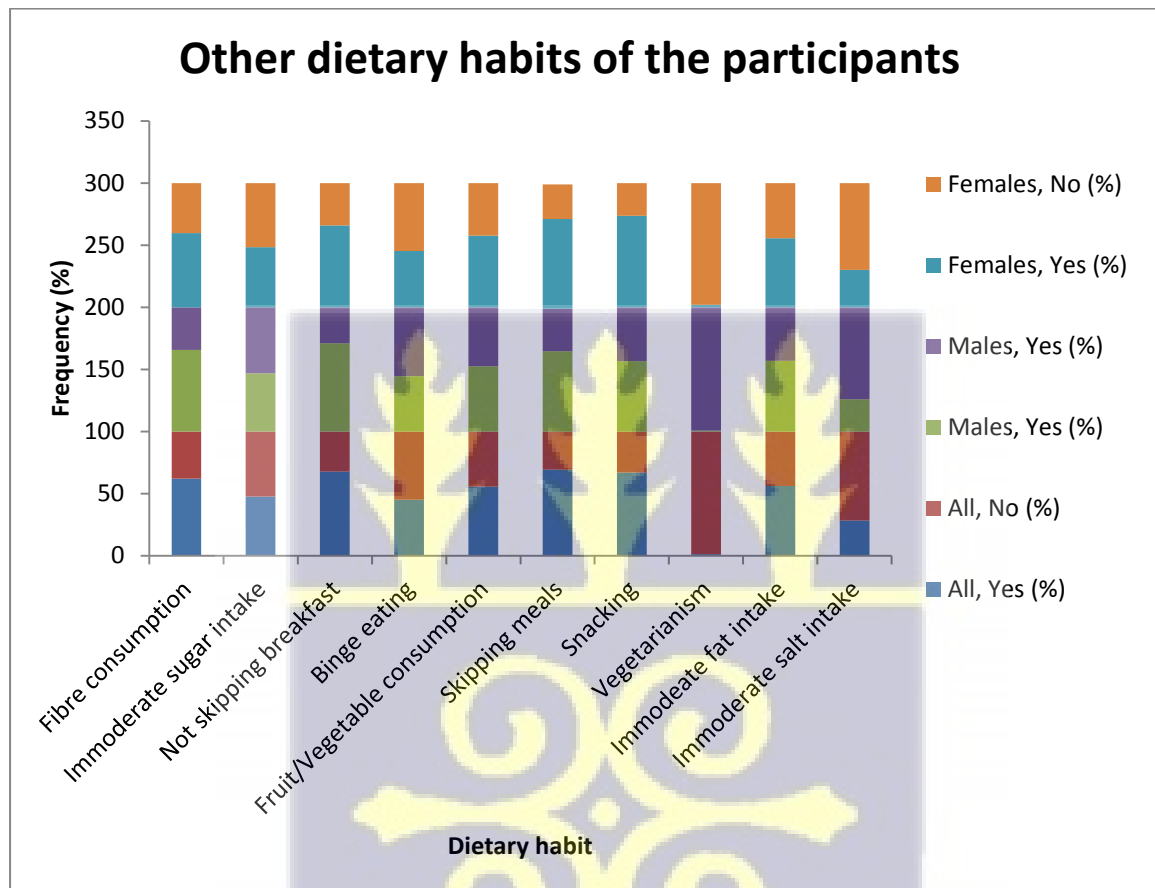


Fig 2: Graph showing other dietary habits of the participants

The Frequency of consumption from the various food groups is shown on Fig 3.

Almost half (33.7%) consumed unpolished cereals less than once per week and few (2.7%) consumed unpolished cereals 6 times per day. This was similar for legumes. Majority consumed milk/milk products, fruits and vegetables 2-4 times per week. For fast foods, pastries and soft drinks, most participants consumed them once per week to 2-4 times per week. About two thirds (67%) never consumed sugar, honey or sweets or they consumed them less than once per week.

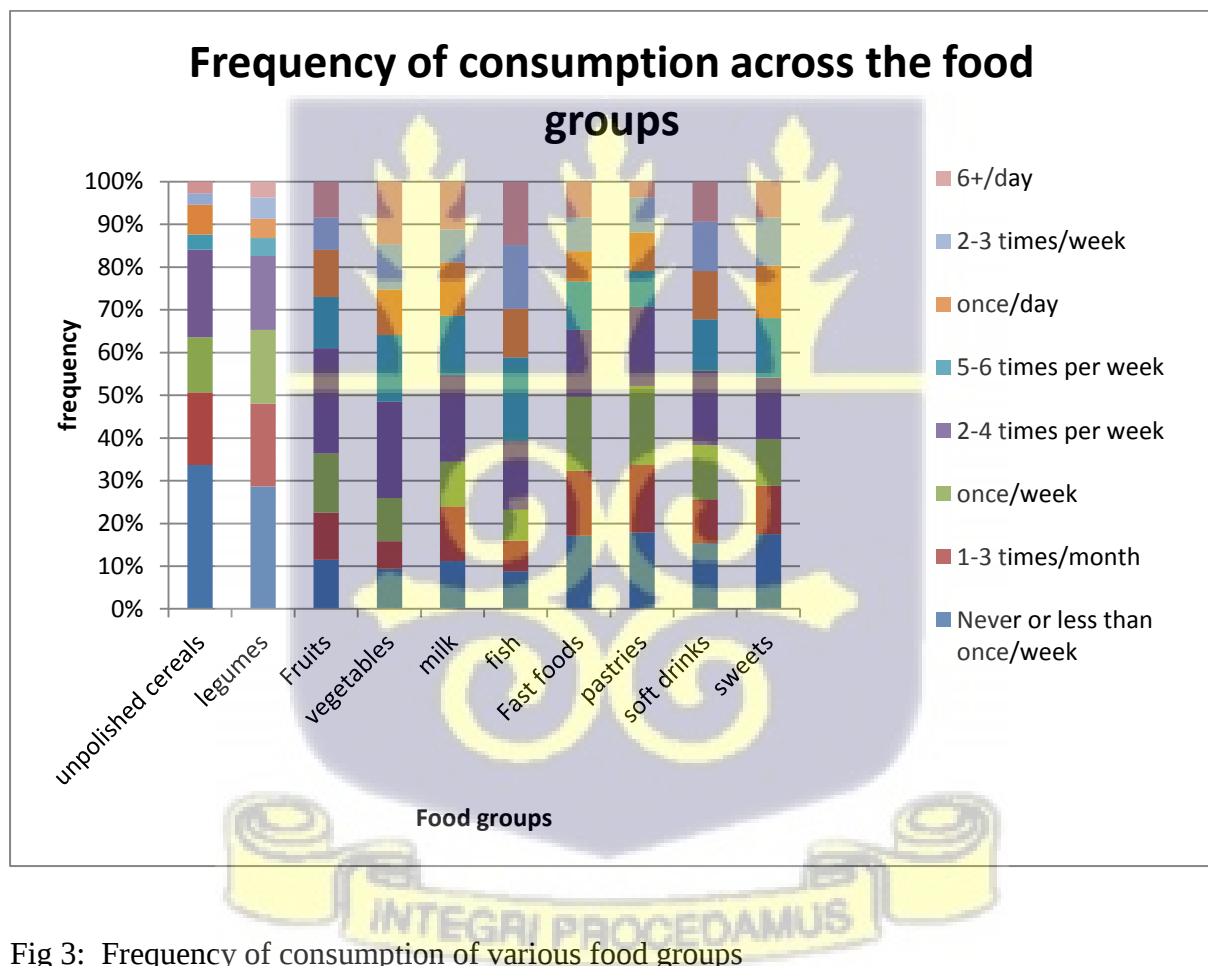


Fig 3: Frequency of consumption of various food groups

The food frequency questionnaire was used to analyse poor and good consumption from the various food groups. For food groups such as unpolished cereals, legumes, fruits, vegetables, fish, milk and milk products, good consumption refer to once/day and above. As such frequency of intakes less than once per day are poor (Allafi *et al*, 2013).

For foods such as fast foods, soft drinks, sweets and pastries good consumption refers to consumption 3 times per week or less. Therefore frequencies of intakes ≥ 4 -6 times per week to 6 times per day are poor (Allafi *et al*, 2013; Musaiger, *et al.*, 2015; El Achhab *et al.*, 2018).

On this basis, the descriptive statistics shows that, majority (59.3%) reported poor consumption among the various food groups. Poor consumption of the various food groups in the study was higher in females than males (as shown on Fig 4a).



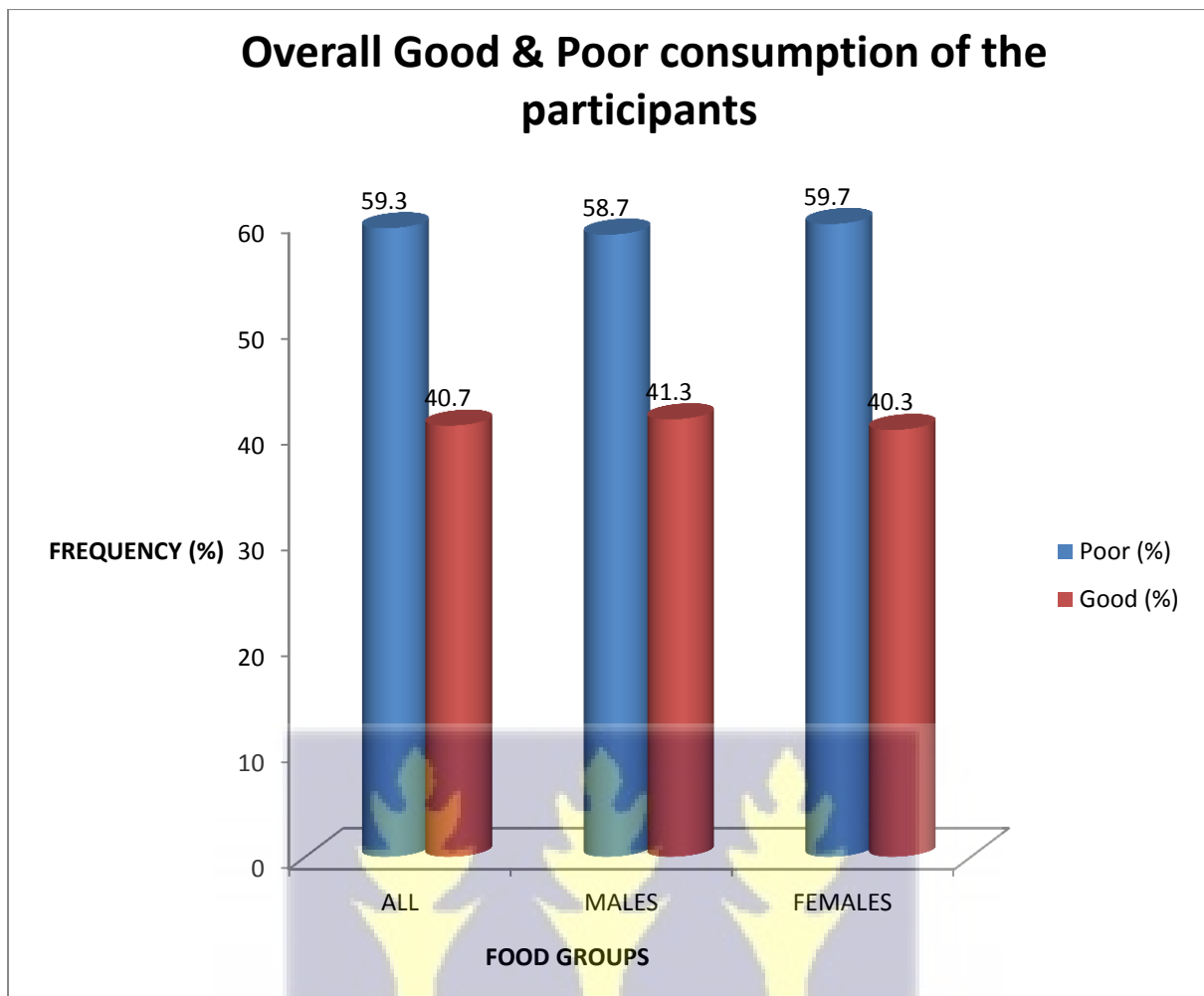


Fig 4a: Graph showing overall good and poor consumption of the participants



Fig 4b shows that for unpolished cereals, legumes, fruits, vegetables, fish, milk and milk products, the prevalence of poor consumption were higher compared to that of fast foods, soft drinks, pastries and sweets.

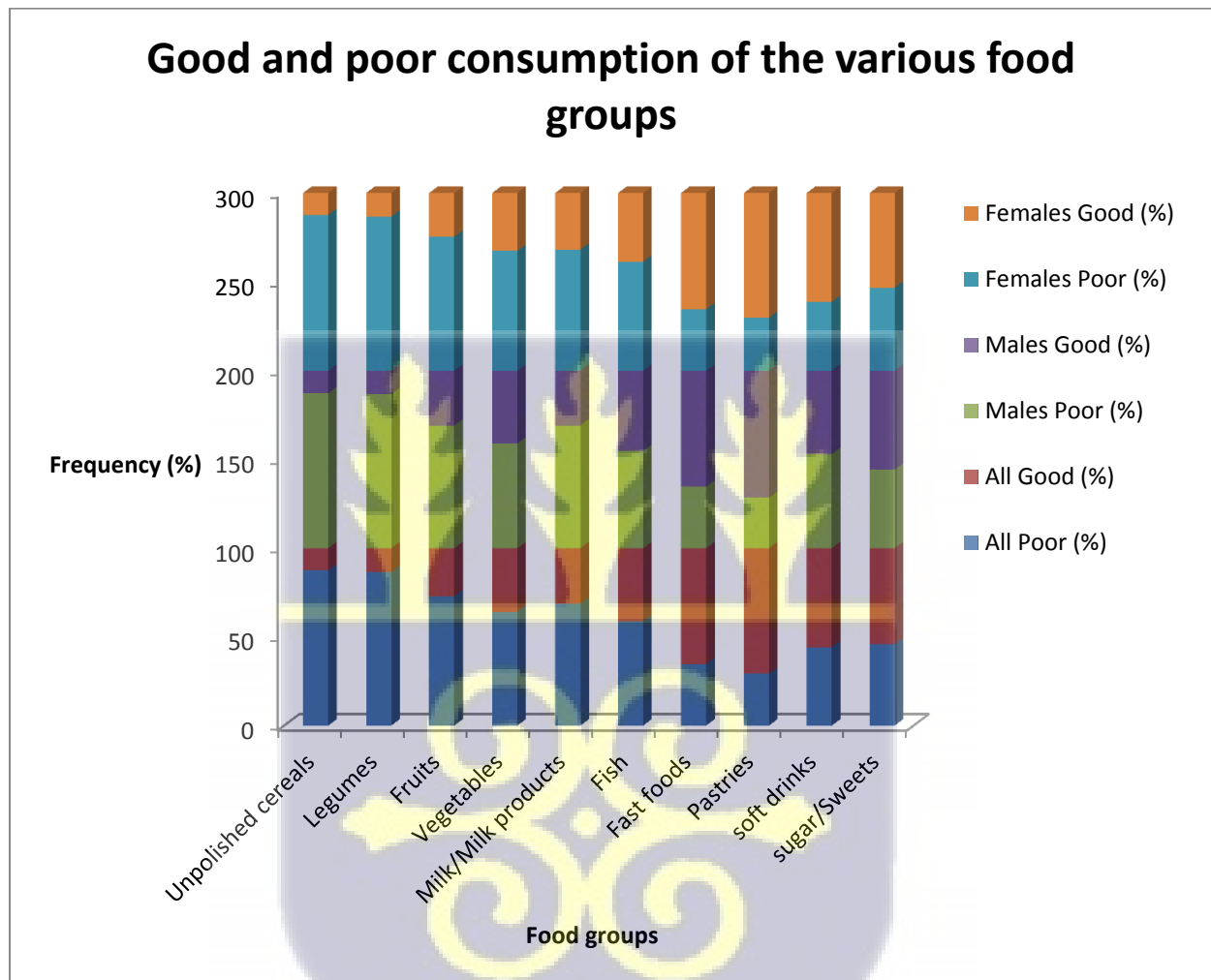


Fig 4b: Graph showing good and poor consumption of the various food groups

4.3 PHYSICAL INACTIVITY OF THE PARTICIPANTS

The graph below (Fig 4) shows the frequencies of physical activity levels of the participants. Majority (89.2%) of the participants had low physical activity level. More than half (55.4%) of females had low physical activity level than males (33.8%).

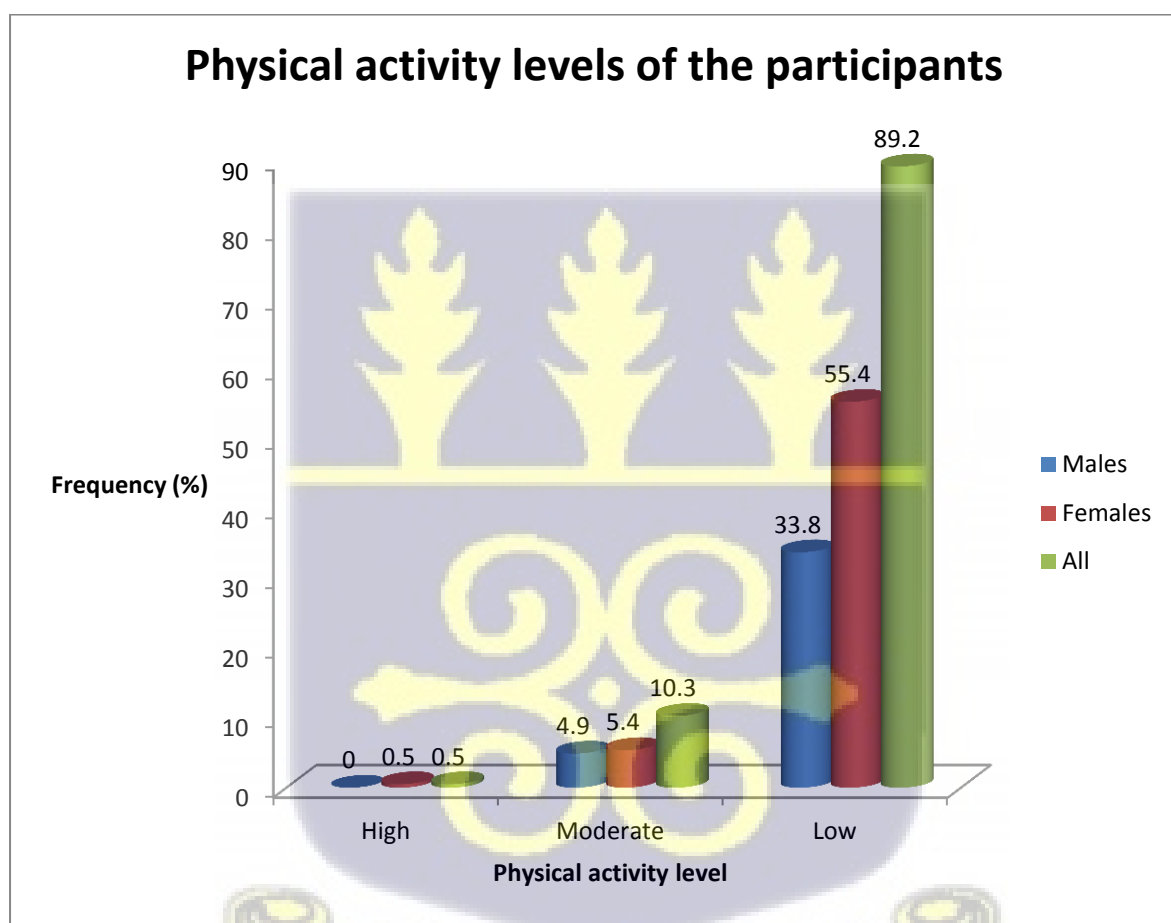


Fig 4: Graph showing the physical activity levels of the participants

4.4 ASSOCIATION BETWEEN DIETARY HABITS AND PHYSICAL INACTIVITY

Table 2 shows the association between physical activity levels and dietary habits of the participants using chi-square test at p-value of ≤ 0.05 . There was no significant association between physical inactivity and any of the dietary habits assessed using the TFEQ.

Table 2: Association between physical inactivity and dietary habits (N=390).

Dietary habits	Physical inactivity		P-value
	Yes (%)	No (%)	(≤ 0.05)
Cognitive restraint	115 (29.6)	274 (70.4)	0.661
Uncontrolled eating	99 (25.4)	290 (74.6)	0.694
Emotional eating	153 (39.3)	236 (60.7)	0.865
Fibre consumption	239 (62.2)	145 (37.8)	0.534
Immoderate sugar intake	181 (47.9)	197 (52.1)	0.628
Not skipping breakfast	262 (68.1)	123 (31.9)	0.596
Binge eating	164 (45.2)	199 (54.8)	0.163
Fruit/Fibre consumption	216 (56.0)	170 (44.0)	0.965
Skipping meals	267 (69.2)	119 (30.8)	0.414
Snacking	256 (67.0)	126 (33.0)	0.150
Vegetarianism	5 (1.4)	375 (98.6)	0.798
Immoderate fat intake	216 (56.2)	168 (43.8)	0.313
Immoderate salt intake	111 (28.6)	277 (71.4)	0.290
Significance set at P value ≤ 0.05		chi-square test	

Table 3 shows the association between physical activity levels and frequency of consumption of various food groups using chi-square test at p-value of ≤ 0.05 . The results show no significant association between physical inactivity and the frequency of consumption of various food groups except for unpolished cereals and sugar/sweets/honey ($p = 0.012$ and $p = 0.034$ respectively).



Table 3: Association between physical activity levels and frequency of consumption of various food groups (N=390)

Physical activity*Food groups	PERCENTAGES (%)								P-value
	Never or less than once/week	1-3 times/month	Once/week	2-4 times/week	5-6 times/week	Once/day	2-3 times/day	6+/day	
Unpolished Cereals	33.7	17.0	12.9	20.5	3.5	7.0	2.7	2.7	0.012*
Legumes	28.6	19.4	17.2	17.2	4.2	4.5	5.0	3.7	0.185
Fruits	11.5	11.0	13.9	24.6	12.0	11.0	7.6	8.4	0.185
Vegetables	9.5	6.4	10.1	22.5	15.6	10.6	10.6	14.6	0.595
Milk/Milk products	11.2	12.8	10.4	20.3	13.7	12.5	7.7	11.2	0.523
Fish	8.6	7.0	7.2	16.2	19.6	11.4	14.9	14.9	0.929
Fast foods	17.1	15.2	17.3	15.7	11.3	7.1	7.9	8.4	0.325
Pastries	17.9	15.8	18.5	18.5	8.4	9.0	8.2	3.7	0.257
Soft drinks	15.4	10.3	12.6	17.5	12.0	11.3	11.5	9.4	0.206
Sugar/sweets	17.5	11.2	10.9	14.4	13.9	12.3	11.3	8.5	0.034*

*Significance set at P value ≤ 0.05

chi-square test

Table 4 shows the association between sedentary habits (time spent watching television, playing computer games, reading) and dietary habits. There was significant association between time spent watching television (TV) and immoderate salt intake ($p = 0.006$). Significant association also exist between time spent reading and vegetarianism ($p = 0.016$).

Table 4: Association between sedentary behaviours and dietary habits using the TFEQ (N =390)

Dietary habits	P- value (≤ 0.05)		
	TV time	Computer time	Reading time
Cognitive restraint	0.055	0.375	0.115
Uncontrolled eating	0.131	0.385	0.285
Emotional eating	0.522	0.647	0.200
Fibre consumption	0.304	0.198	0.493
Immoderate sugar intake	0.192	0.306	0.467
Not skipping breakfast	0.837	0.842	0.788
Binge eating	0.732	0.713	0.728
Fruit/Vegetable consumption	0.450	0.374	0.197
Skipping meals	0.388	0.510	0.704
Snacking	0.501	0.598	0.437
Vegetarianism	0.961	1.000	0.016*
Immoderate fat intake	0.168	0.184	0.203
Immoderate salt intake	0.006*	0.265	0.535

*Significance set at P value ≤ 0.05

chi-square test

Table 5 shows the association between sedentary habits (time spent watching television, playing computer games, reading) and frequency of consumption of food groups. There was significant association between time spent watching TV and intake of unpolished cereals ($p=0.018$), fast foods ($p=0.001$) and pastries ($p=0.050$). There was no significant association between time spent on the computer and the various food groups, except for intake of unpolished cereals ($p=0.003$) and fast foods ($p=0.013$). In addition, significant association was found for time spent reading and frequency of consumption of legumes ($p=0.010$) and pastries consumption ($p \leq 0.001$).

Table 5: Association between sedentary behaviours and frequency of consumption of various foods (N=390)

Food groups	TV time	Computer time	Reading time
Unpolished cereals	0.018*	0.003*	0.374
Legumes	0.138	0.545	0.010*
Fruits	0.342	0.119	0.076
Vegetables	0.098	0.265	0.205
Milk/Milk products	0.201	0.169	0.281
Fish	0.409	0.514	0.063
Fast foods	0.001*	0.013*	0.159
Pastries	0.050*	0.551	$\leq 0.001^*$
Soft drinks	0.156	0.129	0.099
Sugar/sweets	0.281	0.207	0.201

*Significance set at P value ≤ 0.05

chi-square test

CHAPTER FIVE

5.0 DISCUSSION AND CONCLUSION

5.1 DISCUSSION

The main objective of this study was to assess the prevalence of poor dietary habits and physical inactivity of adolescents during COVID-19 period. Additionally, the association between physical inactivity and poor dietary habits was also determined.

5.1.1 Prevalence of poor dietary habits

The result of this study revealed more than a quarter of the participants (37.7% and 41.7% for females and males respectively) scored high on emotional eating compared to cognitive restraint (26.4%, 34.4% for females and males respectively) and uncontrolled eating (23%, 29.1% respectively for females and males). Emotional eating measures the influence of both external and internal signals on food intake. It was anticipated that the psychological trauma following COVID-19 will have an influence on emotional eating. This is because worries, anxiety and depression are major contributors to emotional eating (Beydoun, 2014). This possibly explains why more students scored high in emotional eating compared to cognitive restraint and uncontrolled eating. However the percentage who scored high in emotional eating was lower than another study carried out during the early phase of COVID-19 in April, 2020 among Norwegian adults (Bemanian *et al.*, 2021). The changes in phase, flexibility in restriction, study differences, cultural differences may possibly explain the reduction in emotional eating score as reported by this study.

Generally, scores on cognitive restraint, uncontrolled eating and emotional eating were lower in females than males in this study. Females have been reported to eat more under stress,

hence anticipated to have higher emotional eating score than males(Renzo *et al.*, 2020). The result of this study is in discordant with the study conducted by Renzo *et al.* (2020). Female adolescents are more restrictive in food intake because of body image preference, appearance and fear of gaining weight (Mahan & Raymond, 2017).

Majority of the participants consumed fibre (62.1%) and fruit /vegetables (55.8 %) often. In a study conducted during the early phase of COVID-19 in China, they reported that home stay was correlated with an increase in the intake of fruits and vegetables (Yang, *et al.*, 2021). Consumption of fruits / vegetables is good for the health of the adolescents. According to WHO, these foods are considered healthy as they contain vitamins, minerals and fibre which are important for healthy growth of the students. They also lower the risk of NCD's (WHO, 2019). Moderation of sugar and salt intake were good among the participants. However, 56.1% of the participants consumed fried and oily foods often during the COVID-19 period. Fats are macronutrients that provide more energy than the same gram of carbohydrate and protein. Excess intake of fried and oily foods contributes to weight gain, overweight/ obesity, heart diseases, cancers which are detrimental to the health of the participants (Madell & Nall, 2020).

Majority (67.9%) of the students reported not skipping breakfast. The result of this study contradicts a study carried out before COVID-19 among Ghanaian adolescents, which reported about (63%) of adolescents skipped breakfast (Buxton, 2014). COVID-19 had resulted in a positive influence on consumption of breakfast, according to this finding. This study was carried out in a school that had boarding facility. As such breakfast was compulsory for the students. In addition, it has been reported that most people consumed home cooked foods during COVID-19 since they were at home (Alhusseini & Alqahtani, 2020). This may explain why majority of the participants did not skip breakfast.

The result of the study reported that 69.3% of the adolescents skipped meals. Skipping meals is unhealthy for the body because an individual is likely to overeat during the next meal (Shulman, 2019). Skipping meals also makes people go in for easy and fast foods like pastries, soft drinks which are high in calories. This can result in weight gain and positive energy balance (Shulman, 2019). This result is higher compared to a study conducted during COVID-19 lockdown in the US that reported 25% of adult participants skipped meals (Khubchandani, Kandiah, & Saiki, 2020). Cultural variations and study differences may account for the differences. In addition, possible explanations to the increased prevalence of skipping meals during COVID-19 include stress, emotional eating and food insecurity (Adams, Caccavale, & Smith, 2020; Khubchandani, Kandiah, & Saiki, 2020).

Snacking is another unhealthy dietary habit observed among adolescents, with peer influence and watching television as some factors that influence snacking (Larson, et al, 2016) . The result of snacking for this study was higher (67.1%) compared to those who do not snack (32.9%). Common preferred snacks among adolescents are soft drinks and energy dense foods which are high in calories influencing overweight, obesity and other chronic conditions (Larson, *et al.*, 2016). This is unhealthy to the participants. The score of snacking from this study is similar to a review study that reported that, many studies observed a rise in snacking during COVID-19 (Bennett *et al.*, 2021). Food availability, stress and reduced physical activity may account for the increase snacking habits among the participants during COVID-19 (Bennett *et al.*, 2021).

The score for binge eating in females was higher than that for males. This supports the statement by Westerberg & colleagues, that the prevalence of binge eating is higher in females than males (Westerberg & Waitz, 2013). The overall prevalence for binge eating was 45.1% in this study. A study conducted in Italy also reported incidence of binge eating during COVID-19 (Cecchetto, *et al.*, 2021). The influence of stress on binge eating through

emotional eating may explain this result (Cecchetto, *et al.*, 2021). Adolescents who binge eat are at risk of obesity.

Vegetarianism reported lower prevalence (1.3%) among the other dietary habits. Vegetarianism is a dietary behaviour that is exclusively or almost exclusively composed of plant foods. Some may however consume specified animal products such as eggs, milk and milk products as well as processed foods containing small amounts of animal products (whey, casein). Some nutritional problems of vegetarian diet include iron, protein, zinc, omega-3 fatty acids, vitamin B-12, calcium and vitamin D deficiencies. However, it offers the benefit of reducing the prevalence of obesity and other chronic diseases among adolescents (Craig, 2010).

The results of the Food Frequency Questionnaire (FFQ) showed that, participants consumed foods from various food groups: unpolished cereals, legumes, fruits, vegetables, milk/milk products, fish, fast foods, pastries, soft drinks and sweets. According to Rodríguez, *et al.* (2019), the FFQ is the most valid, useful tool to assess the dietary habits of a population. Generally, the dietary habit of the participants was poor with a prevalence of 59.3%. In a study that estimated the prevalence of poor dietary habits among adolescents in low and middle-income countries, they reported 56.6% prevalence (Fan & Zhang, 2020). Comparing the result of this study to that of Fan and colleagues, the difference may be attributed to the negative effect of COVID-19 on dietary habit because the former study was carried out way before COVID-19 but published during COVID-19 era (Fan & Zhang, 2020). Stress, restrictions in obtaining fresh foods, restriction in movement, increase in sedentary behaviour, food insecurity during COVID-19 are plausible explanations (Adams, Caccavale, & Smith, 2020; Khubchandani, Kandiah, & Saiki, 2020; Bennett, *et al.*, 2021).

In addition, the prevalence of poor dietary habit was higher for females than males. Females have been found to respond to stress by consuming high calorie foods than males (Beydoun, 2014).

5.1.2 Prevalence of physical inactivity

The percentage of adolescents who were physically inactive according to this study was 89.2%. This value is greater than that ('65.6%') reported in a longitudinal study conducted during the pandemic in Shanghai, China (Xiang, Zhang & Kuwahar 2020). Over reporting, cultural variations and study differences may account for the changes. In comparison with a cross-sectional study carried out before the pandemic in Brazil, the current result was also higher than their findings (Miquetichuc *et al.*, 2016). Restriction in movement, reduced social contacts and activities during COVID-19 could explain the difference. In addition physical inactivity among females (55.4%) was higher than that of males (33.8%). This supports the report of Miquetichuc *et al.* (2016) among Brazilian adolescents. Females mostly engage in light intensity activities than males (Miquetichuc *et al.*, 2016). Prolonged physical inactivity is detrimental to the health of the participants. Reduce physical activity is a risk factor for obesity and other non-communicable diseases such as osteoporosis, DM-type 2, CVD's etc (Gaetano, 2016).

5.1.3 Association between physical inactivity and poor dietary habits

The third aim of this study was to determine the association between physical inactivity and unhealthy dietary habits. Most of the results obtained are the expected linkages. There was significant association between physical inactivity and intake of unpolished cereals ($p=0.012$)

and sweets/sugar/honey ($p = 0.034$). Though unpolished cereals are regarded as healthy foods, their frequency of consumption was poor in this study (WHO, 2019). A third (33.7%) of the participants reported never consuming unpolished cereals or consuming them less than once in a week, while less participants (2.7%) consumed unpolished cereals 2 or more times per day.

There was also a significant association between time spent watching television and immoderate salt intake ($p=0.006$), unpolished cereals ($p=0.018$), fast food (0.001) and pastries ($p= 0.050$). This finding is similar to that reported by Compernelle *et al.* (2016). As adolescents watch television, they are exposed to advertisement of unhealthy foods which are high in sugar, salt and fat. This result also supports the idea that time spent watching television is linked with less consumption of healthy foods such as unpolished cereals (Compernelle *et al.*, 2016).

Significant association also exists between time spent using the computer and consumption of unpolished cereals ($p=0.003$) as well as consumption of fast foods ($p= 0.013$). This result is also similar to that reported elsewhere among Mexican school children (Soltero *et al.*, 2021).

Significant association was found between time spent reading and legumes consumption ($p=0.010$), and pastries consumption ($p= \leq 0.001$). Legumes are considered as healthy foods, however the result of this study showed that their consumption was poor. Pastries are also easy foods to use as snacks during reading. This possibly explains the observed association.

The limitations of this study are

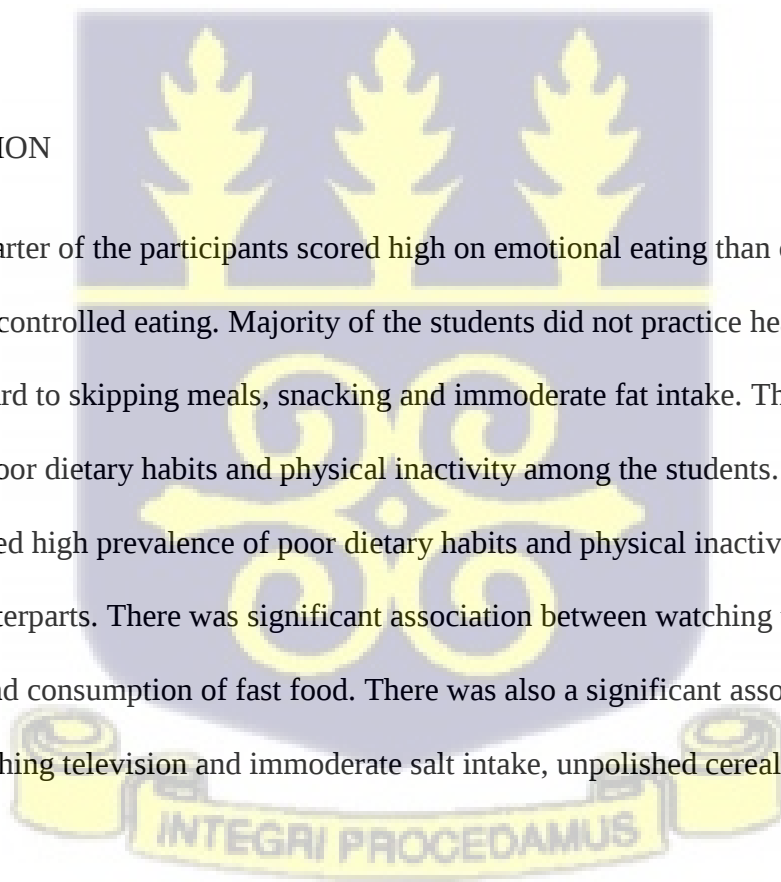
- 1) Information on physical activity levels were obtained indirectly or through self-reporting. This is subject to recall bias, over reporting or underreporting.

- 2) The cross-sectional study employed in this study does not allow for cause and effect inferences.

Despite these limitations, this study has been able to determine the prevalence of poor dietary habits and physical inactivity during COVID-19 pandemic in Ghana. Association between poor dietary habits and physical inactivity were also determined. Food frequency questionnaire and the international physical activity questionnaire employed by this study are considered as validated and useful tools for the determination of dietary habits and physical activity respectively.

5.2 CONCLUSION

More than a quarter of the participants scored high on emotional eating than cognitive restraint and uncontrolled eating. Majority of the students did not practice healthy dietary habits with regard to skipping meals, snacking and immoderate fat intake. There was high prevalence of poor dietary habits and physical inactivity among the students. Generally, females exhibited high prevalence of poor dietary habits and physical inactivity compared to their male counterparts. There was significant association between watching television, using the computer and consumption of fast food. There was also a significant association between time spent watching television and immoderate salt intake, unpolished cereals and pastries.



5.3 RECOMMENDATIONS

It is recommended that;

1. Future studies should employ the use of a more direct method in assessing the physical activity levels such as the accelerometer.
2. Similar studies should be carried out in adult populations.
3. Future studies will investigate some of the dietary habits not covered in this work such as alcohol consumption
4. Health and nutrition education subjects should be included in the curriculum of students and made compulsory in order to help improve student's dietary habits.
5. Dieticians should be employed in schools to oversee school feeding practices as well as educate school children on healthy dietary practices. This will help to foster healthy dietary practices among adolescents.
6. Periods allotted to physical activity subjects in schools should be extended to about twice or thrice in a week.
7. During future pandemic, Ministry of Health and Ghana Education Service should practically educate the public on healthy food choices and dietary guidelines through the media (television and radio).



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APPENDIX A: CONSENT LETTER

PARENT'S CONSENT FORM

DEPARTMENT OF DIETETICS, SCHOOL OF BIOMEDICAL AND ALLIED HEALTH SCIENCES, COLLEGE OF HEALTH SCIENCES, UNIVERSITY OF GHANA.

DIETARY HABITS AND PHYSICAL INACTIVITY OF ADOLESCENTS DURING COVID-19 PERIOD

INFORMATION SHEET

My name is Felicia Kabukai Mensah, a postgraduate (MSc) student of the Department of Dietetics, University of Ghana. I am conducting a study on 'DIETARY HABITS AND PHYSICAL INACTIVITY OF ADOLESCENTS DURING COVID-19 PERIOD' as part of my MSc Degree in Dietetics. Research indicates that eating habits and sitting behaviours are popular risk factors to obesity and chronic diseases later in adult life. Thus, this study will offer the benefit of providing the prevalence of these habits in adolescents during the COVID-19 in Ghana, for the implementation of appropriate health interventions.

Your ward has been invited to be part of this study. We therefore wish to seek your permission to involve your child. However, participation is voluntary and you can refuse or withdraw your ward from the study. If you agree for your ward to join the study, he/she will be required to complete a questionnaire.

Please note that all information provided by your child will be kept confidential and used for research purpose only. The study will not pose any risk to your child and no cost will be charged from your child.

The study is supervised by Dr Freda Dzifa Intiful and Prof. Irene Hatsu with approval from the College of health Sciences Ethics and Protocol Review committee (EPRC). Permission has also been obtained from the school authorities of your ward. If you have any question

regarding the right of your child's participation, you can contact the office of EPRC on 0302940528, 0302665103 between the working hours of 8am-5pm. For further questions about this study, please feel free to call any of the contacts below:

Researcher's contact

Felicia Kabukai Mensah

0248578379

Supervisor's contact

Dr Freda Dzifa Intiful

0243439389

INFORMED CONSENT FORM

I
have read and understood the information regarding the study and what is required of my ward. All concerns and questions have been addressed. My signature or thumbprint indicates my wiliness to allow my child to join the study. Thank you.

Signature/ thumbprint

Date



DEPARTMENT OF DIETETICS, SCHOOL OF BIOMEDICAL AND ALLIED HEALTH SCIENCES, COLLEGE OF HEALTH SCIENCES, UNIVERSITY OF GHANA

CHILD'S ASSENT FORM

My name is Felicia Kabukai Mensah, a final year post graduate student of the University of Ghana, department of dietetics. I am conducting a study on the '**DIETARY HABITS AND PHYSICAL INACTIVITY OF ADOLESCENTS DURING COVID-19 PERIOD**'.

Research indicates that, dietary habits and physical inactivity are popular risk factors to obesity and chronic diseases later in adult life. Thus, this study will offer the benefit of providing the prevalence of these habits in adolescents during the COVID-19 in Ghana, for the implementation of appropriate health interventions. This study is supervised by Dr Freda Dzifa Intiful and Prof. Irene Hatsu with approval from the College of health Sciences Ethics and Protocol Review committee (EPRC) , University of Ghana. Permission has also been obtained from the authorities of your school.

If you agree to join this study, you will be required to fill a questionnaire about your eating and physical activity habits during the COVID-19 period.

You will not benefit directly from this study in the form of cash or any item. However the information you provide will help me to determine the dietary and sitting behaviours of adolescents during the COVID-19 period.

Participation in this study is free will and anytime you decide to leave the study, you are free to do so. If you have any question about the study, you are at liberty to call me on this number: 0248578379.

If you have understood the information about this study and have all your questions answered, kindly write your name and pen your signature to indicate your agreement to join this study. Thank you.

Name.....

Signature..... Date.....



APPENDIX B: QUESTIONNAIRE

**UNIVERSITY OF GHANA
DEPARTMENT OF DIETETICS
QUESTIONNAIRE FOR DATA COLLECTION**

PROJECT TITLE: DIETARY HABITS AND PHYSICAL INACTIVITY OF ADOLESCENTS DURING COVID-19 PERIOD

UNIQUE CODE:

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PART 1: SOCIO-DEMOGRAPHIC DATA

Kindly provide us with the following information about yourself:

1. What is your gender? ☐ Male ☐ Female

2. How old are you? years

3. Which class are you now?

4. Where are you staying during this COVID-19 period?

☐ Dansoman ☐ other place outside Dansoman

5. Who are you staying with during this COVID-19 period?

☐ Both mother and Father ☐ only mother ☐ only father ☐ others.

Specify.....

6. What is your father's highest educational level? ☐ Primary ☐ Junior high ☐ Senior high ☐ Tertiary ☐ No formal education

7. What is your mother's highest educational level? () Primary () Junior high () Senior high () Tertiary () No formal education
8. What is your father's main occupation? () Managerial and supervisory occupation () Professional and technical occupation () clerical, sales and services occupation () Occupation in agriculture, forestry and fisheries
9. What is your mother's main occupation? () Managerial and supervisory occupation () Professional and technical occupation () clerical, sales and services occupation () Occupation in agriculture, forestry and fisheries

PART 2: DETERMINATION OF DIETARY HABITS

The Three Factor Eating Questionnaire

Kindly read each statement carefully and tick the option that indicates how you feel during COVID19 period (after the lockdown).

No		Definitely true	Mostly true	Mostly false	Definitely False
1	When I smell a juicy piece of meat, I find it very difficult to keep from eating, even if I have just finished a meal				
2	I deliberately take small helpings as a means of controlling my weight				
3	When I feel anxious, I find myself eating				
4	Sometimes when I start eating, I just can't seem to stop				

5	Being with someone who is eating often makes me hungry enough to eat also				
6	When I feel sad, I often overeat				
7	When I see a real delicacy, I often get so hungry that I have to eat right away				
8	I get so hungry that my stomach often seems like a bottomless pit				
9	I am always hungry so it is hard for me to stop eating before I finish the food on my plate				
10	When I feel lonely, I console myself by eating				
11	I consciously hold back at meals in order not to weight gain				
12	I do not eat some foods because they make me fat				
13	I am always hungry enough to eat at any time				

14. How often do you feel hungry?

Only at meal times () sometimes between meals ()

Often between meals () almost always ()

15. How frequently do you avoid “stocking up” on tempting (attractive) foods?

Almost never () seldom () moderately likely () almost always ()

16. How likely were you to consciously eat less than you want?

Unlikely () slightly likely () moderately likely () very likely ()

17. Do you go on eating binges though you were not hungry?

Never () rarely () sometimes () at least once a week ()

18. On a scale of 1 to 8, where 1 means no restraint in eating (eating whatever you want, whenever you want it) and 8 means total restraint (constantly limiting food intake and never “giving in”), what number would you give yourself?

No		Definitely true	Mostly true	Mostly false	Definitely False
19	I have been called / consider myself a picky eater				
20	I find many foods distasteful				
21	I won't try a food if I don't like one of its ingredients				
22	A bad experience would keep me from trying a food again				
23	I enjoy trying new, sometimes unusual foods				
24	I like different cultural foods				
25	I like to stick to the foods that I know				
26	I make a deliberate effort to take enough fibre				
27	I love to eat				
28	Having to eat is a bother				
29	I like very sweet foods and take much sugar				
30	I always have breakfast				

31	I take three meals a day with snacks				
32	I take small meals at frequent intervals				
33	I sometimes binge eat				
34	I stop eating as soon as I feel full				
35	I eat fruits and/ raw vegetables everyday				

No		Definitely true	Mostly true	Mostly false	Definitely False
36	I sometimes skip meals				
37	I avoid meat fats (I trim off all visible fats)				
38	I sometimes substitute snacks for meals				
39	I avoid animal foods especially red meats (write 5 in the first box if you are a vegetarian)				
40	I eat the same kinds of foods very often				
41	I eat a wide variety of foods				
42	I take one bulky meal a day rather than smaller meals spread through the day				
43	I often choose fried and oily foods				
44	I avoid eating even when I am hungry because I am terrified of being overweight				
45	I add salt to my food at the table				

Food Frequency Questionnaire

Kindly tick how often you consumed these foods during **COVID-19 pandemic (after lockdown)**.

Food type	Never or less than once/week	1-3 times /month	Once/ week	2-4 times /week	5-6 times /week	Once /day	2-3times /day	6+ /day
Unpolished cereals								
Legumes(soya, cowpea, Bambara beans)								
Fruits								
Vegetables								
Milk and milk products								
Fish								
Fast foods (indomie, fried rice & chicken, pizza, burger etc).								
Pastries								
Carbonated/soft drinks								
Sugar/Honey/sweets								



PART 3: DETERMINATION OF PHYSICAL INACTIVITY

International Physical Activity Questionnaire

These questions are about how you travelled from place to place, including to places like school, stores, movies, and so on during COVID-19 period.

- 1) During this **COVID-19 period**, on how many days do you **travel in a motor vehicle, bicycle or walk** from one place to the other.

_____ **days per week**

() No traveling in a motor vehicle, bicycling or walking → **skip to question three 3**

- 2) How much time do you usually spend on one of those days to **travel in a motor vehicle, bicycle or walk** from one place to another?

_____ **hours per day**

_____ **minutes per day**

- 3) Think about only those physical activities that you did for at least 10 minutes at a time. During this COVID-19 period, on how many days do you do physical activities like heavy lifting, digging, sweeping, washing windows, scrubbing floors and raking in the garden or at home?

_____ **days per week**

() No physical activity in the garden or home → **skip to question five 5**

- 4) How much time do you usually spend on one of those days doing physical activities like heavy lifting, digging, sweeping, washing windows, scrubbing floors and raking in the **garden or home**?

_____ hours per day

_____ minutes per day

- 5) Think about only those physical activities that you did for at least 10 minutes at a time in your leisure time. During this **COVID-19 period**, on how many days did you do physical activities like aerobics, running, fast bicycling, fast swimming, bicycling at a regular pace, swimming at a regular pace, and double tennis **in your leisure time**?

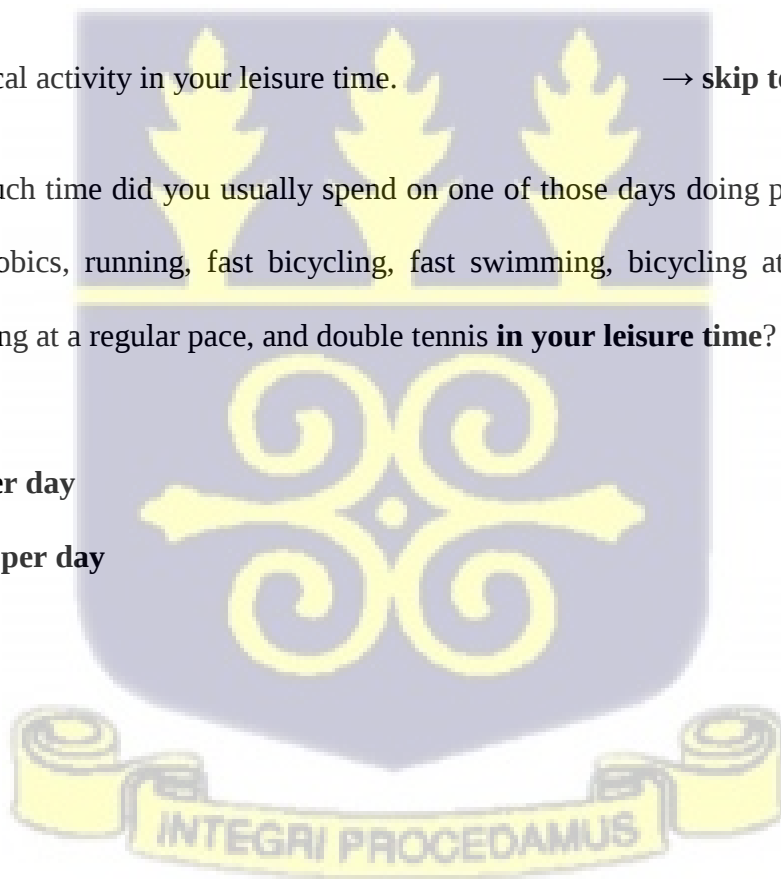
_____ days per week

() No physical activity in your leisure time. → skip to question 7

- 6) How much time did you usually spend on one of those days doing physical activities like aerobics, running, fast bicycling, fast swimming, bicycling at a regular pace, swimming at a regular pace, and double tennis **in your leisure time**?

_____ hours per day

_____ minutes per day



TIME SPENT SITTING

This part of questions is about the time you spent sitting while at home, while doing course work and during leisure time during **COVID-19 pandemic (after lockdown)**. Please write the time you spent on each of the activities described below.

7. During this **COVID-19 pandemic**, how much time do you usually spend **sitting** on a **weekday**?

..... hours per day

.....minutes per day

8. During this **COVID-19 pandemic**, how much time do you usually spend **sitting** on a **weekend**?

.....hours per day

.....minutes per day

9. During this **COVID-19 pandemic**, how much time do you usually spend **sitting** to **watch television**?

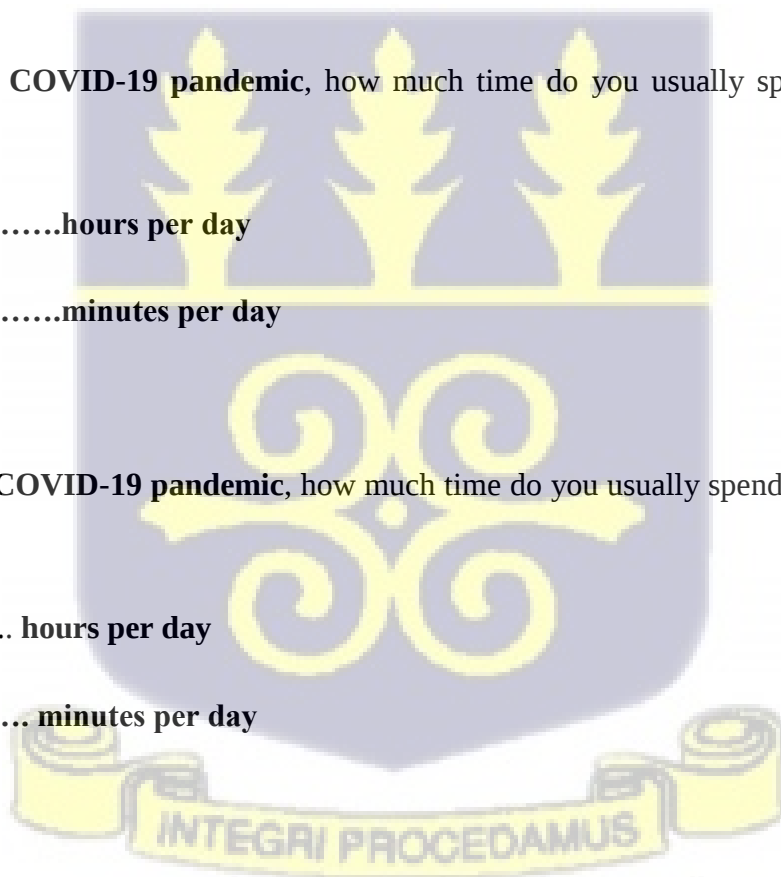
..... hours per day

..... minutes per day

10. During this **COVID-19 pandemic**, how much time do you usually spend **sitting** to play or watch games **on the computer or phone**?

..... hours per day

..... minutes per day



11. During **COVID-19 pandemic**, how much time did you usually spend **on your school work** and to **read** your books?

..... hours per day

..... minutes per day

END OF QUESTIONNAIRE. THANK YOU



APPENDIX C:

ETHICAL APPROVAL LETTER



UNIVERSITY OF GHANA
COLLEGE OF HEALTH SCIENCES
ETHICAL AND PROTOCOL REVIEW COMMITTEE

Ref. No.: EPRC/MAY/2021

May 26, 2021

Ms. Felicia Kabukai Mensah
Dept. of Nutrition and Dietetics
School of Biomedical and Allied Health Sciences
Korle Bu

ETHICAL CLEARANCE

Protocol Identification Number: **CHS-Et/M.5 –4.2 /2020-2021**

FWA: 000185779

IORG: 0005170

IRB: 00006220

The College of Health Sciences Ethical and Protocol Review Committee (EPRC) on May 26, 2021 reviewed and approved your research protocol.

Title of Protocol: **"Dietary Habits and Physical Inactivity of Adolescents during COVID-19 Period"**

Principal Investigator: **Felicia Kabukai Mensah**

This approval requires that you submit six-monthly review report(s) of the study to the Committee and a final full review report to the EPRC at the completion of the study. The Committee may observe, or cause to be observed, procedures and records of the study before, during and after implementation.

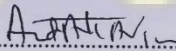
Please note that any significant modification(s) to this project/study must be submitted to the Committee for review and approval before its implementation.

You are required to report all serious adverse events related to this study to the EPRC within seven (7) days verbally and fourteen (14) days in writing.

As part of the review process, it is the Committee's duty to review the ethical aspects of any manuscript that may be produced from this study. You will therefore be required to furnish the Committee with any manuscript for publication.

This ethical clearance is valid until May 26, 2022.

Please always quote the protocol identification number in all future correspondence in relation to this protocol.

Signed: 

Professor Andrew Anthony Adjei
Chair, Ethical and Protocol Review Committee

cc: Provost, CHS
Dean, SBAHS
Head, Nutrition and Dietetics