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EATING OUT: NUTRITION AND HEALTH IMPLICATIONS

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DECLARATION

I, Babette Naa Ahimah Nunoo do hereby declare that this thesis, with the exception of identified quotations and duly acknowledged references are the outcome of my own research and effort in the Nutrition and Food Science Department, University of Ghana, under the supervision of Prof. Matilda Steiner-Asiedu and Dr Frederick Vuvor. To state clearly, none of the materials contain herein have either been submitted or presented in either whole or part for another degree in the University of Ghana or elsewhere.

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ABSTRACT

Background: Eating out (EO) has been identified as a significant driver to the poor quality of diet due to high fat, sodium and energy content of meals which have a negative consequence on nutritional health, resulting in overweight/obesity and related non-communicable diseases. The study sought to assess EO lifestyle and associated factors; assess the nutrient content of some selected meals from fast food restaurants (FFRs) in Accra; and associations of EO lifestyle with selected health indicators among Ghanaians.

Methods: This was a cross sectional study involving 450 adults from 18 to 60 years within some selected communities in Accra metropolis and laboratory proximate analysis (LPA) of twenty (20) meals sourced from different FFRs in *Osu*. A semi-structured questionnaire was used in assessing the socio– demographic characteristics, EO characteristics, physical activity level (PAL) of all subjects. In addition, parameters such as height, weight, blood pressure and fasting blood sugar was measured for a sub- sample of subjects. LPA was conducted to assess the protein, moisture, carbohydrate, fat, ash, energy and mineral content of FFR meals. Descriptive statistics were used to report continuous and categorical data and the health variables were reported based on standard classifications. Independent sample t-test and Pearson chi-square test were used to analyse continuous and categorical variables respectively. Logistic regression was employed to determine which variables were associated with EO and overweight/obesity. Nutrient compositions were estimated both in per serving and 100g as mean ± standard deviations and compared to recommendations. ANOVA and Post Hoc Multiple Comparison were used to compare the means of each nutrients in FFR meals.

Results: Majority (60.7%) of subjects who eat out on an average of 4-6 meals per week, were aged 18-39 years and comprised more of females and singles. The employed frequently eat out (≥ 7) than the unemployed and was also found to be statistically different (p= 0.047). More subjects purchased foods from street vendors for all the eating occasions, preferred take-away restaurants and fried rice was the most common eat out meal. Perceived convenience of EO was the main reason stated by subjects, plus reasons giving by males was statistically different from that of females. Majority (69.6%) of subjects engaged in moderate PAL. The prevalence of overweight/obesity, diabetes and hypertension was 62%, 18.7% and 19.3% respectively. EO was significantly related to BMI, FBS and BP (All $p<0.05$). BMI was found to be related to diabetes, hypertension and age ≥ 40 was found to be significantly associated with being overweight / obese ($p=0.021$). However, it was unlikely for convenience to be a predictor of EO as compared to other reasons for EO.

The nutrient profile of FFR meals varied across recommendations, and majority were higher in fat, energy and sodium. Per 100g of meals, protein, carbohydrate, energy and fat ranged from 6.84-15.03g, 9.41- 37.02g, 86.11- 333.94kcal and 0.81- 27.94g respectively. Ash content ranged from 0.58- 1.89g with sodium, potassium and iron being in the range from 133.93- 516.83mg, 38.47-490.32mg and 0.49- 4.18mg respectively.

Conclusion: Policies and interventions governing EO must be established and enforced since it is evident that EO was associated with adverse nutritional consequences and FFR meals were higher in health risk factors including sodium, fat and energy.

DEDICATION

This thesis work is dedicated to the Lord Almighty and also to my beloved parents, Mr Ebenezer Nunoo and Madam Diana Quaye for their immense love and support.

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LIST OF ABBREVIATIONS

AMDR	Acceptable Macronutrients Distribution Range
BMI	Body Mass Index
CI	Confidence Interval
CVDs	Cardiovascular Diseases
DBP	Diastolic Blood Pressure
DV	Dependent Variable
EO	Eating Out
EPIC	European Prospective Investigation into Cancer and Nutrition
FAO	Food and Agricultural Organisation
FFR(s)	Fast Food Restaurant(s)
GPAQ	Global Physical Activity Questionnaire
IV	Independent Variable
LPA	Laboratory Proximate Analysis
MET	Metabolic Equivalent
MLIC	Middle to Low Income Countries
NCDs	Non- Communicable Diseases
NHAS	Nutrition Health Assessment Survey
OR	Odds Ratio
PA	Physical Activity
PAL	Physical Activity Level
RDA	Recommended Dietary Allowance
SBP	Systolic Blood Pressure
T2DM	Type II Diabetes Mellitus
WHO	World Health Organisation

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background Information

The implications of nutritional habits on the health and wellbeing of an individual cannot be overemphasized. Over the last two decades, overweight/obesity have swiftly escalated as one of the leading causes of adult morbidity and mortality in several populations around the world. Overweight/ obesity was perceived to be exclusive to the affluent, but it is a common friend to both the rich and poor in middle to low income countries (MLIC). Globally over 2.1 billion people worldwide are currently estimated to be either overweight or obese, and it is predicted that about 2.16 billion adults will be overweight, and 1.12 billion obese by 2030 (Kelly *et al.*, 2008; Smith & Smith, 2016). A report by Ofori-Asenso *et al.* (2016), indicated that nearly 43% of Ghanaian adults are either overweight or obese. With the unprecedented continuous rising levels of this menace among most age groups, the institution of the double burden of malnutrition now poses a major challenge to public health, social protection and economic policies in MLIC.

Consequences of overweight on the health of an individual can be immediate or have aftermaths in the later stages of a person's life cycle. Increasing incidences of non-communicable diseases such as hypertension, type II diabetes mellitus (T2DM), hyperlipidaemia, cardiovascular diseases (CVDs), cancer and premature death are the major effects of overweight.

The characteristics of nutrition transition are increases in physical inactivity and changes in dietary habits. In addition to these, genetic factors as well as the increasing availability of high fatty and

energy dense foods in the food environment are the major contributors to overweight (Hruby *et al.,* 2016). Moreover, the shifts in the dietary habits of individuals have resulted in the revolution from mainly traditional meals to the westernized diets. Paralleled with changes in socio-demographics, this revolution have been important drivers to the reliance on meals prepared and consumed away from home, in different populations and mostly in MLIC such as Ghana. Consumption of foods prepared away from home have been implicated significantly in its association with their impact on BMI and thus the rising rate of overweight and obesity (Seguin *et al.*, 2016).

Eating away from home, or eating out (EO) has seen an immense landscape in most urban areas with the emergence of restaurants, street foods, "*chop bars*" and fast foods restaurants. Studies over the years have shown that foods consumed from these places, emphasis on fast food restaurants are larger in portion sizes and higher in energy density but with lower nutrient density and fibre as compared with cooked home meals, marking them as unhealthy (Alkerwi *et al.*, 2015; Lin & Guthrie, 2012; Nago *et al.*, 2014; Powell *et al.*, 2012). Contribution to the daily total calories from EO has increased in most countries. Lin and Morrison (2012), recorded that EO provided about 31% of total calories to the average US adult.

Healthy eating is a main concern for all and therefore undoubtedly, EO plays an important role in the quality of diet and health of an individual. Reasons for EO however vary from individual to individual. Accumulating evidences suggest that, other reasons may be attributed to the increasing EO habits among Ghanaians. These include increasing purchasing power, time constraint,

urbanization, rising levels of women in the workforce (Lipoeto *et al.*, 2012; Naidoo *et al.*, 2017) as well as convenience and media influence. These factors among many others may be the factors influencing EO, which is also concomitant with the increasing overweight/obesity levels and health implications.

1.2 Rationale

Understanding the EO lifestyle, nutrition and health situations among Ghanaians is important. In contrast to the accumulation of vast knowledge on EO situational lifestyle and its effects in different populations, Ghana's EO situations and potential implications are not major concerns for researchers, and therefore have not been explored to further on knowledge. To date, there has been very little information on the importance of eat out foods especially from fast food restaurants (FFRs) in the diet of the Ghanaian population. Information is widely captured on street foods and restricted to its sanitary conditions, income generation, characteristics of street food vendors and consumers and kinds of foods sold (FAO, 2016). Few studies have specifically assessed the contribution of prepared foods from FFRs in Ghana to the food and nutrient intakes of adults. There are few records of the number of eat outs and literature have suggested strongly that, increased density of FFRs and other eat out sources have great influence on one's dietary habits. Individuals associated with EO, tend to have poor dietary lifestyle habits (Larson *et al.*, 2011) with increased BMI, in relation to several health consequences. Increasing BMI in itself is a nutritional challenge where studies have established BMI and its associated relationship with decreased PA, T2DM, hypertension, cancer and other cardiovascular diseases (Hruby *et al.*, 2016). However it is

not established if EO remains largely a significant driver of increasing BMI among Ghanaian adults.

If this knowledge gap continues to be overlooked, it makes planning nutritional interventions and advocacy geared towards healthy EO lifestyle among the ordinary Ghanaian adult difficult and thus the general health and economic growth of the country in long term may continue to be a problem to grapple with. It is against this background that this study investigated the lifestyle behaviours, nutrition and health implication of EO among Ghanaians. The findings of the study will establish associations between EO and diet related non communicable diseases as well as the nutritional quality of foods patronized from FFRs. It is also anticipated that the findings of this study will project and spark the need for the interest of researchers in identifying and addressing the nutritional knowledge gap on EO and thus, aid in the development of interventional strategies to address nutrition and health issues related to EO wheeled towards the wellbeing of Ghanaian adults.

1.3 Conceptual Framework

EO is a plausible driver of the increasing overweight/obesity prevalence and concurrent development of non-communicable diseases (NCDs). A holistic theoretical framework is needed to understand the factors that influence EO and further promote EO research recommendations as well as inform on appropriate nutritional interventions for policy decision makers.

Figure 1.1 maps out the study framework depicting the directional interaction between main constructs; factors that promote eating out and the two main implications on dietary and health.

Decision regarding EO are influenced by factors that can be categorized into individual and environmental factors. Individual factors comprise socio economic status, food preference, psychological, leisure, socio-demographic and sensory appeal. On the other hand religion, cultural, community characteristics, family influence, peer influence and media advertisements are some environmental stimuli of EO. The diagram identifies increased [portion size, caloric intake, total fat and sodium] and decreased micronutrients as immediate dietary implications which have direct impact on the health of an individual, resulting in conditions including increased BMI, hypertension, T2DM, CVDs and cancers. All individual and environmental factors was assessed as well as dietary implications. The health implications assessed in this study however, are increased BMI (overweight/obesity), hypertension and T2DM.

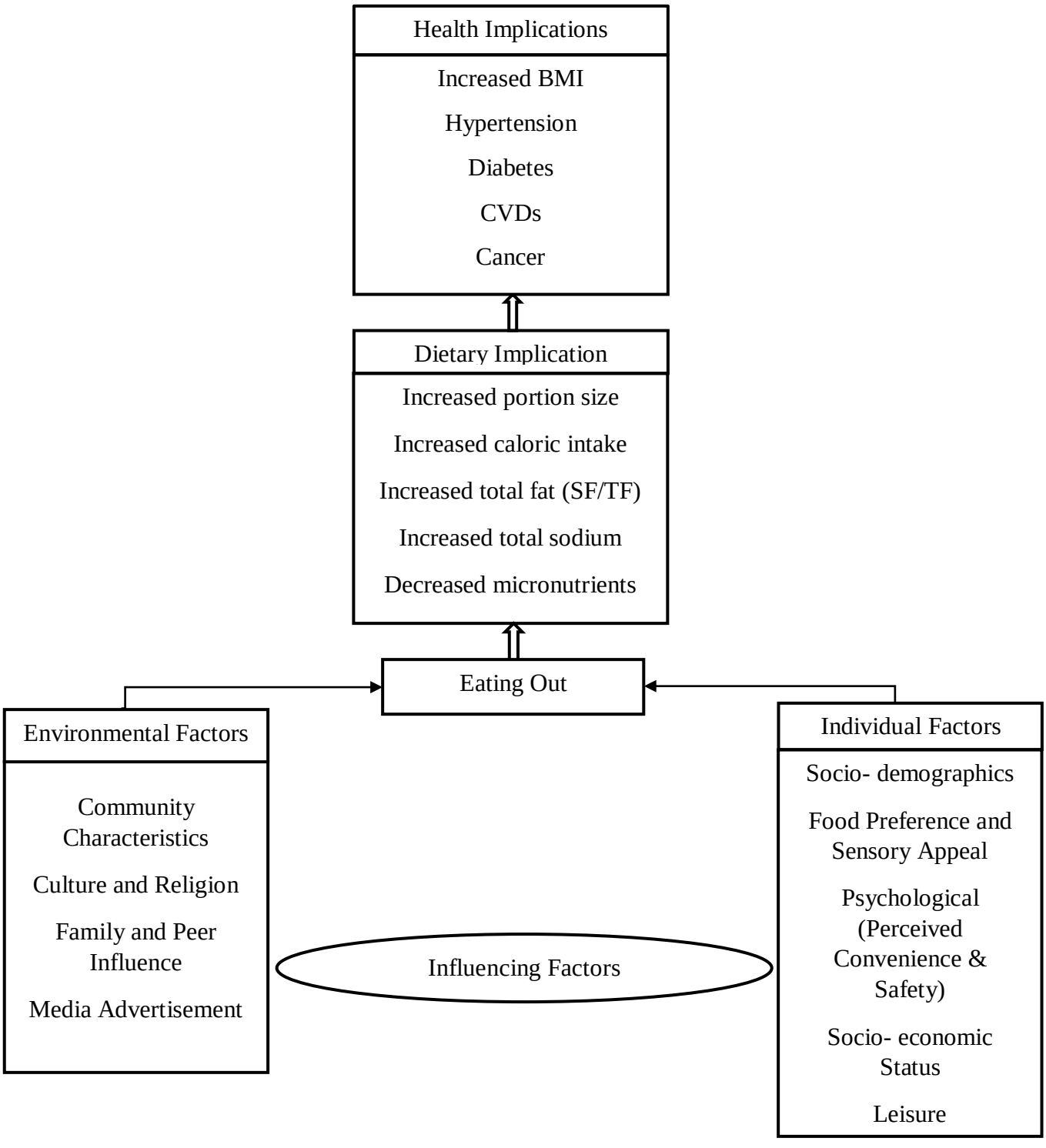


Figure 1.1 Conceptual Framework on the Factors Influencing Eating Out and Implications

1.4 Objectives

1.4.1 Main Objective

The main objective of the study was to investigate factors associated with EO lifestyle behaviours; assess the nutrient content of some selected foods from FFRs in Accra; and their associations with selected health indicators among Ghanaians.

1.4.2 Specific Objectives

i. To investigate the EO lifestyle among Ghanaians.

ii. To explore and identify the main reasons that influence EO among subjects.

iii. To determine the Body Mass Index (BMI) levels, Fasting Blood Sugar (FBS), blood pressure (BP) levels, Physical Activity Levels (PAL) and their prevalence among subjects.

iv. To determine the relationships between some EO lifestyle behaviours, PAL, selected health indicators among Ghanaians.

v. To assess the nutritional profile of different meals sourced from FFRs and compare to recommendations and Acceptable Macronutrients Distribution Range (AMDR).

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Food Environment and Dietary Habits

Optimum nutritional status, which is the primary purpose for obtaining nourishment through food is achieved when food is consumed in balanced proportions, and at the right time and environment. Our nutritional status and in turn, health status therefore depends on the kind of foods we eat. The kind of foods we eat are influenced by our food environment and adopted dietary habits.

Food environment (nutrition environment) generally is the presence of all desirable foods which are available and accessible to people to obtain adequate nourishment for a healthy life. It includes conditions that influence ones' food choices and nutritional status (Swinburn *et al.*,2013).As stated by Rideout *et al.* (2015), it comprises of the physical, social, economic, cultural, and political factors that impact the accessibility, availability, and adequacy of food within a geographic area. The food environment differs depending on the context and can be categorized in many ways to include food resources available in home, school, worksite, community and information environment (Glanz *et al.*, 2005; McKinnon *et al.*, 2009) The concept of a food environment at the community level include restaurants, fast food joints, street food stalls and local "*chop bars*".

On the other hand, dietary habits of an individual refer to the dietary intake data comprising of information about the usual daily food intake, sources of food, eating pattern and usual nutrient intake, which can be said to be either healthy or unhealthy over a period of time (Mouty, 2016).

Simply put, dietary habits refer to how we eat, where we eat, what we eat and why we eat it. The food environment is clearly linked to our dietary habits where it determines what foods is available, convenient, and accessible to consumers at a given time and it plays a major role in food choices and inform dietary habits, affecting the quality of their diet and diet- related health outcomes. Also supported by Hawkes *et al.* (2015), the food environment is composed of daily prompts which push consumers' food choices in particular directions, and thereby contributing to dietary habits. Based on recent work by Mouty (2016), it can be emphasized that, the nutrition environment at the community level is one external factor which contribute immensely in promoting the risk of developing unhealthy dietary habits, including EO which is noted to be increasing rapidly in all populations worldwide.

Although there are potential barriers to the incorporation of healthy EO into healthy dietary habits, it is possible to eat healthy when EO. To promote healthier dietary habits of a population, there is a need to shift the emphasis from individual determinants toward environmental characteristics. These, including increasing prevalence of exposure to various food outlets (obesogenic environment) and assessing the nutritional quality of foods purchased from these outlet that promote frequency of EO and poorer nutritional health respectively.

2.2 Definition of Eating Out

Consuming foods not prepared at home basically defines eating out. EO may also be termed as out of home eating or eating away from home. One significant problem exist within literature regarding the agreement of a clear definition concept of EO which makes comparison among

majority of studies difficult (Bezerra *et al.,* 2012). While some studies report EO as those foods consumed away from home irrespective of where it is prepared (Orfanos *et al.*, 2007; Vandevijvere *et al.,* 2017), others focus on EO as food prepared or purchased outside the home irrespective of the place of consumption (Kant & Graubard, 2004; Lin & Guthrie, 2012; Morland & Evenson, 2009; Burns *et al.,* 2002). An example of the former definition is food prepared at home and consumed at work and the later, is purchasing and consuming foods from restaurants, fast food joints, *chop bars*, street foods vendors and other food outlets and consuming them either at home, place of purchase or elsewhere.

Following these definitions of EO: in terms of where food was obtained, what food was obtained and who prepared the food, this present study defines EO as the consumption of any meal with the exception of snacks prepared and purchased from any food outlets especially, restaurants, fast foods, street foods and "*chop bars"* regardless of the place of consumption.

2.3 Determinants of Eating Out

2.3.1 Socio demographics Trends of Eating Out

The increasing phenomenon of EO across the world is now a routine part of consumers' food habits, purchase behaviours and consumption pattern (Burger Chakraborty *et al.*, 2016; Boo *et al.,* 2008). This situation may be attributed to some socio demographic characteristics of a population.

2.3.1.1 Eating Out and Educational Level

There is increase in the frequency of EO with increasing level of education. Ljubičić *et al.* (2017) established a correlation between higher education and increased frequency of EO among Croatian adults which unexpectedly correlated with a higher consumption of healthy food ($p<0.001$). The authors explained that the first correlation may be owed to a generally higher income and less time to cook and the second to being better informed about healthy food choices. Another study of Malaysian adults found that subjects who had tertiary qualifications reported a significantly higher prevalence of fast food consumption than those of secondary levels (64.5%, $p<0.001$) (Abdullah *et al.*, 2015).

Naska *et al.* (2015) in their study found that, the probability of substantial EO was also higher among both men and women of higher education such as university compared to those with no or only completed primary education. [(OR 1·34, 95% CI 1·13- 1·59 for males and (OR 1·62, 95% CI 1·40- 1·87) for females]. Although the relationship was not significant, a similar trend in US was found among university college graduates as compared to those with high school for both females and males with EO frequency of ≥ 5times per week (15 % versus 7% and 25% versus 15% respectively) (Seguin *et al.*, 2016).

2.3.1.2 Eating Out and Age

With respect to adults ages and EO frequency, some studies have reported that early adulthood is characterised by increased EO which decreases as age increases in adulthood (Kant & Graubard, 2004; Kearney, 2010; Orfanos *et al.*, 2007). A noted trend by Burger Chakraborty *et al.* (2016) indicated that, there was a higher tendency to eat out among Philippians adults age group 25 to 40

years than 41 to 55 years. Another study by Srividhya (2014), showed that although there was no significant difference between adult age and EO frequency, adults between 20- 30 years had the maximum cumulative frequency of EO. According to Bezerra and Sichieri (2010), the highest frequency of EO occurred in the 20- 40 years age group. Despite these generational effects on EO, patterns might change as individual grow older due to varying needs at different life stages (Drescher & Roosen, 2013).

2.3.1.3 Eating Out and Gender

The role of gender is considered important in predicting EO among individuals and population, as many studies have found it to be a strong predictor to EO. Works of Kant & Graubard (2004); Orfanos *et al.*(2007); Bezerra & Sichieri (2010) and Vandevijvere *et al.* (2017) have reported that overall, men rather than women tend to frequently obtain their food from EO. Seguin *et al.* (2016) also noted that, significantly higher proportion of males ate out 5 times or more meals per week than females (22% versus 12%; $p< 0.001$). Contrary to this, some studies found no statistical difference between gender and frequency of EO (Pereira *et al.*, 2005; Bes-Rastrollo *et al.*, 2010; Duffey *et al.*, 2009).

2.3.1.4 Eating Out and Marital Status

The relationship between marital status and EO published by several studies suggests the fact that unmarried/ single adults have the greater likelihood of EO frequently than married, divorced, separated or widowed (Naska *et al.*, 2015; Srividhya, 2014; Tiwari *et al.*, 2017). Dave *et al.* (2009), found that the frequency and sources of EO differed substantially by marital status where, singles

seek food outside their homes more than those who are married. The culture and norms of marriage provides a commensal relationship and encorages eating at home (Lee, 2008).

2.3.1.5 Eating Out and Employment

In general, the employed are significantly more likely to eat out ($p< 0.05$) and EO frequency was found to be higher if the person responsible for meal preparation is employed.(Tiwari *et al.*, 2017; Verlegh, 1999). Specifically among women, known to be providers of meals for their family, a number of studies have indicated that employment status of women contribute to EO by their families (Fraikue, 2016; Tian *et al.*, 2016). Some earlier studies however did not find a positive correlation between employment status of the wife and EO (Darian & Klein, 1989; Kim, 1989).

2.3.2 Food Preference and Sensory Appeal Impact on Eating Out

Food choice is largely impacted by sensory appeal and this determines the type of food consumed and place of food purchased. In terms of appealing to the human senses, taste, aroma, external look and feel, presentation of food and ambience are extremely important in decisions to eat out and places to eat out (Srividhya, 2014).

2.3.3 Income Status Influence on Eating Out

Earning income is a strong pivotal to EO. Employment status is directly linked to income status of an individual and in turn the frequency of consumption and variations in the places of eat outs (Larson *et al.*, 2011; Minaker *et al.*, 2013). According to a Ghanaian study to determine reasons for EO, Fraikue (2016) established the fact that high income earners are the most patrons of eat outs. In contrast, Block *et al.* (2004) study revealed that eat outs, precisely fast foods is popular

among low income earners. Cost effectiveness of meals purchased was regarded as a factor which contributed to EO among Philippines nationals (Burger Chakraborty *et al.,* 2016).

2.3.4 Psychological Factors Influence on Eating Out

Ideally, the purpose of most eat out establishments is to provide quick and easier meals which saves time from long hours of cooking. Reasons popular among eat out consumers is that EO is more convenient and saves time. (Larson *et al.*, 2006; Jabs & Devine, 2006) also stated that in addition to time constraints, limited cooking skills is another perceived barrier to consuming foods prepared from home and thus encourages frequent EO among individuals. Some individuals also perceive EO as safe and healthy, but from literature it is a fact that majority of foods from eat outs are poor in nutritional quality (Lin & Guthrie, 2012). A key benefit of eating in restaurants is that it provides the opportunity to try something that normally we wouldn't cook or serve ourselves (Srividhya, 2014).

2.3.5 Leisure and Eating Out

Burger Chakraborty *et al.* (2016) stated in her study with colleagues that, most eat out establishments are becoming important leisure locations. They further explained that entertainment in the form of leisure is one of the key factors associated with EO. Though EO is no longer a special eating occasion, another study revealed that, to eat out now serves as a leisure among most people and offers them the opportunity to spend time with friends and family outside the home (Srividhya, 2014). Furthermore, EO provides some form of fun and change in monotonous eating habits.

2.3.6 Community Characteristics and Eating Out

Theoretically, the main contributors to the current EO situation worldwide is the easy accessibility and availability of various forms of eat outs within a population. Data supporting this hypothesis is however mixed. Minaker *et al.* (2013) established that nearest distances (accessibility) to fast food eat out has a strong association with EO. In fact, the higher the number of eat outs found within a specific environment, the higher the prevalence of EO among the indigenes. Another measure of the community characteristic that impacts EO is the availability of different types and sources of eat outs, as well as varieties of offered meals to suit the consumer's EO needs.

2.3.7 Culture and Religious Influence on Eating Out

Culture is a way of life and can be defined as a set of characteristics, attitudes, behaviours, and values common to a group of people that helps them decide what to do and how to go about it (Goodenough, 1971). Accordingly, culture is a major determinant affecting the types of food that a person considers acceptable to eat in terms of their sensory appeals (Atkins and Bowler, 2001; Logue, 1991; Prescott *et al.*, 2002). EO has been termed as being a part of our cultural heritage, which is manifested during celebrations of special events like birthdays, wedding anniversaries and promotions (Jones, 2002). Therefore it can be said that culture has shifted notably in terms of eating behaviour where it was formally common to consume foods prepare from home, but currently EO is more common among the adult population. Adoption of the Western culture by most Ghanaians is a driving force to the frequency of EO.

Religious background is also considered as crucial determinants of the kinds of eat out meals consumed, frequency and places of eat out. When certain foods and eating times are prohibited by

religious affiliations (e.g., Islam), it generally impact on food consumption, particularly when preparation methods are mandated (e.g., halal) or fasting are observed (e.g., Ramadan) (Packard & McWilliams, 1993). Resulting from these practices and restrictions are stable and rigid food habits (Khan & Hackler, 1981) and thus, not just affecting food consumption but EO to a large extent.

2.3.8 Family and Peer Influence on Eating Out

Family food decisions highly impacts on EO by being the provider of a kind food while also influencing attitudes and values surrounding EO such as having family time out of home. Naidoo *et al.* (2017) stated in their submission that children may initiate the family's decisions to eat at Western fast-food restaurants. They also indicated that families tend to eat out frequently with the view that it caters for the preference of individual members of the family.

Individuals who spend a substantial amount of their time out with their peers tend to eat out often. EO is often an important part of socializing with family and peers, as reported in a study by (Rydell *et al.*(2008) as a reason for EO at restaurants among young adults.

2.3.9 Media Advertisement and Eating Out

A main environmental stimulus to EO is the advertisements of places of eat out, where the consumer is mainly exposed to these variables well before consumption occurs. Naturally, some people are more responsive to food advertisement in forms of special and limited promotion and discounted meals than others and thus, a key to the frequency of individuals EO. Attesting to the

fact that media has promoted the frequency of EO because people get influenced by continuous advertisements viewed is reported by Mintel report (2007) as cited in Davis *et al.* (2012).

2.4 Patterns of Eating Out

Dietary habits is basically related to ones needs and it determine the patterns of EO which can be identified and categorized in terms of meal time (i.e. breakfast, lunch and supper), meal types, sources of meals (Ali, 2003; Mat, 2003; Baweh, 2004) and frequency of consumption. In terms of meal time, D'Addezio *et al.* (2014) stated that the frequency of EO is greatest during lunch and then dinner. For breakfast, places of eat out operating in the morning are places for consumers to take their breakfast or just buy the food to take away to workplace or for family members at home. At lunch and dinner, eating places are mostly crowded by workers and family respectively. Data results from a Korean study supports the status of EO during lunch being higher (≥40%) than that for breakfast or dinner between 1998 to 2012 (Kwon & Ju, 2014). Naidoo *et al.* (2017) reported that 70.6% of their study subjects usually eat out for lunch, followed by dinner (32.8%) and then breakfast (30.3%).

The sources of meals is related to food businesses available in the environment which are diverse and easily accessible like sit in restaurants, FFRs, street foods and "*chop bars*". Meal type ranges from healthy meals to junk foods as provided by the sources and based on preference, sensory appeal and also cost in most EO situations. Among several others, these meals commonly include fried rice, fried or grilled chicken, fried potatoes (French fries), burgers and *jollof* rice, *banku*, *kelewele*, grilled tilapia, pizza and vegetable salad.

Variations of EO consumption frequency exist in terms of weekly EO. Similar frequencies from literature ranges from once per week to more than 5 times per week. A study (Paeratakul *et al.*, 2003) stipulated that approximately 37% of US adults eat fast food at least once in every two days while another study observed that among Australians, 28% eat out at least twice per week (Smith *et al.*, 2009). Per number of meal occasions per week, EO may range from over 4 meal times per week to more than 15 meal times weekly.

2.5 Global Trends of Eating Out among Adults

The prevalence of the frequency of EO across the world differs from one study to the other. This may be due to the fact that different studies use various study designs, varying sample selection methods and different criteria for EO definition.

Consumption of street foods is popular among different populaces. FAO (2007) cited by Singh *et al.* (2016), stated that approximately 2.5 billion people consume street food. A number of studies have shown increasing consumption of eat out fast foods/ takeaway and restaurant food consumption worldwide, especially in Europe, US and Australia.(Orfanos *et al.*, 2007; Guthrie *et al.*, 2002; Smith *et al.*, 2009). In US, 41% and 25% of adults were reported between the year 1999 and 2000, to eat out at least weekly and daily respectively (Kant & Graubard, 2004). Another study based on UK population indicated that one-quarter (25%) of the adult population ate out at least once a week.(Adams *et al.*, 2015).

According to Claro *et al.* (2014), there was a significant increase in the total food expenditure on EO from 22.2% to 27.9% between 2008 and 2009, among Brazilians which is an indication to the increase in EO. The prevalence of EO in Brazil was 35.1% (Bezerra & Sichieri, 2010).

EO expenditure increased from 8% in 1972 to 32.5% in 1999 in Greece, while Turkey reports indicates that EO consumption has more than doubled from 7% to 15% between 1994 and 2000 (Lazaridis & Drichoutis, 2005).

The Intermedia Group (2018) in their EO statistics reported that over 24 million Australians eat out on an average of two to three times a week. In an Asian study, the Malays reported significantly higher prevalence of EO among adults (86.8%, p= 0.017) compared to the Chinese and the Indians (Abdullah *et al.*, 2015).

Consumption of food away from home have risen not only in developed countries but also in developing countries in general. Lopriore & Muehlhoff (2003), reported in an African study that in cities such as Bamako, Accra and Dakar, most individuals, irrespective of age and socio-economic status eat out in addition to home-prepared family meals.

2.6 Eating Out Trends in Ghana

There is paucity of data on the EO situation in Ghana with regards to frequency, types of meals, sources of eat out and contribution to nutritional quality of Ghanaian adults. There is an assertion that Ghana's EO situation may equally be escalating like other countries due to nutrition transition trends and the adoption of foreign eating culture by majority of Ghanaians in the cities along with significant changes in socio- demographic profile. Ghana's eat out industry is still developing

unlike countries such as South Africa and Egypt with well-developed eat out food chain establishments.

Ghanaians now have unprecedented access to heterogeneous eat out outlets and establishments. Among Ghanaian adults, EO is mainly from the informal street food vendor, traditional eateries ("*chop bars*") beside the formal sectors like full service restaurant and fast food restaurant. There is evidence that the prevalence of eat out establishments specifically FFRs, has increased in Ghana as stipulated by Omari (2014). The common types of restaurant are the full service (sit- in), with fast food/ takeout options, and FFRs where food can be eaten where it is purchased or taken away. In same submission by Omari (2014), about 60% of Ghanaian consumers obtained fast food mainly from restaurants and often take it out because lack of time to sit and eat; discomfort in EO and or using cutlery instead of fingers; the need to share food with household members and dislike for restaurant environment.

One main development in Ghanaian EO culture is the hybridization of local food and westernized food. In this regard, a trend has emerged where fast foods are trickling down from restaurants to street food and "*chop bars*". Omari *et al*. (2013) observed the existence of check- check, which is described as a copycat fast food street food vending operation that is mainly run by men, and the usual popular fast food meal being fried rice served with fried chicken, pepper sauce (*shitor*) and coleslaw.

A previous study indicated that most households relied heavily on eat out meals, with the urban food expenditure patterns in Accra characterized by the heavy dependence on purchased street

foods (Maxwell *et al.*, 2000). Maxwell *et al.* (2000), also reported that majority of these foods include breakfast foods such as porridge, and lunches, which generally consist of a prepared staple food dish and a soup or stew which may either be from street food vendor or chop bar. A recent study on Ghanaians in Accra consumption of fast foods reported that, about 51% ate fast food only at lunchtime, 30% ate it at suppertime, and 16% between lunch and supper (Omari *et al.*, 2013).

EO consumption among Ghanaian adults in Accra may be related not only to income but also to other factors, including whether women in the household work, time constraints, convenience, income fluctuations, proximity to markets, and socio- demographics (Maxwell *et al.*, 2000).

2.7 Reasons for Eating Out

There are multitudes of reasons to why different individuals eat out. Both past and recent studies have reported several reasons for EO. Among the reasons for EO include convenience, lack of time (time saving), lack of alternative/ home meal options, cost, sensory appeal (taste and aroma), reduced difficulty of preparing food, women employment and perceived nutritive value (health reasons) (Davis *et al.*, 2012; Fraikue, 2016; Robson *et al.*, 2016; Rydell *et al.*, 2008; Srividhya, 2014; Warde & Martens, 2000).

Convenience as a reason for EO has been predominantly documented (Robson *et al.*, 2016). Some women also emphasized the convenience of EO in relation to busy work schedules and lack of time. Some described home cooking as being hard to achieve when employed than when unemployed (Naidoo *et al.*, 2017). In an Indian study, the lack of options for cooked home meals, special occasions and leisure were reported as reasons for EO but majority (90.7%) of participant

agreed that relaxing from a hard day at work and spending time with friends/family are the reasons for EO (Srividhya, 2014). This agree with works of Abdullah *et al.*(2015), but on the contrary, Rydell *et al.* (2008) observed that among the least reported reasons for EO is socializing with family and friends and the highest in terms of convenience (quick and easy access) (92%). The notion that "it is cheaper than home-prepared food" is another reason people buy fast food (Seguin *et al.,* 2016). Lack of time for food preparation and greater disposable income has been cited as a possible reasons for the greater reliance on eat out foods in employed persons (Todd, 2014).

Fraikue (2016) in a Ghanaian study, stated convenience as the main reason for EO and linked the reasons for EO to socio- demographic of the study sample where it was also observed that among the four themes developed to determine reasons for EO, 31.4% males eat out fundamentally for convenient reasons and 27.1% females eat out for social reasons. In another Ghanaian study, it was reported that 73% of 400 consumers who often visited the restaurant do so in the company of others including spouses, friends, co-workers, business partners and family (Omari *et al*, 2013). They further observed that this group of Ghanaians would sit, eat, and chat in the restaurants when they have time or on special occasions such as birthdays, festive seasons or when on a date. It can therefore be deduced that Ghanaians eat out for social reasons and other specified reasons.

2.8 Nutritional Need of Adults

Adulthood can be defined as the long life phase after adolescence characterized by maintenance of maturity in physical and mental development. Nutritional needs of an adult from 18 – 60 years is to provide optimum nutrition coupled with adequate PAL while reducing the occurrence of diet related health concerns common during adulthood such as overweight and obesity, T2DM and

hypertension (CVDs risk factor). The nutrients of interest for this study are protein, fat, carbohydrate, sodium, potassium and iron.

The energy requirement of an individual depends on several factors including sex, body weight, total energy expenditure lean body mass and basal metabolic rate. The average recommended energy intakes for adults is 1800- 2600kcal depending on age, gender and PAL (United States Department of Agriculture (USDA), 2018). Since there is no uniform agreement on which dietary approach is the best and effectual to moderate the NCDs risk, the acceptable macronutrient distribution range (AMDR), defined as the range of intakes from macronutrients for energy that is associated with a lower risk of chronic diseases whiles providing adequate intakes of essential nutrients is adopted. Generally, the AMDR for total energy intake from fat, carbohydrate, and protein for adults are 20–35%, 45–65% and 10–35% respectively.

Recommended Dietary Allowance (RDA) is the average daily level of nutrient intake adequate to meet its requirements in all healthy (97-98%) persons. For the macronutrients, the recommended level of protein intake (RDA) per day is 0.8 g/kg body weight. On the average, 46g/ day and 56g/day of protein are needed for women and men respectively. Carbohydrate is the primary source of energy to the body. RDA for carbohydrate is set at 130g per day. Fat is essential functions including facilitating the absorption of fat soluble vitamins. The RDA for fat is set at 30g/day. The AMDR for fat recommended for preventing NCDs is set between 15%- 30%.

Sodium (Na) is an essential mineral found in the extracellular fluid and it is responsible for maintaining blood volume, nerve impulse transmission, active transport, muscle contraction, acid-

base balance and ensuring the normal functioning of cells (WHO, 2012). Average sodium consumption required is 2g sodium/day (equivalent to 5g salt/day) but not more than 1.5g is recommended in persons with NCDs. The average sodium intake of a Ghanaian is 2.5g/ day. Potassium (K) is the major intracellular cation mineral involved in similar functions as sodium. In adults, the recommended intake is not less than 3,510mg/day (WHO, 2013). Iron is an essential micronutrient responsible for the transportation of oxygen in the bloodstream, synthesis of deoxyribonucleic acid (DNA), and the prevention of iron deficiency anaemia (Abbaspour *et al.,* 2014). In adult men recommendation for iron is intake not less than 11.4mg/day, whereas intake not less than 24.5mg/ day is recommended females.

2.9 Dietary Quality Characteristics of Eating Out Meals

Dietary quality is described as having at least two basic components: adequacy of health promoting foods, food groups and nutrients; and moderation of foods, food groups and nutrients linked with poor health outcomes (Guenther *et al.*, 2008).

The substantial increase in EO and number of eat outs offering different types of meals, reinforces concerns about the nutritional quality of these meals. The dietary quality of meals consumed during eat out regardless of eat out source have been implicated in several studies as being large in portion sizes with a single meal often approaching or exceeding an individual's daily energy requirement. They are however poor in quality and commonly known as empty caloric food. This is due to eat out meals being rich in sugar, salt and fat, but lacking important micronutrients, vitamins and fibre (Larson *et al.*, 2011; Ledikwe *et al.*, 2005; Lin & Guthrie, 2012; Ziauddeen

et al., 2017). Meals linked to EO is of a high interest due to their total fat composition, portion size, caloric content, salt and sugar and the fact that these constituents can lead to the development of diet related diseases (Steyn *et al.,* 2013). The nutrient composition of eat out meals could be due to varied use of ingredients and methods of preparation/processing (Tee *et al.,* 1989; Scherr & Ribeiro, 2013). Mancino *et al.* (2009), documented that for meal occasions, eating lunch and dinner away from home also reduces diet quality.

Foods from eat outs are associated with more total dietary energy, more fat and, and more sodium (An, 2016). Taking this hypotheses into consideration, it can be deduced that meals from Ghana's fast food and full service restaurants are high in fat, energy and sodium but low in essential micronutrients. A previous study by Steiner- Asiedu *et al.* (1998) found that eat out (fast food) has some properties that make them nutritionally beneficial and at the same time properties that provides health concerns for consumers in Ghana. Moreover, Omari (2014) reported that FFRs depending on the type of meal usually contains high amounts of carbohydrate, protein, and at least a vegetable making them capable of meeting the energy, protein, and micronutrient needs of consumers and hence improving their health.

2.9.1 Energy and Energy Density

The daily total energy consumption (kcal/ day) from meals has increased and EO is a contributing factor. A review of EO and its association with dietary intake (Lachat *et al.*, 2012), revealed through analyses of trends that there has been a significant increase in the energy contribution from eat out meals during the last decades and it was positively associated with total daily energy intake

among adults. In the US, Lin & Guthrie (2012) report indicated that more than a third of the daily energy intake was obtained from EO, whereas a Belgian study found that 35% of individuals consumed at least 25% of their daily caloric intake from EO (Vandevijvere *et al.*, 2009).

It was established between 2008-2009 that individuals in Brazil who reported consistently eating away from home tended to have higher total energy consumption in the diet (Claro *et al.*, 2014). Based on the European Prospective Investigation into Cancer and Nutrition (EPIC) study, the average contribution of EO to total daily energy intake ranged from 40.4% in men and from 36.9% in women across Europe (Orfanos *et al.*, 2009). 877kcal was reported as daily energy intake from fast food between 2007- 2008 (Powell *et al.*, 2012). Mancino *et al.* (2009), also estimated that eat out meals add 130 calories to the total daily calories, with EO during lunch and dinner having the largest effect on daily total calories. A Ghanaian study (Maxwell *et al.*, 2000), reported that a large share of total calories, about 62% comes from eat out foods intakes. The total energy of a meal can be estimated from total fat, protein and carbohydrate which produces 9kcal/g, 4 kcal/g and 4kcal/g respectively in terms of energy value (FAO, 2003), and this generally should be in terms of the AMDR.

Energy density of foods is calculated as total energy consumed divided by the total quantity of food consumed, expressed in kcal/g. Jaworowska *et al.* (2013), supports the hypothesis that the energy density of foods is a significant determinant of energy intake. They also suggested that the food weight, thus the energy density, may increase or decrease energy intake independent of the macronutrient content of the diet.

2.9.2 Carbohydrate

Evidence from the EPIC study with respect to carbohydrate intake suggest that EO was found to contribute more to total intake of sugar and starch in most European countries (Orfanos *et al.*, 2009). Contrary to this, eat out meals lower in carbohydrates was reported by Kearney *et al.* (2001) in a study using UK nationally representative data.

Some studies have found associations of the contribution of carbohydrate to total eat out energy. Gorgulho *et al.* (2013) documented that, in expressing carbohydrate in percentage of energy (kcal), ideally it must provide between 55%and 75% of total energy intake. Carbohydrate contribution to energy obtained from eat out meals was generally below international recommendation (Orfanos *et al.*, 2009). It is likely that the carbohydrate content of eat out meals from Ghanaian FFRs may contribute higher than recommended intakes for carbohydrate.

2.9.3 Protein

Eat out meals' protein content shows no consistent trend in literature. Previous studies have shown that FFRs meals provide adequate amount of protein, where the daily proportion of protein from EO and it contribution to energy has increased (Kwon & Ju, 2014). Steiner- Asiedu *et al.* (1998), confirmed that fast foods in Ghana are high in protein making consumers who eat them likely to meet their recommended intake for protein. Kim *et al.* (2014) also confirmed that the intake of protein is highest during EO.

Orfanos *et al.* (2009), found that although EO contributed less to protein intake than fat, its contribution to energy was within recommended ranges. Kearney *et al.* (2001) also showed that eat out meals contained a lower proportion of protein.

2.9.4 Fat

Higher consumption of total fat from EO has widely been reported (Auchincloss *et al.*, 2014; Lin & Frazao, 1997; Guthrie *et al.*, 2002; O'Dwyer *et al.*, 2005; Vandevijvere *et al* 2009). The larger the fat content of eat out meals, the higher the likelihood of "bad fat" content as compared with "good fat", which are major health predictors. Confirming this, WHO (2007), stated that intakes of over a third of total calories from fat results in a higher intake of saturated fatty acids which can eventually lead to increasing body weight.

EO contributed more to total fat intake among women in most European countries, but among men in Scandinavia and UK (Orfanos *et al.*, 2009). In relation to fat contribution to EO total energy, (Lachat *et al.*, 2012) reported that total fat from eat outs had a higher contribution to total energy. Generally fat should contribute between 15% and 30% of the total energy intake (Gorgulho *et al.*, 2013). One Irish study reported a lower energy percentage from fat during EO (O'Dwyer *et al.*, 2005). According to (Lachat *et al.*, 2012) specifically, restaurant foods are the eat out source with higher fat content when compared to other sources. Food preparation methods such as frying results in high fat content of these meals because frying results in loss of water and uptake of fat (Pokorn *et al.*, 2003).

2.9.5 Selected Micronutrients

2.9.5.1 Sodium, Na (Salt)

The main source of sodium in foods in general as well as eat out meals is common salt, which is chemically made up of sodium and chlorine. Another major source of sodium in eat out meals is in the form of monosodium glutamate where significant amounts are used in meal preparation. Apart from adding salty taste, sodium masks off notes such as bitterness and strange taste and enhances flavours and sweetness of meals.

Typically, a high intake of salt is unhealthy. Sodium overconsumption results significantly from EO and this has been shown across varied studies (Gorgulho *et al.*, 2013; Kwon & Ju, 2014; Larson *et al.*, 2011; Paeratakul *et al.*, 2003; Tiwari *et al.*, 2017). Sodium content of eat out meal are also variable across sources. The University of California San Francisco Medical Centre (UCSFMC) (2018), asserts that any food with sodium content of at least 400 mg should be considered high in sodium. In Australia, the average sodium in a fast food product is 471mg/100 g and 605mg/ serving (Garcia *et al.*, 2014). Some studies have shown that consumption of daily sodium from other eat out sources and full service restaurants could be seven and six times respectively more than the recommended amount (Kim *et al.*, 2014). An adult meal from a full service restaurant was found to highly contain approximately 3,512 mg of sodium (Auchincloss *et al.*, 2014). Lin & Guthrie (2012), also found that a high sodium density of 2,151mg and 1,864mg per 1000kcal in foods from restaurants and fast foods respectively. The percentage contributions to the daily sodium intake from EO was found to have increased to more than 50% in 2012 among Koreans (Kwon & Ju, 2014).

2.9.5.2 Iron (Fe)

The lower consumption of iron from foods results in iron deficiency, which is known to be the highest contributor to anaemia prevalence and its consequences globally. Iron content of eat out meals are generally low and likewise the consumption of iron from EO. The former may be due to ingredients (Tee *et al.,* 1989) and varied meal preparation methods (Scherr & Ribeiro, 2013). Particularly in animal food sources such as meat, similar studies have indicated the influence of various meal preparation methods on their nutrient contents including iron (García-Arias *et al.,* 2004; Gokoglu *et al.,* 2004).

Guthrie *et al.* (2002); Kearney *et al.* (2001); (Lin & Morrison, 2012) among others have agreed that iron content of eat out meals are low. Iron in the non– haem form is found in leafy vegetables but EO is associated with lower intakes of fruits and vegetables (Seguin *et al.,* 2016). Therefore it is likely one may not obtain maximum amount of iron during EO. In a Kenyan study, the contribution of EO to the total daily iron was found to be low, though iron intakes was higher among those who eat out than those who do not eat out (Riet, *et al.,* 2002). This study asserts the fact that eat out meals have lower iron content but yet contribute to intake of iron.

2.9.5.3 Potassium

Although there is gap in knowledge on potassium content in eat out meals, there is a possibility of meals containing less amount of potassium but contributes some amount to the daily to potassium intakes. This researcher found scarce data on the contribution of potassium in this regard, indicating that more studies need to be done on the micronutrient content of eat out foods to

facilitate comparisons and reviews. Analysis of results from a study showed that the potassium content of eat out meals was lower than recommendation (Paeratakul *et al.*, 2003).

2.10 Eating Out and Health Implications

Globally, 63% of the annual 57 million deaths are caused by diet related diseases, with about 80% of these deaths occurring in low income countries including Ghana (WHO, 2011). It is estimated that this burden of diet related diseases will double from 1990 to 2020 (Mbewu, 2009).

2.10.1 Over nutrition (Overweight/ Obesity) and Predictors

Overweight/obesity is defined as having an excess accumulation of adipose tissue resulting from the recipe of a long-term energy imbalance involving excess calorie consumption coupled with low PAL. Albaik *et al.* (2016), also explains it as a chronic, heterogeneous and multifactorial disease characterized by the disorder of body weight regulatory systems which results in excess body fat accumulation. An individual may be defined as being overweight/ obese in terms of BMI as stated in Table 2.1.

A number of demographic, socio- economic and lifestyle factors have been shown to be relevant to overweight/obesity. The interaction of these major predictors of obesity has important implications for interventions needed to reverse this epidemic. Literature has documented that some predictors of overweight/ obesity include gender (Addo *et al.*, 2009); marital status (Sidik & Rampal, 2009; Averett *et al.* 2008); socio- economic status (income/ employment) (Martín *et al.*,

2008; Pieroni & Salmasi, 2014; Mosca 2013), EO (Shori *et al.*, 2017); age (Benkeser *et al.*, 2012) education (Ali & Lindström 2006), and physical inactivity (Zick *et al.* 2009).

2.10.1.1 Trends

Overweight and obesity have grown significantly in adults, varying across regions and contributing to the increased prevalence of diabetes, hypertension and other chronic diseases as well as increased ill health, death risks and higher cost of health for both the individual and a nation as a whole. Obesity is a major global public health concern in both developed and developing nations.

Kelly *et al.* (2008) stated that, as at 2005 the total numbers of overweight and obese adults were 937 million and 396 million respectively. These numbers have largely increased as WHO (2018b) estimated the worldwide prevalence of overweight and obesity in 2016 to be more 1.9 billion (39%) and over 650 million (13%) respectively for adults aged 18 years and older. The organization also predicted that about 2.7 billion adults will be overweight and obese by 2025. Kelly *et al.* (2008), projected that if the secular trends continue unabated, the absolute numbers could rise to a total of 2.16 billion overweight and 1.12 billion obese individuals, of 38% and 20% of the world's adult population, respectively by 2030. Between 2011 and 2014, 36.5% of US adults were obese with majority being women (Ogden *et al.*, 2015). Statistics from the 2011 Malaysian National Health and Morbidity Survey for adults aged 18 years and above recorded that, 33.3% (5.4 million) were overweight while 27.2% (4.4 million) were obese (Abdullah *et al.*, 2015). Tian *et al.* (2016), indicated in their report that the prevalence of overweight/obesity in China has almost folded from 24.7% in 1991 to 44.0% in 2011. Overweight is far more common than obesity, and

interestingly in some countries men have higher rates of overweight than women, despite the reverse trend applicable to obesity rates.

WHO (2003), estimated that about 115 million of the 300 million obese persons are in developing countries. It was estimated that by this year (2018), overweight rates would increase by about 35% (Amuna & Zotor, 2008). The prevalence of overweight in urban Africa was found to range between 23% in Malawi to 35% in Niger and Ghana, and 38% in Kenya (Appiah *et al.*, 2014). A meta-analysis reported an obesity prevalence of 10% among adults in West Africa, with women being three times more likely to be obese than men (OR= 3.16) (Ofori-Asenso, *et al.*, 2016). In Ghana, overweight/ obesity have been recognized to have increased in total of 56% with rate among women highest from 30% in 2008 to 40% (25% overweight and 15% obese). Overweight/ obesity was more prevalent among age group 40-49 years and those with higher level of education in both Ghanaian men and women (GSS *et al.*, 2015). A review of Ghanaian literature and meta-analysis however reported a lower prevalence of 43% (Ofori-Asenso *et al.*, 2016).

2.10.2 Relationship between Eating Out and Overweight/ Obesity

Overweight/ obesity is an indicator of EO among adults and their links are well documented. Nonetheless, the associations between EO and overweight/ obesity are disputable since both cross sectional studies and longitudinal studies have found positive associations (Ayala *et al.*, 2008; Pereira *et al.*, 2005; Satia *et al.*, 2004), whereas others found no association (French *et al.*, 2007; Burns *et al.*, 2002; Jeffery & French, 1998) or found associations precisely related to gender, pertaining only to men (Bezerra & Sichieri, 2009) or only to women (Kuchler & Lin, 2002).

Similar studies also reported EO positively associated with gain in weight (Bes-Rastrollo *et al.*, 2010; Bezerra *et al.*, 2012).

Seguin, *et al*. (2016) recently explored EO among US adults which showed a positive association between higher frequencies of EO with BMI where the average BMI was much higher among males (27.3 kg/m^2) as compared to females (26.1 kg/m^2). Some studies have agreed also with this positive association between increasing frequency of EO with increased body weight of adults (Bezerra *et al.*, 2012; Morland & Evenson, 2009). Bezerra & Sichieri (2009), have also shown a positive association between high EO proportion (40%) and being overweight. In expressing main eat out meal associations, Ma *et al.* (2003) also reported a positive association between breakfast and dinner eat out and obesity (OR = 2.98; 95% CI 1.46–6.07 and OR = 2.25; 95% CI 1.14– 4.43 respectively). A negative association was also reported between lunch eat out and obesity (OR = 0.40; 95% CI 0.20–0.80) by Ma *et al.* (2003).

Research of Binkley *et al.* (2000) and Kuchler & Lin (2002), support the claim of a positive relationship between frequent EO among men or women only and increasing BMI. According to Bezerra & Sichieri (2009), there is a positive association between frequent EO and increased BMI among men only with overweight (OR = 1.12; 95% CI 1.02–1.24) and obesity (OR = 1.23; 95% CI 1.05–1.43). One study however showed negative or no association between frequent EO and increased BMI in women (OR = 0.88; 95% CI 0.80–0.97) (Bezerra & Sichieri, 2009).

The frequency of EO is highly associated with adult weight gain, and the larger portion and high energy density of eat out meals is accountable for this association. Concerns are also geared

towards the larger portion sizes and higher energy densities of eat out meals, as a result of EO being associated with larger portion sizes, higher energy intake and increased risk of weight gain and obesity (Lachat *et al.*, 2012). A positive association was found between some studies evaluating the consumption of food from restaurants or fast-food restaurants and increased BMI (Bowman &Vinyard, 2004; Satai *et al.*, 2004). Fulkerson *et al.* (2011); Guthrie *et al.* (2002) & Stewart *et al.* (2004), also linked obesity and weight gain to EO from restaurants or fast foods. Mancino *et al.* (2009), identified that obese individuals consume approximately 240kcal from EO.

2.10.2.1 Implications of Obesity

Many have demonstrated the relationship between overweight/ obesity as a biomarker for adverse diet related chronic health conditions. However, it is not clear whether the differences between sub-populations' BMI-diabetes or other BMI- morbidity relationships is a function of differences of body composition, metabolic or genetic factors, or social causes (Popkin, 2004). The risk intensity for the conditions depend on the degrees of obesity. Some of these conditions include high blood pressure (hypertension), T2DM (insulin resistance and impaired glucose tolerance), dyslipidaemia [reduced high density lipoprotein cholesterol (HDL-C) levels, elevated triglyceride (TG) levels and increased low density lipoprotein cholesterol (LDL- C) levels], CVDs and cancers.

2.10.3 Eating Out, Hypertension and Obesity Association

High blood pressure (hypertension) is one of the leading risk factors for cardiovascular disease (CVDs), and the sodium content of our diet has been implicated in most cases of hypertension even though some have unknown causes (Meneton *et al.*, 2005). It is characterized as a silent killer

because it can remain undiagnosed and asymptomatic for a long period of time. Table 2.2 indicates the classification of hypertension in both systolic and diastolic pressures.

As stated earlier, the prevalence of hypertension may be explained by overweight/ obesity in addition to factors such as ethnicity, age, gender, sex, educational level, employment status, PA and EO. Its prevalence is highest (46%) among Africans and statistically significant in the Americas and Europe with Americas prevalence of 35%. Across different populations, men have slightly higher prevalence of hypertension than women (WHO, 2017). In Ghana, 16% of adults are hypertensive and this increases with age, being highest among women age 45-49 (38 %) and men age 50-59 (34 %) (GSS *et al.*, 2015).

Hypertension is highly related to intake of sodium (salt) in foods. In most cases, an individual's intake of salt far exceeds the recommendations as stated earlier. Though some people hypertensive status is not salt sensitive, in salt sensitive persons, hypertension is triggered with increasing salt intake. High potassium of foods serves as a protector against hypertension. There are reports that indicate that elevated systolic blood pressure (SBP) and diastolic blood pressure (DBP) is associated with sodium intake (Chateau-Degat *et al.*, 2010; Gaspare De Santo, 2014; Zhang *et al.*, 2013).

According to Whelton *et al.*, (2012), diets are made of several components and with the aim to curb hypertension, intakes of low caloric meals and sodium with increased intakes of potassium must be considered. Steiner- Asiedu *et al.* (1998), also found that fast foods from restaurants sold in Ghana were excessively high in salt thus, predisposing consumers to a higher risk of

hypertension. WHO (2009), suggested that reducing the consumption of sodium to less than 2000 mg per day significantly reduces both systolic and diastolic blood pressures across all age groups.

Addo *et al.* (2012) for instance, reported a high prevalence of hypertension in Ghana with factors such as high salt intake and increasing BMI being implicated in the rising prevalence. It ranges from 19.3% in rural to 54.6% in urban areas. As expected, the prevalence of hypertension in Ghana is positively associated with increasing age; it is lowest among younger adults and highest among age group 40 years and above, and 16% of adults in urban areas are considered as hypertensive (GSS *et al.*, 2015).

It is a widely known that obesity is positively associated with hypertension. Increasing BMI in the adult population results in a higher risk of hypertension. In a longitudinal study of 40 years follow up, results indicates that weight loss and weight gain is associated with risk of hypertension. Per kilogram per meter squared (1 BMI) increment, there was 11% higher odds of hypertension and 20% higher odds per 4.5kg gain (Hruby *et al.*, 2016).

2.10.4 Eating Out, Type II Diabetes Mellitus and Obesity

Diabetes is a medical condition defined by the Centre for Disease Control (2014), as a group of diseases marked by high levels of blood glucose resulting from issues with insulin production. T2DM is the non- insulin dependent type characterized by increased levels of blood glucose due to the impairment in insulin action and/or insulin secretion, and it is the most predominant in diagnosed diabetes cases (Lin & Sun, 2010). By FBS diabetes criteria, a person with high FBS level of 126mg/dL (7.0mmol/L) or greater after not eating for at least eight hours is likely to have

an elevated blood glucose concentration (WHO, 2006). With FBS between 100mg/dL and 125mg/dL one is classified as pre-diabetic. Other diagnostic criteria for diabetes are oral glucose tolerance test (OGTT) and glycated haemoglobin (A1c).

T2DM is caused mainly by a combination of environmental, lifestyle and genetic factors with other associations related to demographics, obesity and PA. Many studies, undeniably, have shown that various populations throughout developed and developing countries in South America, Africa including Ghana and Asia are experiencing higher prevalence of obesity as well as T2DM due to the promotion of EO coupled with low PAL. The International Diabetes Federation (IDF) (2018), currently estimated that 425 million people worldwide have diabetes. A report estimated that about 30.3 million people of all ages in US have diabetes. Out of this number 13.7million and 5.2 million adults cases have been diagnosed and undiagnosed respectively, with the highest prevalence among age group 45-64 years which is also the group with the most prediabetes cases (National Diabetes Statistics Report, 2018). According to Wild *et al.* (2004), the number of men who will be affected by this condition in the year 2030, will be more than women, even though this condition is prevalent in women than in men. Differences in blood glucose levels, sex hormones, insulin resistance, and obesity rate distribution which explain the fact that more men are affected by this condition than women have been given. Another study has projected the prevalence to be higher in men than women by the years 2020 (Ali, 2013). Geer and Shen (2009) proposed that, this pattern of males and females T2DM distribution is caused by a more inactive lifestyle in men, which results in increases in obesity.

In another study conducted in Tanzania, the prevalence of T2DM was found to be 11.9%, with females having a higher prevalence (7.2%) than their male counterparts (4.7%) (Ruhembe *et al.,* 2014). Age was also found to be a very important risk factor for T2DM, with the disease risk increasing with increasing age (Steyn *et al.*, 2004; D'Adamo & Carpio, 2011), but the disease prevalence decreased for those who were more than 60 years of age. T2DM has been on the rise in sub-Saharan Africa. The prevalence of T2DM in South-East Nigeria as reported by Ejike *et al.,* (2015), was 3.0%, with males having a prevalence of 2.3% and the females 3.6%. In the 31 to 45 years age group, the females had an earlier onset of T2DM than the males. Prevalence of T2DM in parts of Ghana have been reported. The prevalence of T2DM in Ghana in 2014 was estimated at 6% with over 450,000 adults living with the disease (Ofori-Asenso & Garcia, 2016). The estimated total number of adults currently in Ghana with diabetes is 518,400 (IDF, 2018).

Both obesity and diabetes are of public health concern worldwide and they are associated with serious co-morbidities and high economic costs of health according to Yaturu (2011). According to Hu (2011), excessive caloric intake is the main driving force behind the rising obesity and T2DM epidemics globally. Obesity results in increasing insulin resistance, and this suggests that consumption of fast foods increases the risk of T2DM in adults (Pereira *et al.*, 2005). There is a strong association between obesity and T2DM with significant numbers of obese individuals with diabetes. Guh *et al.,* (2009), found that obesity (defined using body mass index) was strongly associated with the incidence of T2DM especially in females (OR=3.92; 95% CI 3.10 – 4.97). The risk of diabetes increases linearly with BMI (Harris *et al.,* 2000). The authors elaborated that the prevalence of T2DM increased from 2% in people with a BMI of 25 to 29.9 kg/m^2, to 8% in people with a BMI of 30 to 34.9 kg/m^2, and then to 13% in those with a BMI greater than 35 kg/m^2.

2.11 Physical Activity and Health Implications

Physical activity (PA) is defined as any movement of the body produced by the skeletal muscles that will necessitate the expenditure of the body's energy store (WHO, 2018a). It has been consistently shown that both healthy diet and adequate PA plays an important role in general health. Lack of PA, independent of diet and factors like smoking and alcohol intake pre- disposes one to the risk of chronic NCDs. Increasing sedentary behaviour is also strongly associated with an increased risk of NCDs and mortality, independent of PA levels (Bennie *et al.*, 2013; Matthews *et al.*,2012).

WHO (2018a), recommends that adults should do at least 150 minutes of moderate-intensity PA throughout the week or do at least 75 minutes of vigorous-intensity PA throughout the week or an equivalent combination of moderate- and vigorous-intensity activity. For additional health benefit, 150 and 75 minutes respectively is recommended. In terms of metabolic equivalent (MET) a minimum of 600 MET minutes/ week of PA and a minimum of ≤4 hours/day sedentary behaviour (equivalent energy expenditure of ≤ 1.5MET minutes/ day) for adults are recommended.

Globally, there have been prevalence records of physically inactive adults and sedentary lifestyle. It is estimated that 31.1% of the world's population is physically inactive. Prevalence across regions indicates it is highest in the Americas (43.3%) with Europe and Africa recording 36.8% and 27.5% respectively (Hallal *et al.*, 2012). A Chilean study revealed that 19.8% of the study population did not meet the weekly recommendation and 35.9% spent more than 4 hours sitting per day (Celis-Morales *et al.*, 2015).

Physical inactivity age trend reports indicate it increases with age (Celis-Morales *et al.*, 2015; Hallal *et al.*, 2012). Men are known to be more physically active than women. A study comparing PA among 5 countries including Ghana revealed that men (63.0%) reported significantly greater amounts of PAL than women 42% ($p< 0.001$) (Dugas *et al.*, 2014).

Overweight/ obesity is primarily due to lack of PA to commensurate energy consumed from food. Positive associations have been established between inadequate PA and increasing BMI in a wide range of different populations (Swinburn *et al.*, 2011). A clear indication of this was shown by Dugas *et al.* (2014), where it was significant among five countries that the prevalence of obesity increases with decreasing PAL, and Ghana had the lowest prevalence. There is no clear association between EO and PAL (Tian *et al.*, 2016; Vandevijvere *et al.*, 2009). A study however found a negative association between reduced PAL and EO (Orfanos *et al.*, 2007). From a previous study (Jeffery & French, 1998), a strong association was found between the frequency of consumption of meals from FFRs and sedentary behaviour, specifically, hours of watching television and overweight/obesity.

Azuamah *et al.*, (2013) also states that physical inactiveness and sedentary lifestyle aggravates insulin sensitivity leading to higher risk of T2DM. In a study to quantify the dose response relationship between PA and diabetes, it was determined that, among subjects with the minimum level of PAL recommended, i.e. 600 MET minutes/week, a 2% lower risk of diabetes was reported as compared with those physically inactive. An increase from 600 to 3600 MET minutes/week reduced the risk by an additional 19% (Kyu *et al.*, 2016). A study by Hu *et al.*, (2003) found with each 120minutes/ day increment in sitting at work, there was a 7% (95% CI 0 - 16) increase in

T2DM risk. Participating in regular PA improves blood glucose control by improving insulin sensitivity and can prevent or delay type II diabetes, as well as it positively improves cholesterol levels, blood pressure control, and help in weight loss management (Colberg *et al.*, 2010).

PA is one of the first step recommended in the management of hypertension since it is effective in its treatment, but responses vary between individuals. Dozens of accumulating data have been consistent in findings regarding a positive association between PAL/ sedentary behaviour and increasing blood pressure. In normal BMI subject, the odds of hypertension were 54% higher when inactive than in highly active subjects (adjusted OR 1.54, 95% CI 1.09–2.18) (Li *et al.*, 2017). Even though the dose- response effect of PAL on hypertension is not clear, the risk of hypertension occurring reduced with increasing MET min/ week above recommendation (Diaz & Shimbo, 2013). Also, though the mechanisms regarding the effect of PAL on hypertension are not consistent, a possible explanation to the effect of PAL on hypertension is that, increased PAL increases the excretion of urinary sodium from the body (Li *et al.*, 2017). Physical inactivity in persons classified as pre hypertensive subjects them to a higher risk of advancing to being hypertensive (Diaz & Shimbo, 2013).

The prevalence of hypertension is higher among persons with T2DM (Ferrannini &Cushman, 2012). From this, it can be said that, with T2DM one is at a higher risk of developing hypertension. Salman R & Al-Rubeaan (2009), found that there 62% lower risk of developing hypertension among persons with T2DM who exercise regularly as compared to those who did not exercise. Likewise, from their findings Xu *et al.* (2014), concluded that because hypertension is an

independent risk factor for the development of T2DM, and also share common risk factors with T2DM, physical inactivity largely increase the chance of T2DM in persons with hypertension.

2.12 Assessment of Nutritional Status

The assessment of nutritional status involves anthropometry, biochemical, clinical and dietary measurements as well as the evaluation of socio- economic status. However, for the purpose of this research, anthropometry, biochemical and clinical methods were used.

2.12.1 Anthropometric Method

Anthropometry is the most common nutrition assessment for nutritional status which measures the physical dimensions of an individual which reflect body composition and development. It serves the purpose of evaluating the progress of growth, detecting malnutrition and measuring the changes in body composition over a period of time (Whitney & Rolfes, 2011). Duggan, (2010) describes anthropometry as a deceptively simple tool for nutritional assessment of individuals because of its objectivity and relatively low technology required in its usage. It can be used to determine prevalence of undernutrition as well as over nutrition in an adult surveyed population (WFP & CDC, 2005). It involves measuring height and weight of an individual. Other anthropometric measurements include waist circumference and skinfold.

Anthropometric Indices

To facilitate interpretation of raw anthropometric measurements such as weight and height, they are combined to form indices such as weight/ $(\text{height})^2$ and compared to predetermined risks levels

or standard cut-off points for adults, and to give some information on the nutritional status of an adult. The main indicator used in assessing nutritional status of adults by anthropometry is BMI.

BMI is a nutritional status indicator for over nutrition and is defined as the weight (kg) divided by the square of height (m^2). Table 2.1 shows the standard categories used to classify BMI according to Center for Disease Control and Prevention (2016).

Table 2.1: Adults Body Weight Classification

Classification	BMI Cut-off points
Underweight	<18.50
Normal	18.50- 24.99
Overweight	25.00- 29.99
Obese Class I	30.00- 34.99
Obese Class II	35.00- 39.99
Obese Class III	≥40.00

BMI= kg/m^2

2.12.2 Biochemical Methods

It involves collection and testing of biological samples such as blood and urine to assess nutritional status. These tests are done to determine the level of biological markers such as nutrients (Maqbool *et al.,* 2008) and detecting changes in the body's metabolic products like blood glucose levels.

2.12.3 Clinical Assessment

Clinical signs of nutritional status may be seen and assessed on our physical body by close observation to find evidence of specific nutritional deficiencies. Clinical measurement of identifiable risk factors of nutritional related health conditions such as BP levels health can also be assessed.

Table 2.2: Blood Pressure Categories

BP Category	**Systolic pressure/mmHg**		**Diastolic pressure/mmHg**
Normal	<120	And	< 80
Elevated	120- 129	And	< 80
High BP(hypertension stage 1)	130- 139	Or	80- 89
High BP(hypertension stage 2)	≥140	Or	≥90
Hypertensive Crisis	>180	And/or	>120

Source: American College of Cardiology (ACC), 2017

CHAPTER THREE

3.0 METHODOLOGY

3.1 Research Design

This study employed a quantitative research techniques. The design was both a cross-sectional survey and laboratory proximate analysis (LPA) to investigate factors influencing EO, EO lifestyle characteristics and access the nutrient content of some selected meals from FFRs in Accra and their associations with selected health indicators among Ghanaians.

3.2 Sampling Techniques

3.2.1 Study Settings

The study took place in Accra metropolis which was randomly selected from the two largest cities in Ghana which are Accra and Kumasi, based on vibrant population and economic growth. The Accra Metropolis, which serves as the capital of Ghana and one of the 10 districts that make up the Accra Metropolitan Area spans an area of approximately 6.56km^2 with population of 1,665,086 as of 2010. A total of twenty (20) communities were conveniently sampled out of the 72 communities in the ten (10) sub metropolitan districts found within the Accra Metropolis, 2 communities per sub- metro (Appendix 4). The communities were grouped at random into 4 made up of 5 different communities each. Each group of communities were written on pieces of paper and then placed into a box and a paper was picked.

A cross sectional survey was carried out by selecting subjects who consented to be part of the study within five selected areas namely: *Dansoman, Achimota, Osu, Legon and Jamestown* areas in two stages. Subjects were selected at random and based on willingness to participate, recruited in the first stage and all study data was collected on the same day or another scheduled day for nutritional assessment.

The *Osu* area located within the *Osu Clottey* sub-metro was chosen as location for sampling FFRs meals for their nutritional quality, based on it being the area with the largest number of FFRs in the country listed in the 2016 Catering Directory of the Ghana Tourism Authority, Quality Assurance Department (Ghana Tourism Authority, 2016). The area is popularly known for its buzzing commercial atmosphere during the day due to the presence of a good number of corporate offices and a lot of retail stores and outlets, for example banks, mall, supermarkets, pharmaceuticals and healthcare as well as hosts of eat out sources. It is well noted for an equally busy night life and known to be the prime location in the capital, Accra and preferred hangout for leisure due to the presence of major hospitality spots including night clubs, restaurants, hotels, bars, pubs, casinos and gaming centres. Due to the nature of entertaining activities in *Osu*, particularly *Osu RE* ("Oxford Street"), the location attracts most Ghanaians, tourists and indigenous hospitality events. This choice of setting for the study provides availability of the wide variety of FFRs based on different cultures as well as other eat outs including fast foods and street foods and good basis for the availability of most of the variables in the study design.

3.2.2 Food Samples Selection

Using the physical location, *Osu*, a total number of forty-two (42) FFRs registered was numbered in an alphabetical order. All odd numbered FFRs were grouped and ten (10) FFRs were randomly selected by balloting. Out of the ten selected FFRs, three were not operating at the time of sample collection and therefore, three (3) even numbered grouped FFRs were randomly selected to replace them for collection of meal samples.

Two foods were randomly selected from the menu with price ranging from 20-45ghc, after a brief informal interview with a manager/waiter about the most patronized/popular foods from each FFRs and was bought for LPA.

3.2.3 Sample Size Determination

The target sample size for the study was calculated using the Slovin's formula based on population size. According to the Ghana Statistical Service, the population of Accra Metropolis as at the 2010 census is 1,848,614. The confidence interval is set at 95% with a margin of error of 0.05. Using the Slovin's equation formula;

$\boldsymbol{n = N/(1 + Ne^2)}$,(Ryan, 2013) **.**

Where, *n* is the sample size, *N* is the population size, *e* is the margin of error (5%), and *1* is a constant value.

Sample size calculation:

Given that $\boldsymbol{n = N/(1 + Ne^2)}$

$\mathbf{n = 1848614/(1 + 1848614(0.05)^2}$

n=399.91 ~ 400

However, an additional 10% of subjects was added to make room for incomplete questionnaires, leading to a total of 440 subjects. Hence, the sample size was rounded up to 450 subjects in total to increase the precision of the estimates. A sub- sample, a third (150) of the total sample were involved in the Nutritional Health Assessment Survey (NHAS).

3.2.4 Study Subjects Inclusion Criteria

For subjects to be included in the study, they had to;

- Be adult men and women between the ages of 18- 60 years.
- Be residing or working within the study areas at time of data collection.
- EO at least four (4) times per week.
- Agree voluntarily to be part and adhere to protocol as well as sign the consent form after details of the study was clearly communicated to them.

3.3 Data Collection

The study instrument was a semi-questionnaire comprising six sections namely: demographic characteristics, EO information, physical activity levels, anthropometry, biochemical and clinical biomarkers in relation to the objectives of the study. The questionnaire was pre- tested and pre-

coded to ensure the quality of information obtained. Data was collected once from subjects between the early hours of the day (6-9.30am) before breakfast/ medication on an agreed scheduled after consent to partake in the study.

3.3.1 Socio- demographic Data

A modified World Health Organisation (WHO) (2008) STEPwise approach to Surveillance (STEPS) semi-structured questionnaire was used to obtain information on sex, age, educational level, employment status, religion, marital status and ethnicity.

3.3.2 Eating Out Data

Subjects indicated how often they ate out with least being four times in a week. EO data also covered information on reasons for EO for the three eating occasions (i.e. breakfast, lunch and dinner), the type of eat outs they patronize and some of the foods they usually patronize. However, data on the number of times subject ate home meals and the types of home meals consumed were obtained to aid in analysis of the ratio of EO and eat home (EH). Reasons for EO where grouped into five themes namely convenience, lack of time, socialization, lack of home alternative, sensory appeal and lack of cooking skills.

3.3.3 Physical Activity Level Data

All subjects, using the Global Physical Activity Questionnaire (GPAQ) (WHO, 2010) self-reported their PAL. The GPAQ was used to estimate the total weekly volume (MET/min) of PA in three main domains: occupation, travel and recreation and for at least 10 minutes at a time, at two

different intensities: moderate and vigorous. Sedentary behaviour was also captured in the questionnaire. These were used to classify persons according to volume of intensity, i.e. low (<600 MET/min), moderate (600–1,499 MET/min), and high (1,500 MET/min vigorous intensity or >3,000 MET/min MVPA).

3.3.4 Anthropometric Data

Height and weight measurements were used to compute the BMI of subjects. All anthropometric measurements were measured using validated standard procedures and in triplicates.

3.3.4.1 Height Measurement

Heights were measured using a United Nations Children's Fund (UNICEF) portable stadiometer and taken in metres to the nearest 0.01m. The stadiometer was placed against a wall on a firm and even surface, and each subjects were asked to stand on it without shoes with feet slightly apart in an upright position with their back to the height rule, with their head, back, buttocks, calves and heels touching the upright height rule, and head; The heads of subjects were positioned properly to be the Frankfort horizontal plane and were asked to take in a deep breath so as to straighten their spine and the moveable headboard was lowered until it firmly touches the crown of the head for direct readings to be obtained.

3.3.4.2 Weight Measurement

A Seca scale was used to measure the weight of subjects to the nearest 0.01 kg. The weighing scale was placed on a levelled firm surface and subjects were asked to remove extra clothing and items

from hands and pockets before they stood barefooted and upright with feet slightly apart on the Seca scale. With the subjects head levelled up and hands down by their sides, readings were taken.

BMI of each subjects was then computed using the formula:

$$\text{BMI} = \text{Weight(kg)} \Big/ \text{Height}(m^2)$$

3.3.4.3 Clinical Assessment Data

Clinical assessment of subjects for signs and symptoms of medical conditions included the measurement of blood pressure (BP). This was taken using a clinically automated blood pressure monitor (OMRON, HEM-712C) measured to the nearest 1mmHg. The subjects were allowed to sit quietly and comfortably for about 5 minutes. Their left arm rested on a table so the blood pressure cuff was at the same level as their heart. With the cuff placed above the elbow and after ensuring it fitted the arm tightly and snugly, the start button on the monitor was pressed and the systolic and diastolic blood pressures measurements were recorded on the questionnaire. Measurements were taken twice. The second of the two measures was recorded if the difference between the two was less than 10mmHg. A third measure was performed if the difference between the first two measures was more than 10mmHg, and any two measures with a difference less than 10mmHg were recorded.

3.3.4.4 Biochemical Assessment Data

FBS of subjects was measured using the Easy Touch automated digital glucometer. In order to prevent contaminations, clinical gloves were worn. A 70% alcohol with sterile cotton was used to

clean the tip of the thumb and was pricked gently using a sterile lancet. With the test stripe inserted into the glucometer, the pricked thumb was slightly squeezed and a drop of blood was drawn into the test stripe and reading was recorded on the questionnaire in mmol/L. The used lancet tip was pushed into its protective disk and placed in a disposable bag together with test strips and cotton wool and disposed of properly.

3.3.5 Laboratory Proximate Analysis (LPA) Data Collection

3.3.5.1 Sample Preparation

Proximate analysis using standard methods was done on obtained meal samples from the various FFRs and transported in a food grade ice chest to the lab. Whole meal (edible and non- edible) was weighed and recorded. Non edible portions of the main meal such as for garnishing, bones and packaging were discarded, and all edible portions were blended together in a food processor without adding water. The non-edibles were weighed and subtracted from the total weight of whole meal to obtain the exact portion size of the meal. Each blended and homogenized meal sample was kept a sterile microwavable storage bowl, labelled and stored in the freezer at -19^{o}C. Analyses were performed on each samples after thawing for one hour at room temperature. All analyses were done in triplicates.

3.3.5.2 Moisture Determination

Prior to meal samples being stored in the freezer, about 2g of each sample was taken for moisture determination. The moisture content of the meals were determined according to Pearson (1976). Moisture cans with lids were thoroughly cleaned, dried in an air oven (Genlab^{TM}, Model-MINO175/F) and allowed to cool in a desiccator. About 2g of meal sample were then weighed

into moisture cans and covered with lids. They were stored in the air oven to dry overnight to a constant weight at a temperature of 105^{O} C. They were allowed to cool in a desiccator and weighed, the lost in weight (moisture) was then recorded for each sample. Moisture content was expressed as on dry basis.

3.3.5.3 Crude Protein Content Determination

Protein content of samples was determined using the Kjedahl method described by Anderson & Ingram (1989).

Digestion

Approximately about 2g of the each sample was weighed into a digestion flask and a spatula of N-catalyst was added to speed up the reaction. The mixture was shaken thoroughly and a 25ml of 95% purity concentrated Sulphuric acid was added by pouring it down the side of the flask carefully and swirled gently. Upon colour change, the mixture was heated on a block digestion system with temperature knob set at 6. Heat was maintained at a constant temperature for about 90 mins until the mixture results in a clear solution, and flask was allowed to cool. A blank digest will also be prepared.

Distillation

About 100ml of 2% Boric acid solution and few drops of mixed indictor (0.06g bromocresol green, 0. 04g methyl red in 100ml ethyl alcohol) was placed in a 500ml Erlenmeyer flask. 100ml of

distilled water was added to the digestion flask and shaken to dissolve any precipitate. About 80ml of 50% NaOH was added to neutralize the acid and create an alkaline medium. Distillation was done using the Bunchi Distillation Unit K.314 until over 150ml of distillates have been collected into the 2% Boric acid.

Titration

The distillates were titrated with 0.01N HCL to a faint pink end point and percent protein was calculated using the formula:

$$\%\text{Nitrogen} = \frac{\text{titration value} \times \text{volume of extract} \times 100\% \times 0.01\text{N HCL} \times 14}{\text{weight of sample} \times \text{aliquot} \times 1000}$$

Where;

14= molar mass of Nitrogen

1000= constant

%Protein = % Nitrogen× Conversion Factor (6.25) (FAO, 2003).

3.3.5.4 Crude Fat

Using the Soxhlet method according to Pearson (1976), about 2g of each sample was weighed into an extraction thimble plugged with a fat free cotton wool. It was then placed into an extraction tube allowing it to slide down the sides of the tube. A clean dried Soxhlet flask was weighed and filled to a little over half of its volume with petroleum ether and then each fixed to a condenser to collect fat. After assembling, it was then refluxed rapidly for three hours, after which the extractor

was disconnected, thimbles lifted to the top of the tube with tongs and clipped to the sides to drain. The ether was reclaimed and the round bottom flask was dried in an air oven overnight at 60^{o}C to remove traces of ether and moisture, cooled and weighed. The fat content of meal samples were calculated as the gain in weight of the Soxhlet flasks.

The percentage Fat was calculated as: [**(W2 –W1)/ Weight of Sample (g)] X 100%**

W1-Weight of empty flat bottom flask

W2-Weight of flat bottom flask + Extracted fat

3.3.5.5 Ash Determination

According to Belitz *et al.* (2009), determination of ash content of the samples involved weighing about 2g of the sample into a weighed crucible which was pre-conditioned by cleaning, drying, heating at 600^{o}C for 10minutes in a muffle furnace, cooling in a desiccator and weighing empty crucible. The sample in the crucible was placed in a hot furnace at 600^{o}C for 6 hours. The muffle furnace was then turned off and the crucible allowed to cool overnight. Weight gained of the crucible was calculated as ash matter.

3.3.5.6 Carbohydrate Content Determination

This was determined by differential method. It was done by subtracting the sum of moisture content, protein, fat and ash from 100.

3.3.5.7 Energy Determination

Total energy content of samples were computed using conversion factor for each energy yielding substrate of each meal sample. Where carbohydrate, protein and fat yielded 4.0kcal/g, 4.0kcal/g and 9.0kcal/g of energy respectively.

3.3.5.8 Mineral Content Determination

The mineral content of meal samples were determined using the Atomic Absorption Spectrum (AAS), Perkin- Elmer Corp. (1968) or a Spectrophotometer. Iron, sodium, calcium and potassium contents were determined in the meal samples.

Using acid digestion method, about 1g of the sample was weighed into a 125ml Erlenmeyer flask and 10ml of ternary acid mixture concentrate(20ml $HClO_4$: 500ml HNO_3: 50ml H_2SO_4) was added under a fume chamber. The content was mixed and heated gently at low to medium heat on a hot plate under a per chloric acid fume hood. The samples was then heated for 30minutes until dense white fumes appeared (fumes of H_2SO_4) and finally heated strongly (medium to high heat) for about half a minute. After digestion is completed, the solution was cooled, and 50ml distilled water was added and boiled for half a minute on the same plate at medium heat.

The mixture was finally cooled and filtered completely into a 100ml Pyrex volumetric flask using a Whatman No. 42 filter paper and made to the mark with distilled water. It was stored, read at specified wavelengths for each mineral and calculated by:

$$\% \text{ Mineral} = \frac{\text{ASS reading}}{1000} \times \frac{100}{1000} \times \frac{100}{\text{weight of sample}}$$

Converting to mg/kg= %Mineral × 10000

"As is" values of the proximate analysis was converted to dry matter by the formulae below, for instance protein:

$$\text{Protein content on 'dry matter basis'} = \frac{\text{"As is" of protein} \times 100}{100 - \text{Moisture content of that sample}}$$

3.4 Ethical Consideration

Ethical clearance was sought from the Ethics Review Committee of the Collage of Basic and Applied Sciences, University of Ghana (ECBAS-023/17- 18). All issues regarding confidentiality, anonymity, risks and benefits, freedom to participate as well as redrew from the study at any time without any adverse consequences was categorically stated. The principal researcher and trained field assistants explained clearly the purpose of the study to each participant. Each participant was given an informed consent sheet to complete and sign or thumb print so as to certify that they have clearly understood the purpose of the research and willingly agreed to partake in it. They were given a unique code to maintain anonymity.

3.5 Recruitment and Training of Field Assistants

This study employed the assistance of Bsc. Nutrition and Food Science graduates. They were trained on ethics and confidentiality issues, on the proper use the instruments for all measurements

and how to administer the questionnaire in different languages (Ga and Twi). All inconsistencies were identified and corrected during the training session.

3.6 Quality Control Measures

- The questionnaire was pre- tested on a 20 subjects around *Adarbraka* with similar characteristics. All short- falls relating to questionnaire were corrected before the actual data collection to ensure apposite data were collected.
- The questionnaires and informed consent form were administered in two major local languages; *Ga* and *Twi* for subjects who cannot communicate in the English language.
- Recruited field assistants were highly trained to ensure that all the research protocol was followed to reduce random and systematic errors.
- Questionnaires were cross- checked immediately after data collections from each participant as well as after each day's data collection to ensure all responses were valid.
- All equipment used for the measurements were calibrated prior to data collection and using standardized techniques and all measurements were taken in duplicates.
- All proximate analyses were performed in triplicates using standardized methods.

3.7 Data Management and Analysis

After data collection, all data entry, cleaning and statistical analysis were performed using the Statistical Software Package for Social Sciences (SPSS) version 20.0, Microsoft Excel 2013 and Minitab version 18.0 software packages. To show differences, a *p*-value< 0.05 was considered as significant.

Descriptive statistics were used to report continuous and categorical data. Frequencies and proportions were used to summarize both qualitative and quantitative categorical variables such as age, religion, marital status, educational level, sex, occupation, religion and EO data. Quantitative (continuous) variables such as anthropometric, clinical, biochemical was reported using means and standard deviations. Categorical variables with lower frequencies were converted into other levels within the same variable.

Chi– square and independent t- test analysis were employed to investigate relationships between the dependent variable (DV) and independent variable (IV): socio- demographics (IV) and EO variables (DV); EO (IV) and health variables (DV) and BMI (IV) and other health indicators of the study (DV). The chi-square test was utilized to test the differences and prevalence between gender and nutritional health. Logistic regression analysis was implemented to analyse the factors associated with the frequency of eating out (IV) and overweight/obesity (DV) among subjects and odds ratios (OR) at 95% confidence interval was reported.

Distributions of health variables within various categories were determined and reported in frequencies based on standard classifications. Four BMI categories (<18.5kg/ m^2; 18.5kg/ m^2- 24.9kg/ m^2; 25.0kg/ m^2- 29.9kg/ m^2 and ≥30kg/m^2) was selected to classify subjects (Center for Disease Control and Prevention, 2016). Blood pressure categories according to the American heart association (See Table.2.2) were used to classify subjects and reclassified as either being normal (<120/80 mmHg), pre- hypertensive (systolic pressure from 120- 139 and diastolic pressure from 80-89)/mmHg or hypertensive (≥140/90 mmHg).A subject was classified as having T2DM, when they had FBS concentration of ≥7.0 mmol/L (126mg/dL) after an overnight fast. They were classified as pre- diabetic when FBS was from 5.6mmol/L- 6.9mmol/L (100mg/dL- 125mg/dL) and normal at FBS <5.6 mmol/L.

For the LPA, continuous data of the nutrient composition of meals were represented as mean ± standard deviations. Nutrients were estimated both in per serving and 100g. Tukey Pairwise Comparison test (One- way ANOVA; Post Hoc Multiple Comparison) was used to compare the means of the concentration of each nutrients between different meal samples and across different sources. The nutrient contents analysed were compared to daily nutrients recommendations.

CHAPTER FOUR

4.0 RESULTS

4.1 Socio- demographic Characteristics of Study Subjects

Out of a total of 450 subjects who participated in the study, 428 (95.1%) subjects with complete data were included in the final analysis. Biochemical and health screening were conducted on a sub-sample of 150 subjects due to cost and logistical constraints. The background profile of the subjects are presented in Table 4.1 and Table 4.2 respectively.

Over half (58.2%) of the subjects were females. Most (75.7%) of the subjects were aged between 18-39 years with the majority belonging to the Christian faith and the Akan ethnicity. Almost two-thirds (65.0%) of subjects reported to be single while one-third had tertiary education and 81.5% were employed (Table 4.1).

Table 4.1: Background Characteristics of Study Subjects (N=428)

Variable	n (%)
Age	
18- 39	324 (75.7)
40-60	104 (24.3)
Sex	
Male	179 (41.8)
Female	249 (58.2)
Educational Level	
Primary	25 (5.8)
JHS[1]	62 (14.5)
SHS[2]	118 (27.6)
University/Tertiary	143 (33.4)
Others[3]	80 (18.7)
Religion	
Christianity	353 (82.5)
Islam	71(16.6)
Traditional	4 (0.9)
Ethnicity	
Ga/ Adangbe	87 (20.3)
Akan	218 (50.9)
Ewe	67 (15.7)
Northerner	56 (13.1)
Marital Status	
Single[4]	278 (65.0)
Married	150 (35.0)
Employment Status	
Unemployed	79 (18.5)
Employed/ Self employed	349 (81.5)

[1] JHS= Junior High School**;** [2] SHS= Senior High School; [3] Include uneducated, commercial, vocational, accounting and artistry schools; [4] Include Divorced and Widowed

Regarding the NHAS subjects (Table 4.2), majority were aged between 18- 39 years (77.3%) and were females (55.3%). Over a half (62.7%) of them were single and 32.7% have had some form of tertiary education. Most (82.7%) of the subjects were employed.

Table 4.2: Background Characteristics of NHAS Subjects (n= 150)

Variable	n (%)
Age	
18- 39	116 (77.3)
40-60	34 (22.7)
Sex	
Male	67 (44.7)
Female	83 (55.3)
Educational Level	
Primary	9 (6.0)
JHS[1]	18 (12.0)
SHS[2]	44 (29.3)
University/Tertiary	49(32.7)
Others[3]	30 (20.0)
Religion	
Christianity	123 (82.0)
Islam	24 (16.0)
Traditional	3 (2.0)
Ethnicity	
Ga/ Adangbe	38 (25.3)
Akan	71 (47.3)
Ewe	20 (13.3)
Northerner	21 (14)
Marital Status	
Single[4]	94 (62.7)
Married	56 (37.3)
Employment Status	
Unemployed	26 (17.3)
Employed/Self employed	124 (82.7)

[1] JHS= Junior High School; [2] SHS= Senior High School; [3] Include uneducated, commercial, vocational, accounting and artistry schools; [4] Include Divorced and Widowed

4.2 Eating Out Characteristics

4.2.1 Eating Out Frequency and Type of Restaurant

The average number of EO per week as indicated in Figure 4.1 shows that more than half (60.7%) of subjects frequently eat out at least 4- 6 times per week. The type of restaurant commonly preferred by subjects was the fast food or takeaway as compared to sit- in restaurant (89% and 11% respectively).

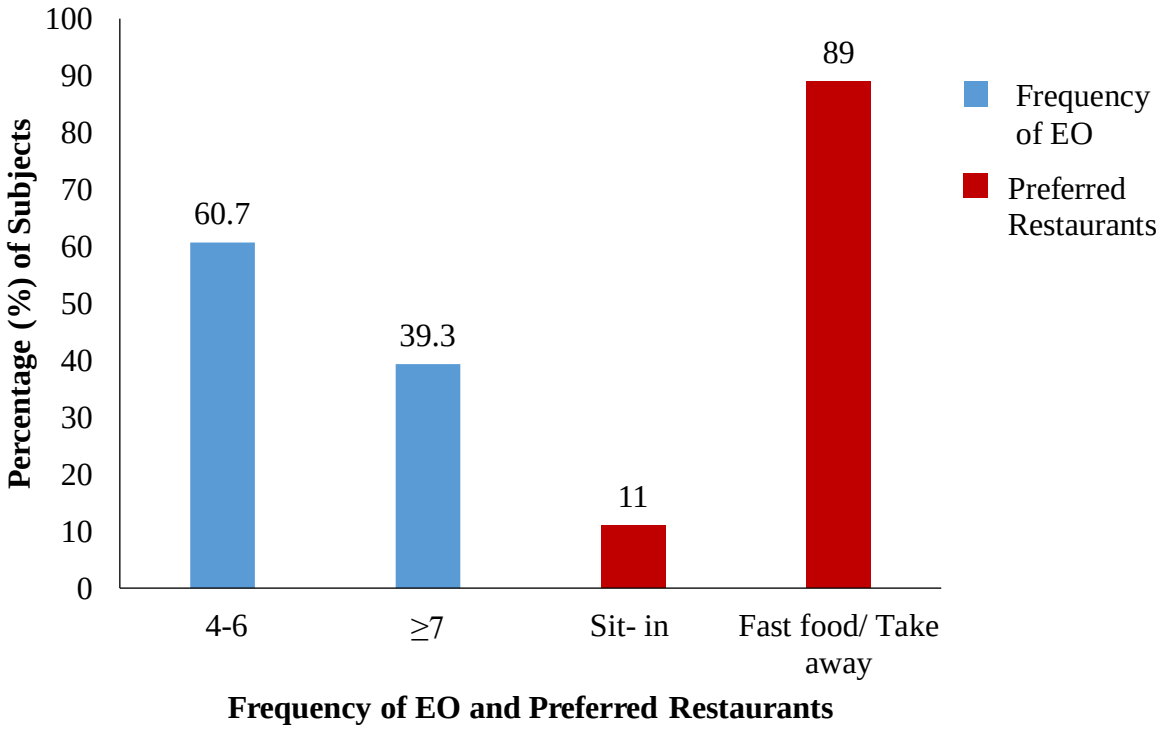


Figure 4.1: Frequency of Eat Out and Preferred Restaurants of Subjects (N =428)

4.2.2 Pattern and Sources of Eat Out

Table 4.3 below shows that among subjects, more than two thirds (83.9%) and almost half (48.1%) ate breakfast and lunch respectively out of home at most twice a week. Eating dinner out 3- 4 times weekly was also indicated by 36.7% of subjects. The source of eat out breakfast, lunch and dinner was from street vendors for many subjects (79%, 61.9% and 65% respectively).

Table 4.3: Frequency of Eat Out Pattern and Sources among Subjects (N=428)

	n (%)		
Variable	**Breakfast**	**Lunch**	**Dinner**
Frequency (meals/week)			
0-2	359 (83.9)	206 (48.1)	156 (36.4)
3- 4	61 (14.3)	157 (36.7)	169 (39.5)
5- 7	8 (1.9)	65 (15.2)	103 (24.1)
Source of meals			
Restaurants	34 (7.9)	100 (23.4)	100 (23.4)
Chop Bars	56 (13.1)	63 (14.7)	50 (11.7)
Street Vendors	338 (79.0)	265 (61.9)	278 (65.0)

4.2.3 Usual Meal Consumption Time

The usual eating time for the different eating occasions are shown by Figures 4.2, 4.3 and 4.4. For some subjects (34.8%), breakfast was usually consumed between 8- 9am, whereas lunch was consumed between 1-2pm by about a third (30.6%) of subjects. Dinner meals were consumed by subjects (29%) between 8-9pm.

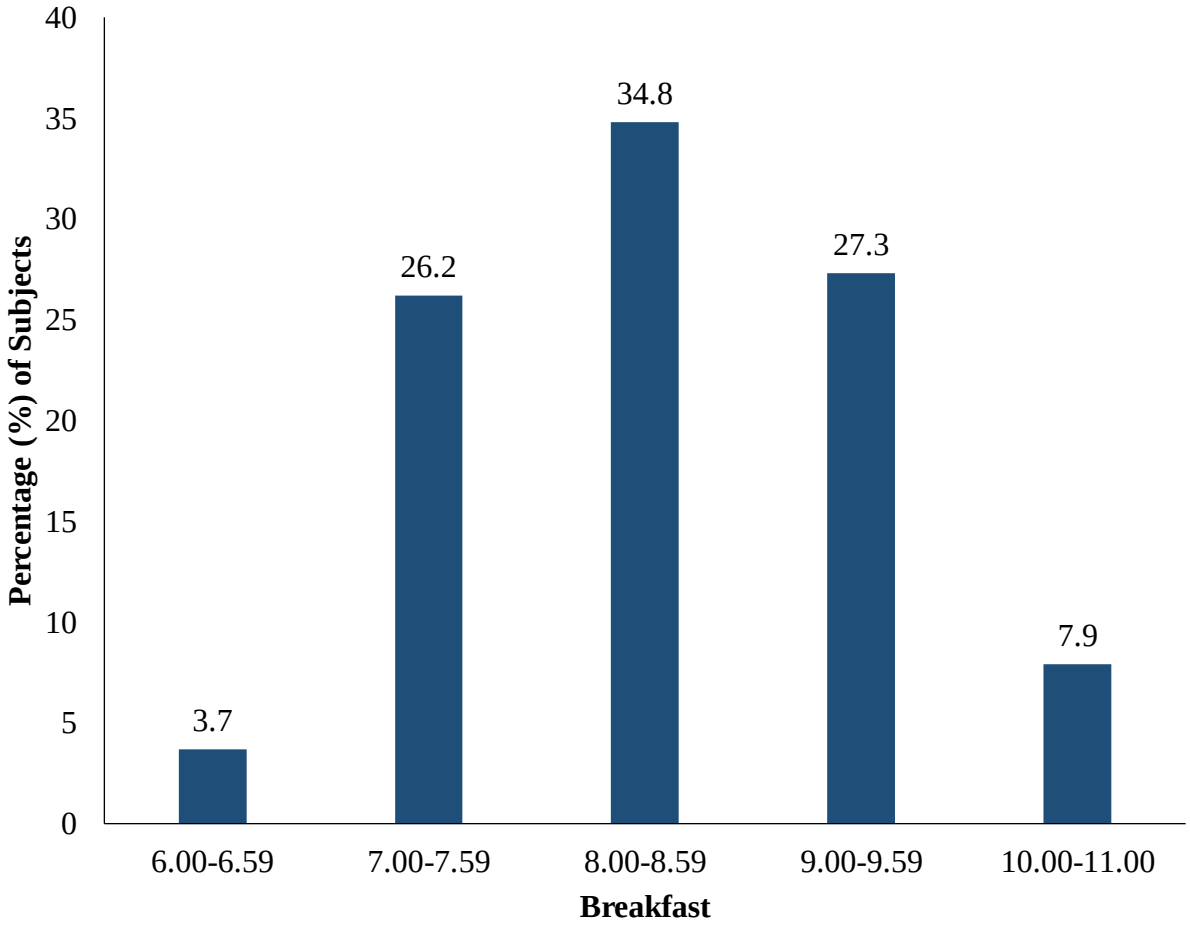


Figure 4.2: Usual Time of Breakfast by Subjects

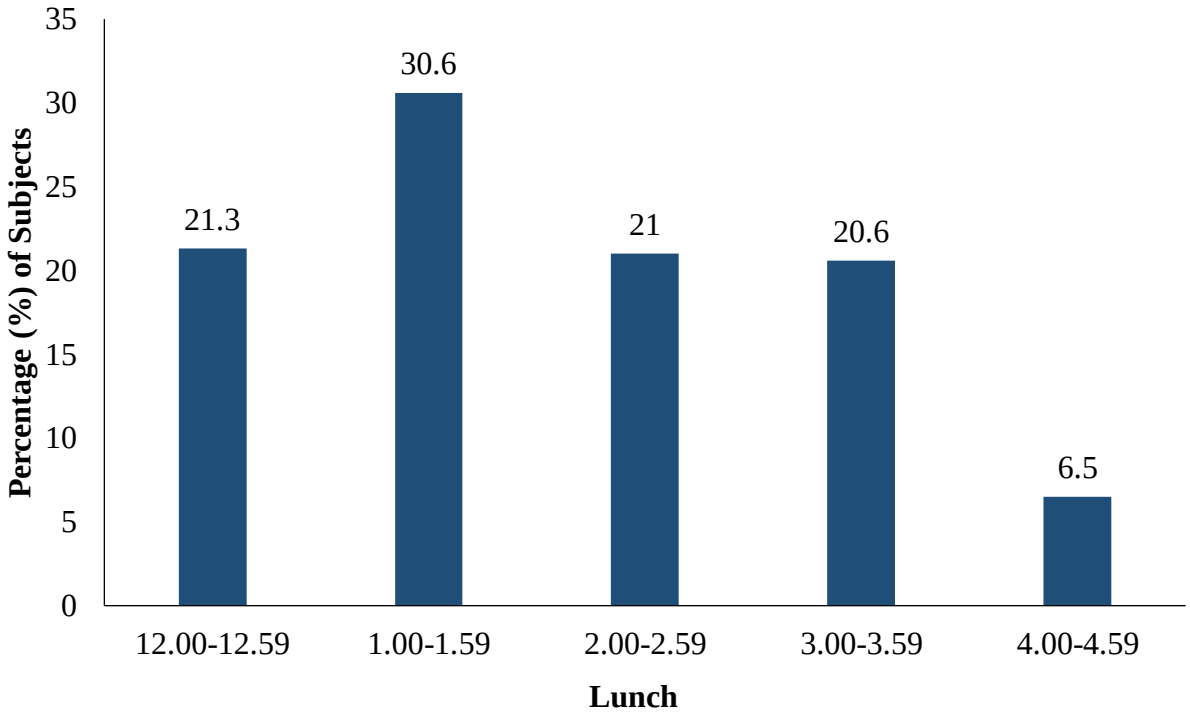


Figure 4.3: Usual Time of Lunch by Subjects

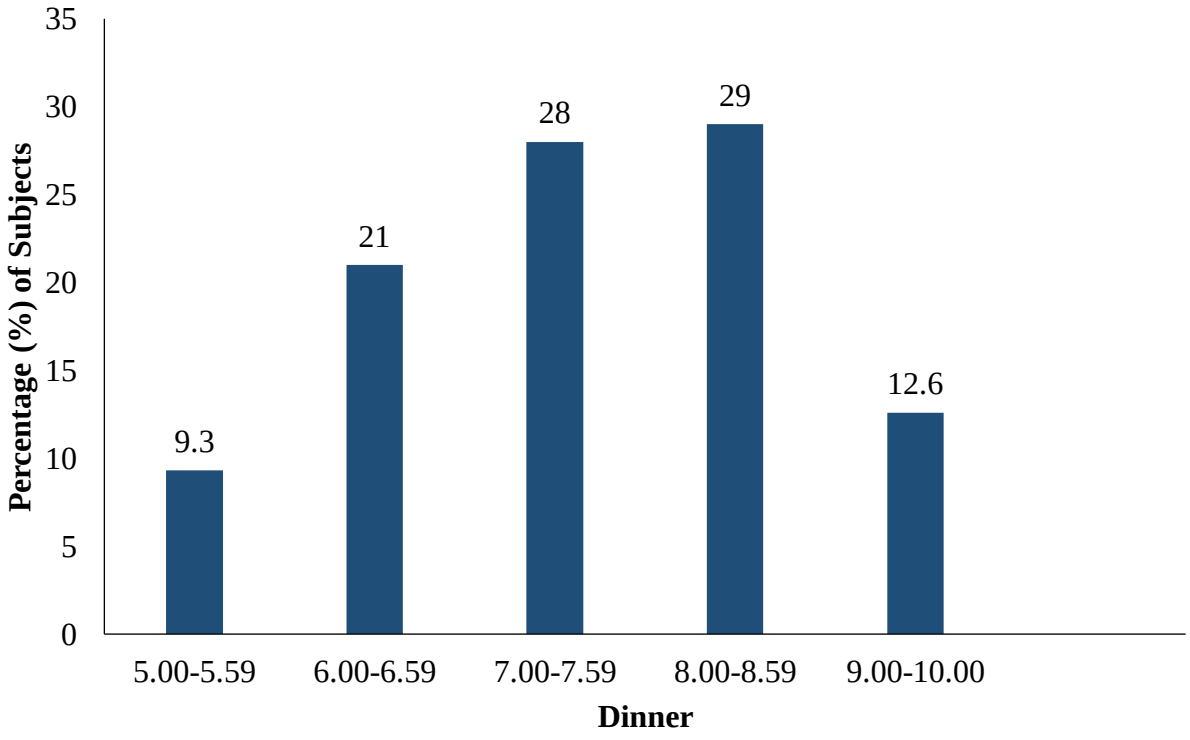


Figure 4.4: Usual Time of Dinner by Subjects

4.3 Associations of Eating Out Characteristics by Socio- demographic Information

4.3.1 Relationship between Eating Out Frequency and Socio- demographic

4.3.1.1 Relationship between Study Subjects' Weekly Frequency of Eat Out and their Socio- demographics

As indicated in Table 4.4, more females (60.1%) than males (39.9%) frequently ate out (≥7). Also more single subjects (66.7%) than married (33.3%) ate out frequently (≥7). There was no significant relationship found among subjects' socio- demographic characteristics and frequency of EO per week apart from employment status (p= 0.047). Both self- employed and employed mostly (85.7%) ate out more frequently (≥7) than the unemployed (14.3%).

Table 4.4: Frequency of Eat Outs per Week among Subjects by Socio- demographic (N=428)

Variable	Eating Out per Week n (%)		*p*- value
	4-6	≥7	
Age			0.786
18- 39	198 (76.2)	126 (38.9)	
40-60	62 (23.8)	42 (25.0)	
Sex			0.513
Male	112 (43.1)	67 (39.9)	
Female	148 (56.9)	101 (60.1)	
Educational Level			0.954
Primary	15 (5.8)	10 (6.0)	
JHS	37 (14.2)	25 (14.9)	
SHS	75 (28.8)	43 (25.6)	
University/Tertiary	84 (32.3)	59 (35.1)	
Others	49 (18.8)	31 (18.5)	
Religion			0.734
Christianity	212 (81.5)	141 (83.9)	
Islam	45 (17.3)	126 (15.5)	
Traditional	3 (1.2)	1 (0.6)	
Ethnicity			0.553
Ga/ Adangbe	57 (21.9)	30 (17.9)	
Akan	130 (50.0)	88 (52.4)	
Ewe	37 (14.2)	30 (17.9)	
Northerner	36 (13.8)	20 (11.9)	
Marital Status			0.550
Single	166 (63.8)	112 (66.7)	
Married	94 (36.2)	56 (33.3)	
Employment Status			**0.047**
Unemployed	55 (21.2)	24 (14.3)	
Employed/Self employed	205 (78.8)	144 (85.7)	

4.3.1.2 Relationship between Study Subjects' Weekly Eat Out Frequency and their Socio-demographics

There was no relationship found between frequency of weekly EO and NHAS subjects' background characteristics, as shown in Table 4.5.

Table 4.5: Frequency of Eat Out among NHAS Subjects by Socio- demographic (n=150)

Variable	Eating Out per Week n (%)		*p*- value
	4-6	≥7	
Age			0.664
18- 39	73 (78.5)	43 (75.4)	
40-60	20 (21.5)	14 (24.6)	
Sex			0.390
Male	39 (41.9)	28 (49.1)	
Female	54 (58.1)	29 (50.9)	
Educational Level			0.860
Primary	7 (7.5)	2 (3.5)	
JHS	10 (10.8)	8 (14.0)	
SHS	27 (29.0)	17 (29.8)	
University/Tertiary	30 (32.3)	19 (33.3)	
Others	19 (20.4)	11 (19.3)	
Religion			0.984
Christianity	76 (81.7)	47 (82.5)	
Islam	15 (16.1)	9 (15.8)	
Traditional	2 (2.2)	1 (1.8)	
Ethnicity			0.766
Ga/ Adangbe	25 (26.9)	13 (22.8)	
Akan	45 (48.4)	26 (45.6)	
Ewe	12 (12.9)	8 (14.0)	
Northerner	11 (11.8)	10 (17.5)	
Marital Status			0.428
Single	56 (60.2)	38 (66.7)	
Married	37 (39.8)	19 (33.3)	
Employment Status			0.201
Unemployed	19 (20.4)	7 (12.3)	
Employed/Self employed	74 (79.6)	50 (87.7)	

4.3.2 Relationship between Study Subjects' Eat Out Patterns and their Socio-demographics

There was no significant difference between EO pattern and the socio- demographic characteristics of subjects as indicated in Table 4.6 ($p > 0.05$).

Table 4.6: Relationship between Socio- demographic and Frequency of Eat Out Patterns by Type of Meal (N=428)

	n(%)										
	Breakfast			*p*-	Lunch			*p*-	Dinner			*p*-
Variable	**0-2**	**3-4**	**5-7**	**value**	**0-2**	**3-4**	**5-7**	**value**	**0-2**	**3-4**	**5-7**	**value**
Age				0.601				0.643				0.952
18- 25	269(74.9)	48(78.7)	7(87.5)		153(74.3)	119(75.8)	52(80.0)		117(75.0)	128(75.7)	79(76.7)	
40-60	90(25.1)	13(21.3)	1(12.5)		53(25.7)	38(24.2)	13(20.0)		39(25.0)	41 (24.3)	24(23.3)	
Sex				0.082				0.712				0.615
Male	142(39.6)	32(52.5)	5(62.5)		82(39.8)	69(43.9)	28(43.1)		70(44.9)	67(39.6)	42(40.8)	
Female	217(60.4)	29(11.6)	3(37.5)		124(60.2)	88(56.1)	37(56.9)		86(55.1)	102(60.4)	61(59.2)	
Educational Level				0.807				0.824				0.427
Primary	22(6.1)	2(3.3)	1(12.5)		11(5.3)	12(7.6)	2(3.1)		6(3.8)	9(5.3)	10(9.7)	
JHS	53(14.8)	7(11.5)	2(25.0)		27(13.1)	24(15.3)	11(16.9)		23(14.7)	26(15.4)	13(12.6)	
SHS	102(28.4)	15(24.6)	1(12.5)		57(27.7)	40(25.5)	21(32.3)		37(23.7)	50(29.6)	31(30.1)	
University/Tertiary	116(32.3)	24(39.3)	3(37.5)		71(34.5)	50(31.8)	22(33.8)		61(39.1)	53(31.4)	29(28.2)	
Others	66(18.4)	13(21.3)	1(12.5)		40(19.4)	31(19.7)	9(13.8)		29(18.6)	31(18.3)	20(19.4)	
Religion				0.864				0.177				0.576
Christianity	297(82.7)	50(82.0)	6(75.0)		176(85.4)	128(81.5)	49(75.4)		124(79.5)	140(82.8)	89(86.4)	
Islam	58(16.2)	11(18.0)	2(25.0)		29(14.1)	28(17.8)	14(21.5)		30(19.2)	27(16.0)	14(13.6)	
Traditional	4(1.1)	0(0.0)	0(0.0)		1(0.5)	1(0.6)	2(3.1)		2(1.3)	2(1.2)	0(0.0)	
Ethnicity				0.819				0.756				0.551
Ga/ Adangbe	75(20.9)	10(16.4)	2(25.0)		41(19.9)	31(19.7)	15(23.1)		29(18.6)	36(21.3)	22(21.4)	
Akan	179(49.9)	35(57.4)	4(50.0)		110(53.4)	80 (51.0)	28(43.1)		88(56.4)	77(45.6)	53(51.5)	
Ewe	56(15.6)	9(14.8)	2(25.0)		30(14.6)	27(17.2)	10(15.4)		19(12.2)	32(18.9)	16(15.5)	
Northerner	49(13.6)	7(11.5)	0(0.0)		25(12.1)	19(12.1)	12(18.5)		20(12.8)	24(14.2)	12(11.7)	
Marital Status				0.398				0.093				0.145
Single	238(66.3)	35(57.4)	5(62.5)		144(69.9)	97(61.8)	37(56.9)		92(59.0)	116(68.6)	70(68.0)	
Married	121(33.7)	26(42.6)	3(37.5)		62(30.1)	60(38.2)	28(43.1)		64(41.0)	53(31.4)	33(32.0)	
Employment Status				0.883				0.583				0.742
Unemployed	66(18.4)	12(19.7)	1(12.5)		35(17.0)	33(21.0)	11(16.9)		28(17.9)	34(20.1)	17(16.5)	
Employed/Self employed	293(81.6)	49(80.3)	7(87.5)		171(83.0)	124(79.0)	54(83.1)		128(82.1)	135(79.9)	86(83.5)	

4.4 Reasons for Eating Out

Figure 4.5 shows the varied reasons given by all study subjects for eating out comprising of convenience, preference, sensory appeal, lack of home alternatives, inadequate cooking skills, time constraints and socialization. For each meal eating occasion, the main reason motivating EO given by most of the subject is convenience. Majority (51.4%) ate lunch out than for breakfast 42.8%, and dinner (41.8%) due to convenience. Time constraint was another major factor promoting EO as reported by those who ate various meals out: 23.6% for breakfast; 17.5% for lunch and 22.2% for dinner. More subjects ate breakfast out because of the lack of home alternatives (12.1%) than due to preference (11.2%). Consuming breakfast out due to inadequate cooking skills was most likely (7.2%) than during lunch (4.4%) or dinner (4.9%).

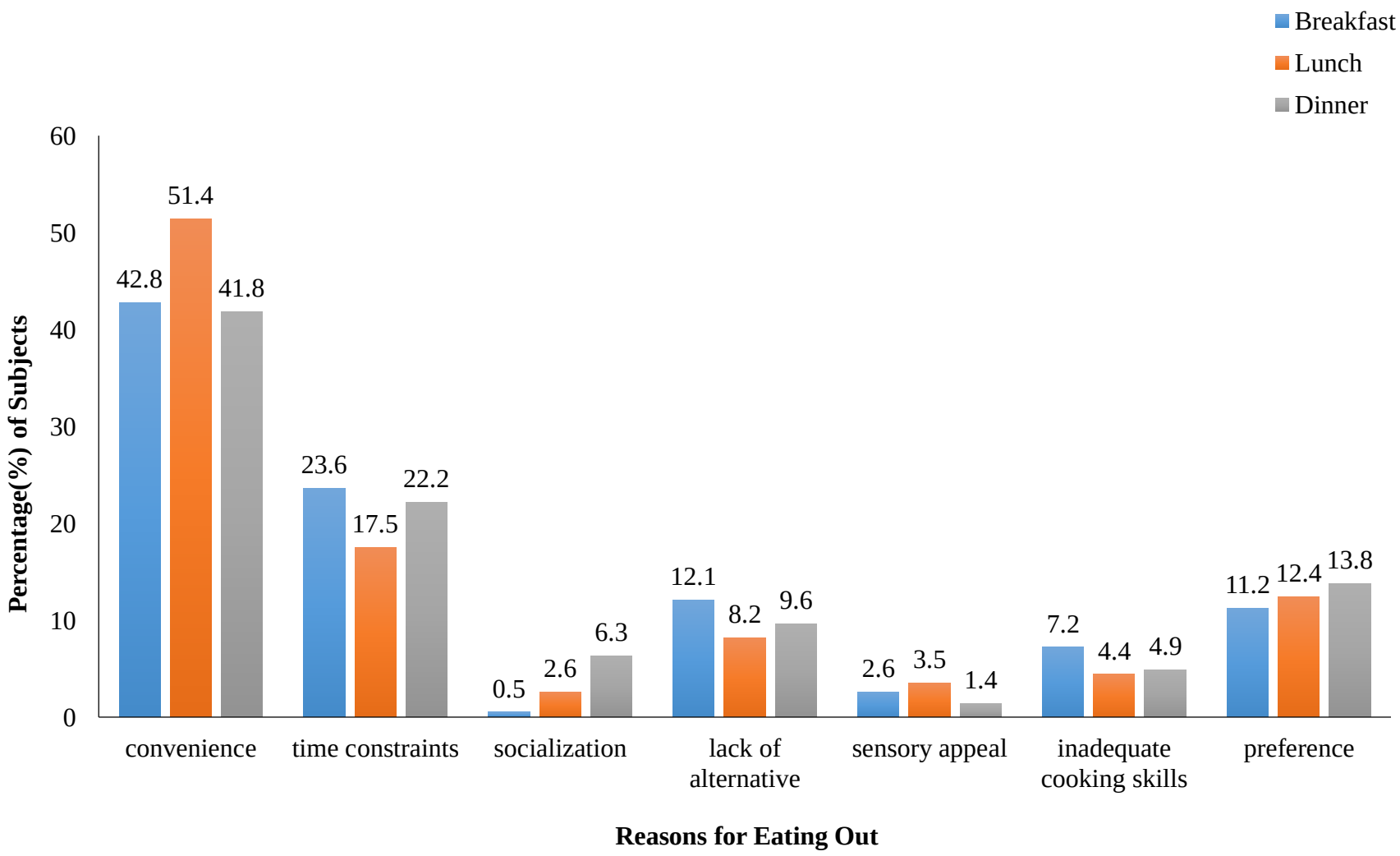


Figure 4.5: Subjects Reasons for Eating Out during Patterns of Meal Consumption (N=428)

4.5 Reasons for Eating Out by Gender

As shown in Table 4.7, there are no significant relationship between gender and reasons given for EO breakfast (p= 0.401) and lunch (p= 0.708). However, the relationship between reason for lunch EO and gender showed a significance (p= 0.039), where trends indicate that more males than females ate lunch out because coincidentally, they lacked adequate cooking skills and home alternatives. Other reasons for lunch EO trended among women than among men.

Table 4.7: Relationship between Gender and Reasons for Eating Out (N=428)

	n(%)								
	Breakfast			**Lunch**			**Dinner**		
Variable	**Male**	**Female**	***p*-value**	**Male**	**Female**	***p*-value**	**Male**	**Female**	***p*-value**
Reasons			0.401			**0.039***			0.708
Convenience	76(41.5)	107(58.5)		95(43.2)	125(56.8)		75(41.9)	104(58.1)	
Time Constraints	44(43.6)	57(56.4)		22(29.3)	53(70.7)		43(45.3)	52(54.7)	
Socialization	1(50.0)	1(50.0)		2(18.2)	9(81.8)		11(40.7)	16(59.3)	
Lack of Home Alternatives	17(32.7)	35(67.3)		21(60.0)	14(40.0)		13(31.7)	28(68.3)	
Sensory Appeal	5(45.5)	6(54.5)		6(40.0)	9(60.0)		2(33.3)	4(66.7)	
Inadequate Cooking Skills	10(32.3)	21(67.7)		10(52.6)	9(47.4)		7(33.3)	14(66.7)	
Preference	26(54.2)	22(45.8)		23(43.4)	30(56.6)		28(47.5)	31(52.5)	

4.6 Frequency of Eating at Home among Subjects

Out of the twenty- one (21) weekly meals consumption, over a half of all subjects (58.7%) ate only 2-5 meals and only 2.7% of all subjects ate at least eleven (11) home meals per week as shown in Figure 4.6.

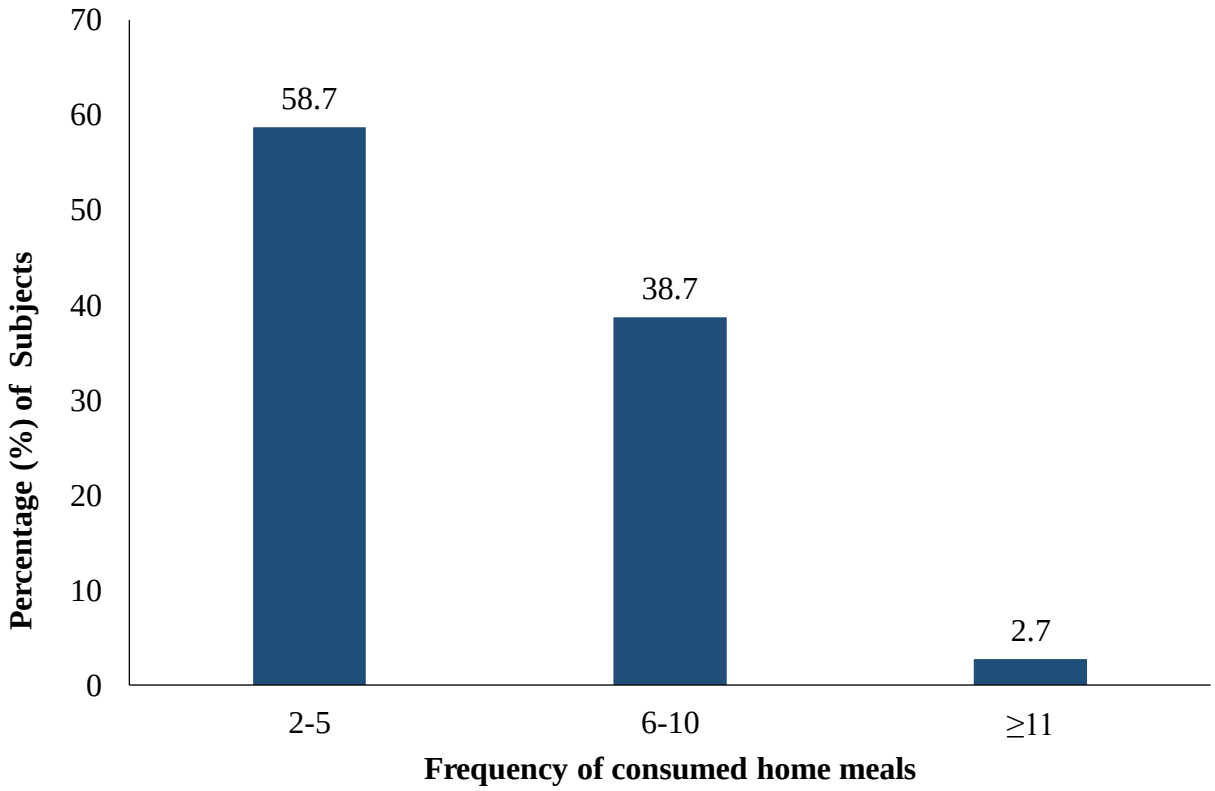
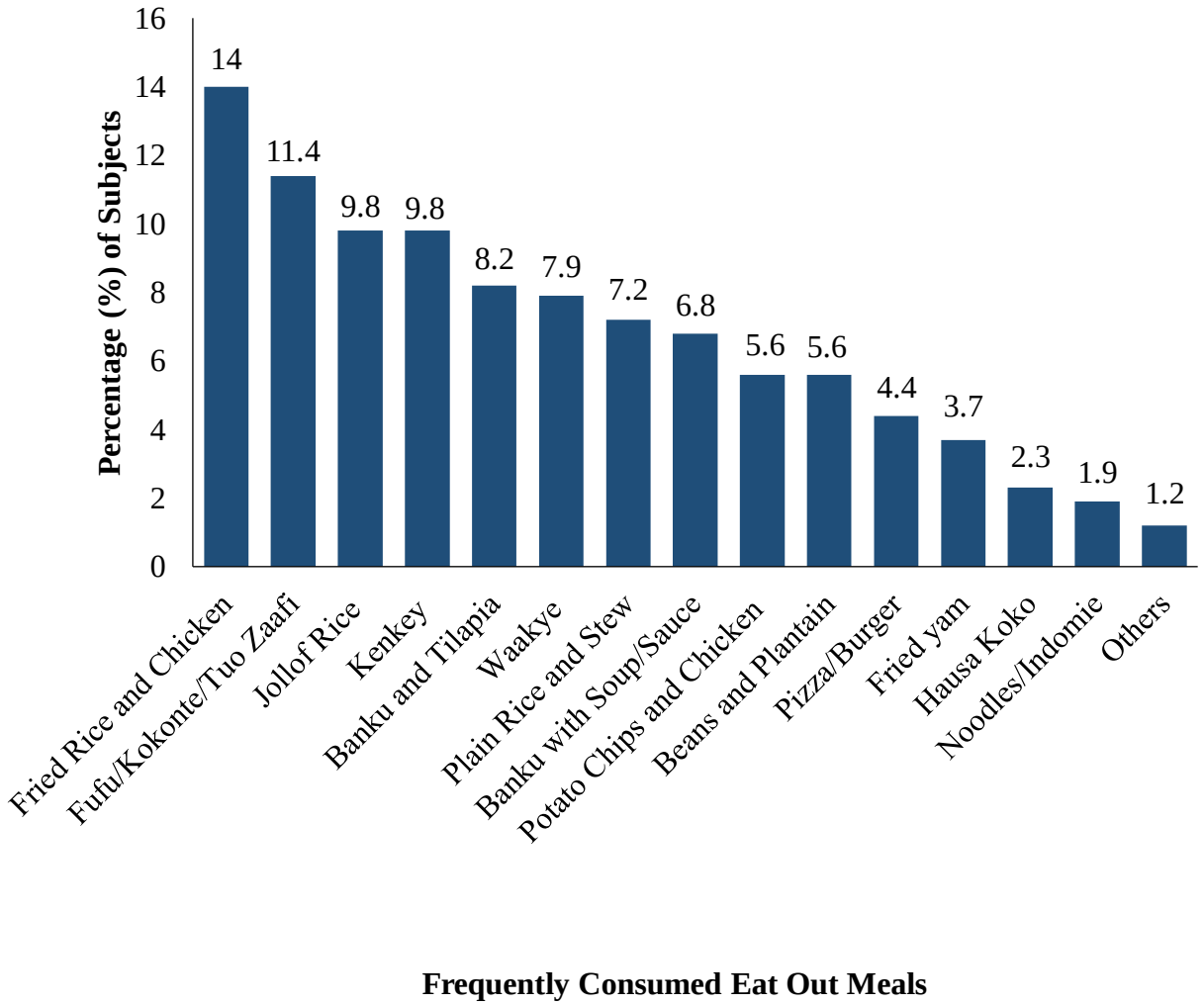


Figure 4.6: Percentage Distribution of Frequency of Meals Consumed at Home among Subjects (N=428)

4.7 Frequently Consumed Eat Out and Home Meals

4.7.1 Frequently Consumed Eat Out Meals among Subjects

Frequent eat out meals among subjects are shown in Figure 4.7. Fried rice and chicken (14%), *fufu/ kokonte/ tuo zaafi* (11.4%), *jollof* rice (9.8), *kenkey* (9.8%) and *banku* and tilapia were among the top five main common eat out meals among the study subjects.



Others include *Ayoo*, Fried golden prawns, sandwich, salad and shawarma

Figure 4.7: Frequent Meals Consumed by Subjects during Eat Out

4.7.2 Frequently Consumed Home Meals among Subjects

Popular home meals consumed by subjects are shown in Figure 4.8. Out of all meals plain rice and stew/ soup dishes dominated (24.5%). Other top common meals include *fufu/ kokonte/ tuo zaafi* (15.4%), yam and stew dishes (15%), *banku* with *okro* stew/soup (10.7%) and plantain/ *ampesi* with stew dishes (9.6%).

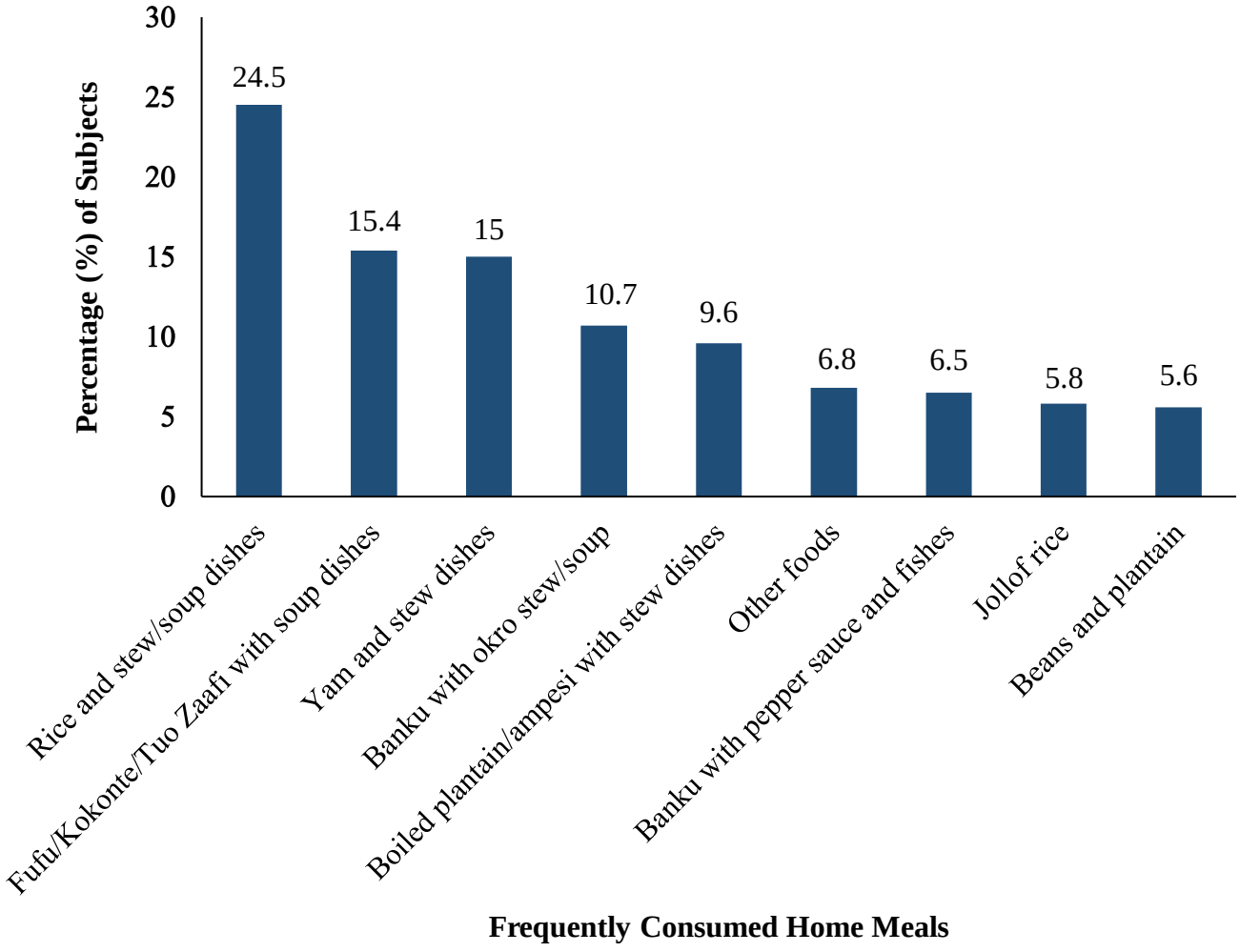


Figure 4.8: Frequent Meals Consumed by Subjects at Home

4.8 Nutrition and Health Situation of Study Subjects

A sub- sample of the study population was used for this section of the current study.

4.8.1 Nutrition and Health Characteristics of Study Subjects

The nutritional health characteristics of subjects is reported in Table 4.8. Overall, the average BMI of subject is 26.50±4.31 kg/ m^2 and although there is no significant difference between the mean BMI of male and female (p= 0.571), males reported a slightly higher mean BMI (26.86±4.15 kg/m^2) than the females (26.22±4.44 kg/m^2). Also, the average FBS of males was higher (6.43±1.69 mmol/L) than females (5.86±1.45 mmol/L) with the difference being statistically significant (p- value= 0.031).

Table 4.8: Nutrition and Health of Study Subjects (N=150)

Variable	Overall	Males	Females	*p*- value[a]
Weight (kg)	71.72±13.13	75.35±12.76	68.79±12.75	0.484
BMI (kg/m^2)	26.50±4.31	26.86±4.15	26.22±4.44	0.571
FBS (mmol/L)	6.11±1.58	6.43±1.69	5.86±1.45	**0.031***
Systolic Pressure (mm/Hg)	116.29±16.03	119.22±14.78	113.92±16.68	0.468
Diastolic Pressure (mm/Hg)	75.68±12.29	76.38±12.14	75.12±12.47	0.484
Physical activity level (MET)	1604.80±1655.63	1606.57±1715.39	1603.37±1616.29	0.853

[1]All values reported in mean± SD

[a] Independent t-test

4.8.2 Physical Activity Levels of Subjects

The PAL pattern of the study subjects is presented in Figure 4.9. More than two- thirds (69.9%) of subjects engaged in moderate PA weekly. About a tenth (10.3%) engaged in high PAL.

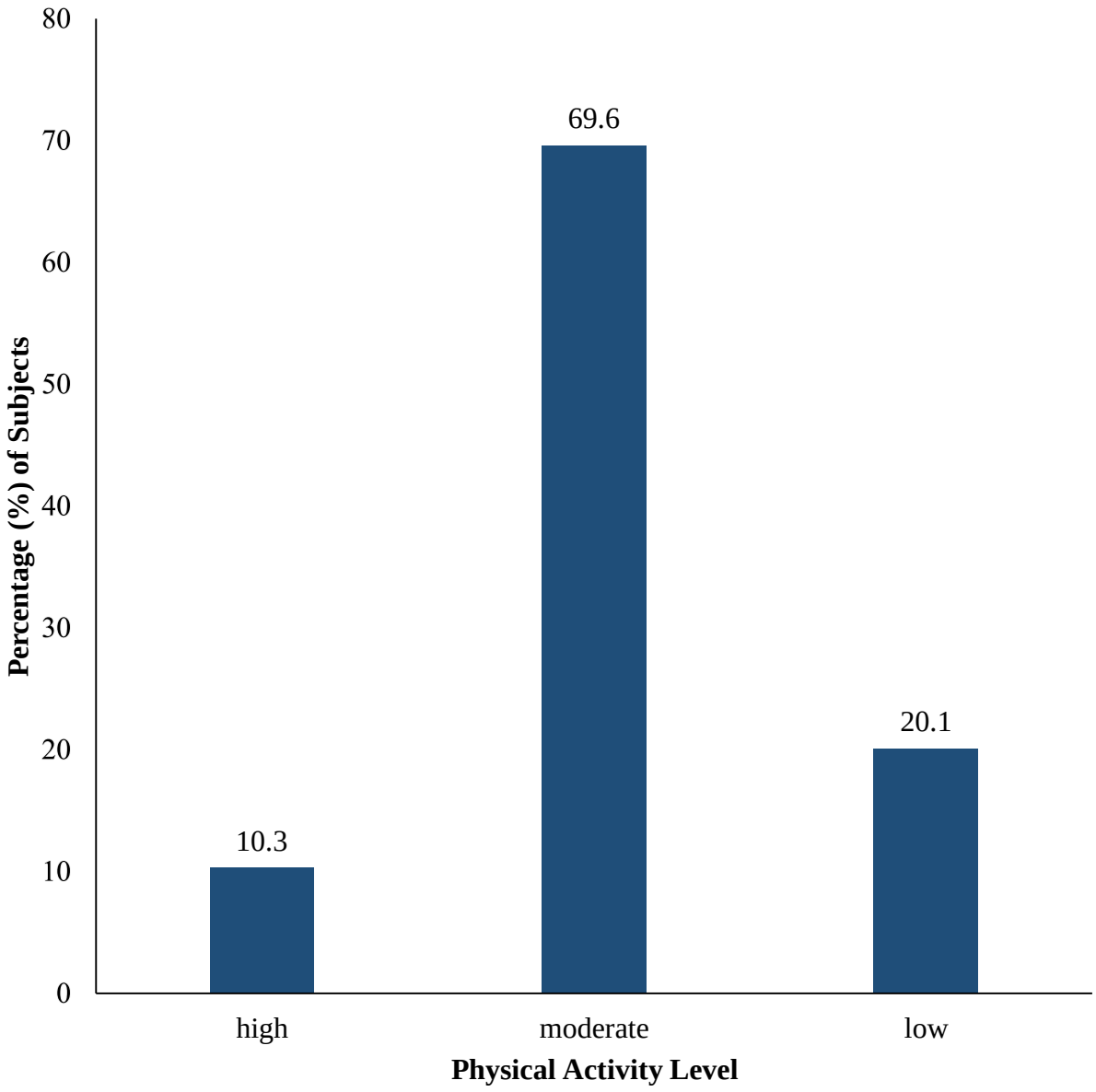


Figure 4.9: Pattern of Physical Activity Levels of All Subjects (N=428)

4.8.3 Classification of Nutritional Status and Prevalence of NHAS Subjects

Table 4.9 shows the prevalence of nutritional status classification among subjects. Among the various categories, there was a significant difference between males and females FBS classification ($p = 0.007$). A higher proportion of males were more diabetic (29.9%) than females (9.6%) with an overall prevalence of 18.7%. More females were however non- diabetic and pre-diabetic (50.6% and 39.8% respectively) as compared to males (40.3% and 29.9% respectively). Besides, more of the subjects (44%) were overweight and 18% were obese. A higher proportion of females (45.8%) were overweight than men (41.8%) but a higher proportion of men (22.4%) than women (14.5%) were obese. The prevalence of hypertension among all subjects was equally as the prevalence found among males and females (19.3%; 19.4% and 19.3% respectively).

Table 4.9: Nutrition and Health Status of Subjects by Gender

Variables	Overall (N=150)	Male (n=67)	Female (n=83)	*p*-value
BMI Classification				0.454
Normal	57(38.0)	24(35.8)	33(39.8)	
Overweight	66(44.0)	28(41.8)	38(45.8)	
Obese[a]	27(18.0)	15(22.4)	12(14.5)	
FBS Classification				**0.007***
Non- diabetic	69(46.0)	27(40.3)	42(50.6)	
Pre-diabetic	53(35.3)	20(29.9)	33(39.8)	
Diabetic	28(18.7)	20(29.9)	8(9.6)	
Systolic Classification				0.191
Normal	73(48.7)	28(41.8)	45(54.2)	
Elevated	48(32.0)	21(31.3)	27(32.5)	
Hypertension Stage 1	21(14.0)	13(19.4)	8(9.6)	
Hypertension Stage 2	8(5.3)	5(7.5)	3(3.6)	
Diastolic Classification				0.964
Normal/ Elevated	91(60.7)	41(61.2)	50(60.2)	
Hypertension Stage 1	33(22.0)	15(22.4)	18(21.7)	
Hypertension Stage 2	26(17.3)	11(16.4)	15(18.1)	
Hypertension Classification				0.872
Normal (normotensive)	88(58.7)	38(56.7)	50(60.2)	
Pre-hypertension	33(22.0)	16(23.9)	17(20.5)	
Hypertension	29(19.3)	13(19.4)	16(19.3)	
PAL Classification				0.841
Low	30(20.0)	12(17.9)	18(21.7)	
Moderate	102(68.0)	47(70.1)	55(66.3)	
High	18(12.0)	8(11.9)	10(12.0)	

[a] Obese include obese type1 ,2 and 3 according to standard classification

4.9 Nutrition and Health Status by Subject BMI

From Table 4.10, subjects being normal, overweight or obese is significantly related to being non-diabetic, pre-diabetic or diabetic ($p< 0.001$) as well being classified as normotensive, pre-hypertensive or hypertensive ($p< 0.001$). Most of those who were overweight (42.4%) and obese (51.9%) were pre- diabetic and diabetic respectively. Over a half of overweight subjects (56.1%) were normotensive whereas obese (59.3%) were hypertensive. PAL and frequency of consumed home meals however, were not related to BMI.

Table 4.10: Relationship between BMI and Selected Variables

Variable	n(%)			
	Normal	**Overweight**	**Obese**	***p*-value[a]**
FBS				**<0.001***
Non- diabetic	40(70.2)	26(39.4)	3(11.1)	
Pre- diabetic	15(26.3)	28(42.4)	10(37.0)	
Diabetic	2(3.5)	12(18.2)	14(51.9)	
Hypertension				**<0.001***
Normal	46(80.7)	37(56.1)	5(18.5)	
Pre- hypertensive	8(14.0)	19(28.8)	6(22.2)	
Hypertensive	3(5.3)	10(15.2)	16(59.3)	
PAL				
Low	13(22.8)	13(19.7)	4(14.8)	0.058
Moderate	42(73.7)	44(66.7)	16(59.3)	
High	2(3.5)	9(13.6)	7(25.9)	
Home Meals frequency/week				0.383
≤5x	33(57.9)	42(63.6)	13(48.1)	
≥ 6x	24(42.1)	24(36.4)	14(51.9)	

[a] Significance at *p*-value <0.05 (Pearson Chi- Square)

4.10 Relationship between Eating Out Events and Nutritional health

As indicated in Table 4.11, the relationships between the average number of meals consumed per week during eat out and health characteristics were all significant. Mean body weight was significantly higher in subjects who eat out ≥7 meals/ week (74.62± 16.10)/kg than those who eat out 4-6 meals/ week (69.94± 10.64)/kg (p< 0.001). About 11% of subjects who eat out 4-6 meals/ week were obese whereas close to 30% of subjects who eat out ≥7 meals/ week were obese. Almost 30% of subjects who eat out ≥7meals/ week were diabetic whereas about 12% eat out 4-6 meals /week were diabetic was significantly higher (29.8%) among those than those who eat out ≥7. Approximately 32% of those who eat out ≥7meals/ week were hypertensive and nearly 12% were found to eat out 4-6 meals /week and were hypertensive.

Table 4.11: Relationship between Eating Out and Nutritional Health of Subjects

Average EO Frequency/week	**4-6**	**≥7**	**p- value**
Variables			
Body weight[a] (kg)	(69.94± 10.64)	(74.62± 16.10)	**<0.001***
BMI (kg/m^2)			**0.008***
Normal (18.5-24.99)	36 (38.7)	21 (36.8)	
Overweight (25.0-29.99)	47 (50.5)	19 (33.3)	
Obese[a] (≥30)	10 (10.8)	17 (29.8)	
FBS (mmol/l)			**0.019***
Non- diabetic (<5.6)	48 (51.6)	21 (36.8)	
Pre- diabetic (5.6- 7)	34 (36.6)	19 (33.3)	
Diabetic (≥7)	11 (11.8)	17(29.8)	
Hypertension (mmHg)			**0.010***
Normal (normotensive) (<120/80)	61 (65.6)	27 (47.4)	
Pre- hypertensive (120-139/80-89)	21 (22.6)	12(21.1)	
Hypertensive (≥140/90)	11 (11.8)	18 (31.6)	

[a] independent t- test statistics
p- value significance at <0.05

4.11 Predictors of Frequency of Eating Out

In finding out the predictors of frequency of 4-6 eat out per week, age, sex, educational level, marital status and employment status as well as their reasons for EO (breakfast, lunch and dinner) were used. Table 4.12 shows the results of the binary logistic regression run. There was no significance found when these factors were tested with EO frequency of 4-6 per week besides reason for breakfast eat out (p= 0.032) which showed as a possible predictor of EO 4-6 times per week. The odds of EO 4-6 times weekly was less than a fold for subjects who gave convenience as a reason for breakfast eat out compared to subjects who gave other reasons for breakfast eat out (OR= 0.642, 95% CI= 0.429- 0.962, p= 0.032).

Table 4.12: Logistic Regression Showing the Association between Eating Out (4-6 times) Weekly and Potential Predictors/Covariates (N= 428)

Variable	OR (95% Confidence Interval)	*p*- value**
Age		0.705
<40 [a]	0.913 (0.570- 1.463)	
≥40[b]	1	
Sex		0.470
Male	0.861 (0.575- 1.291)	
Female	1	
Educational Level		0.703
Educated [c]	0.822 (0.301- 2.248)	
Uneducated	1	
Marital Status		0.330
Single [d]	1.238 (0.806- 1.903)	
Married	1	
Employment Status		0.094
Employed [e]	0.630 (0.367- 1.082)	
Unemployed	1	
Reason for Breakfast Eat Out		**0.032***
Convenience	0.642(0.429- 0.962)	
Other Reasons [f]	1	
Reason for Lunch Eat Out		0.746
Convenience	1.068 (0.719-1.585)	
Other Reasons [f]	1	
Reason for Dinner Eat Out		0.577
Convenience	1.120 (0.752-1.669)	
Other Reasons [f]	1	

OR= Odds Ratio
** Significance at <0.05
[a] 18-39 years
[b] 40-60
[c] Primary, Junior High School (JHS), Senior High School (SHS), University/Tertiary and Others(commercial, vocational, accounting and artistry schools)
[d] Single, divorced and widowed
[e] Employed and self employed
[f]Time constraints, socialization, lack of home alternatives, sensory appeal, inadequate cooking skills and preference

4.12 Predictors of Overweight/ Obesity

Potential covariates including age, sex, educational level, marital status, employment status, EO frequency and PAL were used in assessing the possible predictor of overweight/ obesity among NHAS subjects of the study. Displayed in Table 4.13is the result of the binary logistic regression. Age was the only significant predictor of overweight/ obesity, where the odds of being overweight/ obesity when aged <40years was less than a fold compared to being 40years and older (OR= 0.315, 95% CI= 0.118- 0.840, *p*= 0.021). Other possible predictors, although not significant are EO frequency and PAL. The odds of being overweight/ obesity when EO is ≥7 times is about a fold (OR= 0.967) as compared to EO frequency of 4-6 times. Likewise, the odds of being overweight/ obesity when engaged in low PA is about one and half (OR= 1.483) folds compared to having high PAL

Table 4.13: Logistic Regression Showing the Association between Overweight/ Obesity and Potential Predictors/Covariates (N= 150)

Variable	OR (95% Confidence Interval)	*p*- value
Age		**0.021***
<40[a]	0.315 (0.118- 0.840)	
≥40[b]	1	
Sex		0.938
Female	1.028(0.512- 2.063)	
Male	1	
Educational Level		0.717
Educated [c]	1.569 (0.138- 17.852)	
Uneducated	1	
Marital Status		0.227
Married	0.624 (0.291- 1.340)	
Single [d]	1	
Employment Status		0.483
Unemployed	1.377 (0.563- 3.364)	
Employed [e]	1	
EO Frequency (meals/week)		0.929
≥7	0.967 (0.466- 2.009)	
4-6	1	
PAL		0.369
Low	1.483 (0.628- 3.503)	
Moderate/high	1	

** Significance at *p*- value< 0.05

[a] 18-39 years

[b] 40-60

[c] Primary, Junior High School (JHS), Senior High School (SHS), University/Tertiary and Others(commercial, vocational, accounting and artistry schools)

[d] Single, divorced and widowed

[e] Employed and self employed

4.13 Proximate Composition of Selected Meals from Fast Food Restaurants

The list of meals from various restaurants are listed in Table 4.14. For ethical reasons, reference meal codes are used to identify restaurant for anonymity.

Table 4.14: List of Restaurant Foods from Different Sources and their Reference Codes

Fast food Restaurants Meals	Reference Meal Code
Grilled Chicken + Fried Vegetable Rice + Coleslaw + Black Pepper Sauce	FI
Broasted Chicken +*Jollof* Rice+ Coleslaw + Black Pepper Sauce	F2
Charcoal Grilled Chicken + Fried Rice+ Coleslaw + Hot Black Pepper	P1
Charcoal Grilled Chicken + Fried Potato +Coleslaw + Ketchup	P2
Beef Burger + Fried Potatoes + Ketchup	H1
Grilled Chicken Skewers + Fried Rice + Red Pepper Sauce	H2
Zinger Burger (Chicken Burger + Cheese)	K1
Fried Potatoes + Fried Chicken + Ketchup	K2
Banku +Grilled Tilapia + Green Pepper + Red Pepper Sauce	R1
R's Style Grilled Chicken + *Jollof* Rice	R2
Banku + Tilapia + *Okro* Stew	MR1
Fufu + Goat Light Soup	MR2
Fufu + Chicken Light Soup	AS1
Rice Balls + Salmon + Groundnut Soup	AS2
Jollof Rice + Fried Turkey + Green Pepper Sauce	CR1
Kenkey + Fried Peppered Pork + Pepper Sauce	CR2
Waakye + Fried Red Fish + Boiled Egg + Spaghetti +Gari +Tomato Stew + Black Pepper Sauce	CK1
Beans Stew + Fried Plantain + Fried Red Fish	CK2
Pork Vegetable Rice + Pepper Sauce	NI
Combination Fried Rice (Chicken, Shrimp And Beef) + Pepper Sauce	N2

4.13.1 Macronutrients and Moisture Content of Selected Meals from Fast Food Restaurants

Table 4.15 presents the mean content of carbohydrate, protein and fat and their contribution to RDA and AMDR. There were significant differences ($p< 0.001$) between the macronutrients across all restaurant meals. Post hoc analysis showed where the differences within meals lie (See Table 4.16 footnotes). The mean portion weight of meals ranged from 208.60± 0.20g- 1053.63± 0.35g, where F2 provided the highest weight per serving and K1 provided the least portion size. Moisture content of meals ranged between 42.99± 0.05g and 78.99± 0.09g.

Mean of fast food restaurant meal fats ranged between (0.81± 0.10 -27.94± 0.11) g/ 100g with the highest reported for P1 and the least meal fat content reported for AS1. Percentage of RDA provided by meals with highest and lowest fat content are 2.70% and 93.13% respectively. AMDR contribution reported for P1 is 75.30%, however H2 reported the least (5.52%) contributor to AMDR as compared with the meal with the least fat content AS1 (7.88%).

Protein content ranged from 6.84± 0.75g/100g to 15.30± 1.63g/100g with AS1 and R2 recording the lowest and highest respectively. Similarly, AS1 reported the lowest (13.2%) and R2 the highest (30.01%) contributors to RDA. Protein content of R2 recorded the highest contributor to AMDR whiles that of F2 provided the lowest contribution to its AMDR.

Carbohydrate (CHO) content of meals ranged from 9.41± 0.93g/100g to 37.02± 1.12g/100g. MR2 and K1 meals reported the lowest and highest CHO content respectively as well as contribution to RDA (7.24% and 28.48% respectively). Percentage contribution to AMDR by CHO from H2 was highest (71.97%) whiles P1 reported the lowest (12.34%).

Table 4.15: Macronutrients and Moisture Content of Selected Meals per 100g Edible Portion

Food Code	Per serving Weight/g	Moisture Mean±SD	Fat/g Mean±SD	% RDA	% AMDR	Protein/g Mean±SD	%* RDA	% AMDR	CHO/g Mean±SD	% RDA	%AMDR
FI	970.67 ± 1.16	55.54±0.08	$7.84±0.10^{g}$	26.12	33.43	$9.06±2.46^{bcd}$	17.76	13.33	$26.04±2.52^{bcde}$	20.03	49.39
F2	1053.63 ± 0.35	53.43±0.14	$18.46±0.10^{c}$	61.52	61.08	$8.74±2.08^{bcd}$	17.14	10.47	$17.72±2.20^{efghij}$	13.63	26.06
P1	489.73 ± 0.06	49.71±0.10	$27.94±0.11^{a}$	93.13	75.30	$10.32±2.51^{abcd}$	20.24	22.40	$10.30±2.58^{ij}$	7.92	12.34
P2	815.97 ± 0.21	59.37±0.04	$5.37±0.08^{k}$	17.90	26.23	$9.60±1.66^{bcd}$	18.83	22.14	$24.37±1.74^{cdef}$	18.75	52.92
H1	476.68 ± 0.02	67.26±0.11	$9.53±0.13^{e}$	31.75	49.42	$10.53±0.88^{abcd}$	20.64	21.36	$11.41±0.80^{ij}$	8.78	26.31
H2	385.67 ± 0.32	50.35±0.10	$1.21±0.10^{o}$	4.03	5.52	$11.09±2.39^{abcd}$	21.75	17.08	$35.47±2.39^{ab}$	27.28	71.97
K1	208.60 ± 0.20	42.99±0.05	$7.64±0.08^{g}$	25.46	26.47	$10.72±1.27^{abcd}$	21.02	14.94	$37.02±1.12^{a}$	28.48	57.02
K2	392.47 ± 0.06	50.37±0.04	$18.94±0.09^{b}$	63.12	59.38	$9.77±1.08^{bcd}$	19.15	32.42	$19.39±1.05^{defghij}$	14.91	27.02
R1	1046.40 ± 0.10	71.56±0.10	$2.17±0.10^{m}$	7.23	16.21	$13.73±2.90^{ab}$	26.92	27.10	$11.51±2.61^{ij}$	8.85	38.21
R2	779.43 ± 0.06	55.27±0.09	$6.01±0.13^{j}$	20.03	26.69	$15.30±1.63^{a}$	30.01	48.41	$21.83±1.84^{cdefgh}$	16.79	43.10
MR1	600.92 ± 0.07	71.94±9.68	$4.08±0.05^{l}$	13.59	29.01	$8.33±1.06^{cd}$	16.33	38.69	$14.11±10.57^{ghij}$	10.85	44.64
MR2	603.26 ± 0.01	78.99±0.09	$1.41±0.06^{o}$	4.69	14.72	$8.95±1.08^{bcd}$	17.55	38.66	$9.41±0.93^{j}$	7.24	43.71
AS1	622.48 ± 0.00	76.71±0.05	$0.81±0.10^{p}$	2.70	7.88	$6.84±0.75^{d}$	13.42	26.35	$14.49±0.82^{fghij}$	11.14	62.57
AS2	537.97 ± 0.03	76.76±0.29	$2.68±0.10^{m}$	8.95	23.26	$7.65±1.44^{cd}$	15.00	13.34	$12.28±1.98^{hij}$	9.45	47.29
CR1	306.80 ± 0.02	54.10±0.11	$10.26±0.10^{d}$	34.18	40.26	$12.14±0.73^{abc}$	23.80	22.37	$22.11±0.72^{cdefgh}$	17.01	38.57
CR2	380.13 ± 0.01	55.67±3.72	$8.95±0.05^{f}$	29.83	37.11	$11.72±1.84^{abcd}$	22.98	25.56	$22.41±5.05^{cdefgh}$	17.24	41.30
CK1	462.23 ± 0.02	60.84±0.09	$6.61±0.09^{i}$	22.03	32.44	$11.08±0.94^{abcd}$	21.73	24.56	$19.88±0.93^{defghi}$	15.29	43.38
CK2	531.01 ± 0.02	60.23±4.06	$5.40±0.13^{k}$	18.00	26.92	$8.91±1.44^{bcd}$	17.47	17.55	$24.07±5.19^{cdefg}$	18.52	53.34
NI	664.92 ± 0.07	56.33±0.06	$6.13±0.10^{j}$	20.43	27.17	$7.72±1.64^{cd}$	15.14	14.29	$29.24±1.46^{abcd}$	22.49	57.61
N2	575.74 ± 0.01	54.06±0.40	$7.11±0.05^{h}$	23.68	29.58	$7.63±1.48^{cd}$	14.95	14.11	$30.43±2.08^{abc}$	23.41	56.31

RDA- Recommended Dietary Allowance

AMDR- Acceptable Macronutrient Distribution Ranges

*RDA estimated average of adult men and women (51g) Values with the same superscripts within the column

One- way ANOVA (All means $p< 0.001$; significance at p- value< 0.005);

Post Hoc Tukey Pairwise Comparison [values with the **same superscript alphabets within a column** are not significantly different ($p< 0.05$)]

4.13.2 Energy Composition of Selected Meals from Fast Food Restaurant

Table 4.16 summarizes the energy composition of meals from fast food restaurants. The mean energy per 100g and per serving size of food ranged from 86.11±0.26 kcal to 333.94±0.57 kcal and 519.49±1.55 kcal to 2865.19±12.94 kcal respectively. Per 100g of food samples, P1 reported the highest energy (519.49±1.55 kcal) and MR2 reported as the lowest in energy supply (333.94±0.57 kcal). Energy obtained from portion size per serving was lowest (519.49±1.55 kcal) for MR2 and highest (2865.19±12.94 kcal) for F2. Overall there was significant differences between means of food energy for both per 100g and per serving ($p \leq 0.001$) across meals, but significant differences were not found within some foods (See Table 4.17 footnotes). Contribution of foods to the estimated energy requirement ranged from MR2 being the lowest (3.73%) to P1, being the highest (14.46%) contributor. It was indicated that MR2 food had the lowest energy density of 0.86 kcal/g whiles P1 had the highest energy density of 3.34 kcal/g.

Table 4.16: Energy Load of Selected Meals

Food Code	Energy/100g[a] (Mean±SD)	%Contribution to EER	Total Energy/ Serving(g)[a] (Mean±SD)	Energy Density(kcal/g)
F1	210.92±0.70^{def}	9.13	2047.28±4.43^{b}	2.11
F2	271.93±1.31^{b}	11.77	2865.19±12.94^{a}	2.72
P1	333.94±0.57^{a}	14.46	1635.42±2.85^{c}	3.34
P2	184.23±1.07^{fg}	7.98	1503.22±8.70^{cd}	1.84
H1	173.49±0.44^{g}	7.51	827.01±2.06^{hi}	1.73
H2	197.11±0.93^{efg}	8.53	760.17±3.65^{i}	1.97
K1	259.70±1.53^{bc}	11.24	541.73±2.68^{jk}	2.60
K2	287.03±0.74^{b}	12.43	1126.50±2.80^{fg}	2.87
R1	120.47±2.18^{hi}	5.22	1260.6±22.70^{ef}	1.20
R2	202.63±0.37^{defg}	8.77	1579.37±2.86^{c}	2.03
MR1	126.44±38.69^{h}	5.47	759.82±232.41^{i}	1.26
MR2	86.11±0.26^{j}	3.73	519.49±1.55^{k}	0.86
AS1	92.63±0.52^{ij}	4.01	576.58±3.21^{jk}	0.93
AS2	103.87±1.36^{hij}	4.50	558.78±7.34^{jk}	1.04
CR1	229.27±0.38^{cd}	9.93	703.42±1.21^{ij}	2.29
CR2	217.02±15.06^{de}	9.40	824.95±57.25^{hi}	2.17
CK1	183.32±0.80^{fg}	7.94	847.38±3.66^{hi}	1.83
CK2	180.50±16.92^{fg}	7.82	958.47±89.82^{gh}	1.81
N1	203.00±0.30^{defg}	8.79	1349.77±2.06^{de}	2.03
N2	216.17±1.99^{de}	9.36	1244.55±11.44^{ef}	2.16

*Calculated as total energy per serving/per serving weight of edible food

[a] Energy values are in kcal

EER= Estimated Energy Requirement

One- way ANOVA (All means $p< 0.001$; significance at p- value< 0.05);

Post Hoc Tukey Pairwise Comparison [values with the same superscript alphabets within a column are not significantly different ($p< 0.05$)]

4.13.3 Micronutrient Content of Select Meals from Fast Food Restaurants

Summarized in Table 4.17 is the mean ash content of foods ranging from 0.58±0.13mg/100g to 1.89±0.03mg/100g with N1 and H2 being lowest and highest respectively. Sodium (Na) content per serving was highest in P2 (4217.29±608.51mg/serving) and K1 had the lowest Na content (348.72±217.36 mg/serving). The contribution of foods to daily recommendations of Na shows that per 100g of food, P2 contribute 25.84% as the highest and P1 contributed the lowest of 6.70%. The iron (Fe) content of CR1 per serving was found to be the lowest (2.61±0.64 mg) and CK2 iron content per serving was found to be the highest (22.21±2.05 mg) among all foods. To the daily recommendation of Fe per 100g sample, R1 contributed the least amount (2.72%), whereas CK2 contributed the highest (23.22%) to daily Fe. Total potassium (K) per serving was lowest (255.77±3.76 mg) in N1 and highest (2838.25±1341.16 mg) in F2. H1, however contributed in terms of daily recommendation the highest (13.97%), whiles N1 contributed the least (1.10%) to the daily recommendation. The Na/ K ratio among foods ranged from the lowest CK2 (0.29) to highest (4.32) in P2.

Table 4.17: Total Ash and Selected Micronutrients Content of Selected Meals

Food Code	Ash /100g (Mean±SD)	Na/100g (Mean±SD)	%[a]	Na/ serving (Mean±SD)	Fe/ 100g (Mean±SD)	%[b]	Fe/serving (Mean±SD)	K/ 100g (Mean±SD)	%[c]	K/ serving (Mean±SD)	Na/ K Ratio
FI	1.52±0.03	427.77±124.31^{a}	21.39	4152.05±1205.13^{a}	0.83±0.31^{bcd}	4.61	8.09±2.96^{bc}	106.98±2.26^{de}	3.05	1038.46±22.73^{bcde}	4.00
F2	1.65±0.08	395.17±217.45^{a}	19.76	4164.11±2292.69^{a}	0.53±0.05^{d}	2.94	5.60±0.51^{bc}	269.35±127.19^{abcd}	7.67	2838.25±1341.16^{a}	1.47
P1	1.73±0.10	133.93±48.69^{a}	6.70	655.90±238.39^{bc}	1.29±0.31^{bcd}	7.17	6.31±1.52^{bc}	403.03±77.88^{abc}	11.48	1973.79±381.39^{abcd}	0.33
P2	1.28±0.15	516.83±74.44^{a}	25.84	4217.29±608.51^{a}	0.99±0.24^{bcd}	5.50	8.12±1.94^{bc}	119.52±6.78^{de}	3.41	975.22±55.52^{cde}	4.32
H1	1.28±0.12	326.57±124.94^{a}	16.33	1556.67±595.60^{abc}	1.83±0.24^{bcd}	10.17	8.72±1.13^{bc}	490.32±23.19^{a}	13.97	2337.23±110.61^{abc}	0.67
H2	1.89±0.03	276.47±132.92^{a}	13.82	1066.16±512.41^{bc}	1.41±0.52^{bcd}	7.83	5.45±2.02^{bc}	125.92±5.90^{de}	3.59	485.62±22.68^{de}	2.20
K1	1.63±0.27	167.17±104.20^{a}	8.36	348.72±217.36^{c}	1.46±0.28^{bcd}	8.11	3.04±0.58^{c}	213.17±89.11^{cde}	6.07	444.68±185.90^{de}	0.78
K2	1.55±0.05	300.25±186.11^{a}	15.01	1178.41±730.53^{bc}	1.84±0.15^{bcd}	10.22	7.23±0.61^{bc}	235.12±65.13^{cde}	6.70	922.77±255.70^{cde}	1.28
R1	1.03±0.37	285.85±161.81^{a}	14.29	2991.23±1693.55^{abc}	0.49±0.14^{d}	2.72	5.09±1.48^{bc}	232.95±99.09^{cde}	6.64	2437.65±1037.15^{abc}	1.23
R2	1.58±0.08	433.45±124.17^{a}	21.67	3378.50±968.11^{ab}	0.60±0.33^{cd}	3.33	4.66±2.53^{bc}	143.52±20.70^{de}	4.09	1118.61±161.34^{bcde}	3.02
MR1	1.55±0.05	296.78±73.87^{a}	14.84	1783.47±444.10^{abc}	0.52±0.39^{d}	2.89	3.09±2.33^{c}	123.50±6.64^{de}	3.52	742.14±40.01^{de}	2.40
MR2	1.24±0.05	298.20±139.47^{a}	14.91	1798.91±841.39^{abc}	0.92±0.94^{bcd}	5.11	5.54±5.68^{bc}	125.07±3.21^{de}	3.56	754.47±19.40^{de}	2.38
AS1	1.15±0.09	263.63±139.78^{a}	13.18	1641.06±870.13^{abc}	0.95±0.28^{bcd}	5.28	5.91±1.76^{bc}	252.77±96.92^{bcde}	7.20	1573.42±603.31^{abcde}	1.04
AS2	0.63±0.18	145.00±63.53^{a}	7.25	780.07±341.76^{bc}	2.27±0.47^{b}	12.61	12.20±2.51^{b}	278.33±162.24^{abcd}	7.93	1497.37±872.83^{abcde}	0.52
CR1	1.40±0.05	378.22±152.07^{a}	18.91	1160.38±466.64^{bc}	0.85±0.21^{bcd}	4.72	2.61±0.64^{c}	144.95±10.30^{de}	4.13	444.71±31.58^{de}	2.61
CR2	1.26±0.03	307.42±94.08^{a}	15.37	1168.57±357.62^{bc}	2.02±1.32^{bc}	11.22	7.67±5.01^{bc}	117.42±7.34^{de}	3.35	446.33±27.89^{de}	2.62
CK1	1.59±0.05	429.10±135.58^{a}	21.46	1983.45±626.69^{abc}	1.11±0.31^{bcd}	6.17	5.12±1.42^{bc}	243.05±118.52^{cde}	6.92	1123.45±547.79^{bcde}	1.77
CK2	1.40±0.05	136.60±56.87^{a}	6.83	725.37±302.00^{bc}	4.18±0.39^{a}	23.22	22.21±2.05^{a}	477.75±124.64^{ab}	13.61	2536.91±661.79^{ab}	0.29
NI	0.58±0.13	439.60±159.95^{a}	21.98	2922.95±1063.31^{abc}	0.62±0.51^{cd}	3.44	4.12±3.37^{c}	38.47±0.57^{e}	1.10	255.77±3.76^{e}	11.43
N2	0.78±0.20	212.02±59.57^{a}	10.60	1220.66±342.97^{bc}	0.74±0.21^{cd}	4.11	4.24±1.20^{c}	49.65±2.69^{de}	1.41	285.87±15.47^{e}	4.27

All mean±SD (Standard Deviations) in milligrams (mg) unit

[a] % values of daily recommended of 2000mg (WHO, 2013)

[b] % values of Recommended Dietary Allowance (RDA) of www.nap.edu

[c] % values of daily recommended of 3510mg (WHO, 2013)

One- way ANOVA [(per 100g; Na $p = 0.001$, Fe and K $p \leq 0.001$) (per serving; all $p \leq 0.001$)] significance at p- value< 0.05

Post Hoc Tukey Pairwise Comparison [values with the same superscript alphabets within a column are not significantly different ($p < 0.05$)]

CHAPTER FIVE

5.0 DISCUSSION

This study attempts to explore factors influencing EO lifestyle; access the nutrient content of some selected foods from FFRs in Accra; and sought to investigate their associations with selected health indicators among Ghanaians.

5.1 Socio- demographic Characteristics

Ghanaian adults with diverse socio- demographic attributes participated in the study and the highest frequency of average number of meals consumed during eat out was 4-6 times per week. The results of this study are not consistent with other studies due differences in socio- demographic characteristics of the different study samples. Findings from other studies attributing EO frequency to socio- demographic are conflicting and therefore not conclusive.

It was observed that frequent EO was more likely with adults aged 18- 39 years, and this is consistent with previous findings of Bezerra & Sichieri (2010) and Burger Chakraborty *et al.* (2016) which indicated that ageing significantly affects the frequency of EO where young adults from 20 to 40 years and 25 to 40 years eat out on a regular basis than older adults over 40 years. Another assertion to this is that, age influences EO decision and as one grew older EO frequency is informed by factors such as availability of food, access to new information, past experiences, and changes in the physiology of an individual (Kinsey & Wendt, 2007) including changes in body composition and health.

There is a general assertion that males eat out more than females. Fraikue (2016), found that three quarters of her study respondents who ate out were males implying that due to our Ghanaian culture males obviously eat out more than females. In contrast, this study found that more women are likely to eat out habitually than men. This may be due to the higher percentage of females involved in the study as compared to males and partly because more women now than before are employed. As a way to manage perceived time scarcity due to work demands, they cannot cook regularly and depend on EO. This study and other studies (Bes-Rastrollo *et al.,* 2010; Duffey *et al.,* 2009) however found no relationship between gender and EO frequency (p=0.513).

In line with studies of Naska *et al.* (2015) and Tiwari *et al.* (2017), this study argues that singles would eat out more the married as observed. This may be due to the fact that, married couples perceive eating together from the same food pot help to foster the bonding between couples and family.

In terms of EO and employment, this study is consistent with findings by Todd (2014), where the employed frequently ate out ≥ 7 than the unemployed and was also found to be statistically different (p= 0.047). Inadequate time for food preparation due to work demands, greater disposable income and increased access opportunities to eat outs are possible reasons for the greater reliance on eat out foods among employed persons.

5.2 Eating Out Characteristics

The average number of meals when EO is about 4- 6/ week by most (60.7%) and may be attributed to subjects having the capacity to afford their choices of meals from different eat out sources

ranging from a formal restaurant to informal street vendors which depends on their socio-economic status This therefore may have contributed to the lower frequency of consumption of home meals of 2-5 times/ week by more than half of subject (58.7%). A similar study (The Intermedia Group, 2018) conducted in Australia found EO frequency to be on an average of two to three times a week. Although the relationship between EO occasion pattern and subjects socio-demographics are not significant (p- values ≥ 0.05), from the results, consumption of breakfast and lunch during EO was at most twice (83.9% and 48.1% respectively) a week whereas dinner was 3-4 times (39.5%). This indicates that fewer people eat out during all the three daily eating occasions throughout the week. Varied trends in frequency of EO between studies can be attributed to different study designs, sample selection methods and criteria for EO definition.

Most of the subjects prefer obtaining meals from street vendors during EO for all eating occasions. This trend was confirmed by a previous study by Maxwell *et al.* (2000) in Accra who indicated that most urban dwellers heavily depended on foods purchased from street vendors. Street vendors provide cheap source of eat out meals and have proliferated in every part of Accra, and therefore easily accessible to most people as compared to other eat out sources. This phenomenon can be linked also to increasing urbanization and population growth.

Comparing sit- in (full service) restaurant to fast food or take away restaurant, the latter is preferred mostly because lack of time to sit and eat; discomfort in using cutlery, the need to share food with household members and general dislike for restaurant environment (Omari, 2014). These can also be likened to why majority of this study subjects chose fast food or take away restaurants against sit- in (full service) restaurants.

Typically, meals can be consumed at different times of the day based on personal choices. It is also suggested that timing of meals is structured by culture and hunger (Lee, 2008). Most of the subjects usually ate breakfast between 8 and 9 am, and this is the time most employed persons may report to work and would eat breakfast because of lack of time to consume breakfast at home. The ideal time for lunch break among most subject was1-1.59pm. It is asserted that most of those employed break from work to obtain lunch meals between 12- 2pm, and this may account for the lunch time by majority of this study subjects who are also employed. Dinner consumed less than 3 hours before retiring to bed over some period is considered to increase susceptibility to weight gain and obesity for most individuals (Kinsey & Ormsbee, 2015). Most subjects were culprits to this late dinner eating trend since it was consumed between 8 and 8.59pm by many, and therefore effects of overweight/ obesity and related conditions such as hypertension and T2DM may be probable.

The most popular eat out meal of subjects was fried rice, which was also found as the popular fast food meal among Ghanaians in another study (Omari, 2014). This meal is not normally prepared at home because it requires special cooking skills and planning, therefore the vast majority often consume it during exceptional events or as an EO feast (Omari, 2014). In recent times most Ghanaian home dishes are dominated by rice dishes and therfore not surprising rice dishes also dominated as a meal subjects consume at home.

5.3 Reasons for Eating Out

Subjects' reasons for EO during an eating occasion varied across convenience, preference, sensory appeal, lack of home alternatives, inadequate cooking skills, time constraints and socialization. Convenience was highly emphasised as the main motivator for EO for all eating occasions and it appears that being a male was highly related ($p= 0.039$) to reasons given for EO during lunch. This observation is in line with works of Rydell *et al.* (2008) stating convenience as the reasons for EO by majority of their study subjects Employment status of especially women who work outside the home may be a contributor to why most considered EO as convenient. Females, traditionally are considered to be in charge of cooking meals at home and this may renders most men with inadequate cooking skills as seen in this study. This also results in lack of home alternative, and therefore males are left with EO option especially when females are absent to cook in the home, or there is a preferred meal other than what is available at home. Majority of females reported socialization as a reason for EO and it was speculated by another study with similar result that, they eat out for social reasons in order to feel belonging to a group (Fraikue, 2016).

5.4 Nutrition and Health Situation

To the knowledge of this current study's author, no published work has determined whether EO has a relationship with the health of a Ghanaian sampled population and thus the results of this study provide a novel contribution to literature. It provides a premise to extend knowledge on the EO situation among Ghanaians in general, and its contribution to the prevalence of diet related conditions which is limited due to the lack of national data on EO.

The overall prevalence of overweight/ obesity for the study was 62%, higher than those reported by the GSS *et al.* (2015) and Ofori- Asenso *et al.* (2016), 56% and 43% respectively. Commodore-Mensah *et al.* (2014) also reported prevalence of 20-62% among Ghanaian adults who eat out. This finding highlights the growing burden of overweight/ obesity and also the concerns raised by other researchers (Abubakari & Bhopal, 2008; Anderson, 2017) on the continually increasing overweight/obesity prevalence, and its dire consequences among adult Ghanaians over the years. In short it is noted that it is higher because of this study subjects' sampling criteria. In spite of gender being unrelated to BMI in this study, more males were unusually found to be obese while more of their female counterpart were overweight. This finding in not in line with what has been mostly published by other researchers both in Ghana and abroad which have found that more women are overweight/ obesity than males which is attributed to cultural perception of body weight and size (Ofori- Asenso *et al.,* 2016; Amugsi *et al.*, 2017). In recent times, observation made affirms that more young men are concern about their body physique. Furthermore, with the aim of maintaining perceived manly features, combination of both PA (exercise) and dietary supplement to increase their muscle mass may contribute to weight gain (Hulmi *et al.*, 2015), and thus overweight/obesity attributed to lean

muscle mass but not fat as in the case of women. This therefore raises an alarm on the use of BMI to effectively determine the prevalence of overweight and obesity which may lead to either under or over estimation of trends. Also, it can be asserted that this finding is a chance finding.

Modifiable factors such as EO frequency and PAL were not associated with overweight/ obesity. Age, a non- modifiable predictor was strongly associated with overweight/ obesity and reflects the general fact that aging is a major predictor of overweight /obesity. A known strong biological basis has it that, as one ages the body's fat content increase due to reduced metabolism and PAL tend to decrease (Celis-Morales *et al.*, 2015).

On the average the study subjects' population can be described as a pre-diabetic population with a mean FBS of 6.11± 1.58 mmol/L. This findings is higher than a previous report by Amoah *et al.* (2002) whose population can be described as non- diabetic. The prevalence of diabetes in this study sample (18.7%) was more than thrice the national prevalence of 6% (Ofori-Asenso & Garcia, 2016), but lower than what was estimated by Anderson (2017), which may be ascribed to the higher rates of undiagnosed diabetes within an urban population. Although this sample may not be a representative of the entire population of Ghanaian adults, this is a wake-up call for intervention measures to tackle diabetes prevention to drastically reduce the prevalence. The findings from this study reflected gender was related to diabetes with higher prevalence in men than women and this was consistent with previous studies (Danquah *et al.*, 2012; Hall *et al.*, 2011). BMI was related to diabetes with overweight and obesity dwelling among pre-diabetics and diabetics of the sample population respectively. This overweight/ obesity trend may be a plausible factor in the aetiology of the observed pre-diabetes

and diabetes prevalence related to gender. The prevalence of pre- diabetes among women indicates they are at a higher risk of developing diabetes in the future if preventive measures based on lifestyle and dietary factors are not put in place.

Hypertension prevalence (19.3%) among study subjects falls in the estimated prevalence range among adult Ghanaians from 19% to 48% (Ministry of Health- Ghana, 2012). It is assumed that the prevalence of hypertension would have been higher than estimated since factors such as increased salt intake especially from eat outs or/ and other food sources can be attributed to hypertension. Likewise, although the PA of males was not different from females, the overall low prevalence of high PAL among subject may also be a contributing factor to a higher prevalence of hypertension. More engaged in moderate PAL and therefore the prevalence of hypertension being on the lower end of the range may be attributed to the higher prevalence (68%) of engaging in moderate PAL which served a protective factor against hypertension (Armstrong *et al.*, 2015). Obesity is generally known to contribute to development of hypertension (Hruby *et al.*, 2016) and hence, a significant proportion of hypertensives in the sample are overweight and obese relative to those who are normal weight.

Overall, only 20.1% of subjects did not meet the minimum WHO PAL recommendations of $\geq$600MET min week^{-1} whereas more subject indulged in moderate PA. This finding is similar to that of Celis-Morales *et al.* (2015) who found almost 20% of subjects with low PAL given with reasons as majority of these subjects were older as expected.

5.5 Eat Out and Nutritional Health Characteristics

Findings suggest that the higher EO frequency was related to the body weight, BMI, FBS and hypertension in the study. Higher body weight observed with the higher frequency of EO buttress the fact explained by several studies that increasing frequency of EO is associate with increased body weight (Bezerra *et al.*, 2012; Lee, 2008). Although the event of EO frequency and how it is related to body weight is not fully elucidated, it may be attributed to the higher caloric intake and higher portion sizes associated with EO. A higher proportion of subjects who have a higher EO frequency of ≥7 were obese than those of lower EO frequency (4-6) as also found by Kant & Graubard (2004) and Tian *et al*,. (2016). Regarding diabetes and hypertension, more of those found to be diabetic/hypertensive eat out greater than or equal to 7 (≥7) and this in line with the evidence (Seguin *et al.*, 2016) suggesting that EO has a dire implications on the health of an individual, and in no doubt, overweight/ obesity is an important driver promoting these health consequences.

Although stating convenience as reasons for both lunch and dinner eat outs were not significant, given other reasons for breakfast rather than convenience was highly associated. In contrast, findings of Dave *et al.* (2009) did not corroborate our study finding in which they found that convenience is the most important factor associated with EO frequency. In addition, the odds of EO frequency was significantly associated with being young, single, men and employed in a Korean American Study (Lee, 2008). Implication of this findings suggests interventions which make it possible to increase availability and accessibility of healthier foods at cheaper prices than unhealthy foods, and thus encouraging healthy EO generally are needed. Also,

interventions such as short tutorials on quick healthy breakfast options or choosing healthy foods may also promote healthy EO.

5.6 Nutritional Composition of Fast Food Restaurant Meals

All FFR meals analysed in this study variably differ in nutrient content and this is likely to be as a result of differences in sources as well as the type and amount of cooking ingredients used for each meal. Studies that compare diet profile of FFR in Ghana are scanty but it can be deduced that the meals make variably useful contributions to the daily nutrient requirement of persons likely to consume them.

The moisture content of meals (42.99-78.99) % falls above the range (30.35-54.02) % of meals reported by Musaiger *et al.* (2008). However, in line with their study, this study argues that the variability in moisture content may be due to different cooking methods of preparation. For instance, deep frying of foods results in a lower moisture content of the food and the lowest moisture meal (K1) is made up of burger which has a low moisture baked bread bun with deep fried crispy boneless chicken breast which may have contributed to it. Moisture content is a measure of deterioration due to the actions of microbes as a result of water activity and has an effect on the nutrient content of meals (Otemuyiwa & Adewusi, 2014).

The right amount of fat in food can supply an appreciable amount per an average of three meal sitting and results indicate majority of the FFR meals when consumed at a sitting supply more than a 50% of the daily fat needs in a meal sitting. It is evident that these meals are within the normal AMDR range but highly above than the recommended range to prevent NCDs. It is alarming to

observe a fat content of about 93% for a single meal to be consumed by an individual. Almost all sampled FFR meals due to preparation methods add cooking oil to meals prepared thereby contributing additional fat to meals. Higher amount of fat in food results from animal fat and added cooking fat/oil which may increase saturated, trans and total fat of FFR meals, and these have been implicated greatly in the aetiology of overweight/obesity and it consequent conditions of hypertension and T2DM.

It is appealing to realise that although a few (R2, MR1 and MR2) are above the AMDR range, all meals contribute substantial amount of the daily protein requirement. This findings corroborate a previous Ghanaian finding by Steiner- Asiedu *et al.* (1998) who found appreciable amount of protein in FFR meals and therefore makes them nutritionally beneficial to an individual's physical growth and metabolic maintenance. Protein content of FFR meals ranges from 6.84- 15.30g/100g which falls within the range (6.2-23g/100g) obtained by Otemuyiwa & Adewusi (2014).

Carbohydrate was adequate in all meals but full of simple carbohydrate which may instantly increase the glucose level of the blood and may be of concern especially for persons who have T2DM. As sugar accumulate in blood it will exert pressure to increase insulin production which is may not be enough in T2DM condition and therefore results in aggravation of complications associated with T2DM.

The higher energy values of meals may be attributed to the increase in total fat content. A larger portion size of a higher energy meal would results in a higher energy density of meal and vice versa. A clear indication is MR2 which had the lowest energy content both in per 100g or per

serving and with a smaller portion size and therefore had a lower energy density. The data depicts that, majority of meals energy density are ranging from 0.86kal/g- 3.34kcal/g and this agrees with Bowman *et al.* (2004) who indicated that most FFR meals are high in energy. These observations have health implications on the occurrence of overweight/obesity and weight management, especially in adults who are trying to lose or maintain weight.

Ash content, which measures the total mineral content ranged from (0.58- 1.89 g/100g), lower than that obtained (1.3- 3.8g/100g) from FFR meal reported by Otemuyiwa & Adewusi (2014). Iron and potassium were low in most FFR meals, and data are comparative to findings of Musaiger *et al.* (2008). It is assumed that other consumed food may be able to supply adequate amounts of these minerals to meet the daily requirements. Considering the importance of iron in view of the fact that iron deficiency anaemia is a major public health concern in Ghana especially in adolescent girls, women of childbearing age, pregnant women, and young children (Petry *et al*., 2016) highlighting the importance of advocating for food iron fortification and nutritional education to both consumers and FFRs on the importance on quality of diet on the health of consumers.

Considering sodium content per serving of meals for a single meal sitting and daily recommendation, sodium is high in most meals which singly can contribute more than a third of recommendation. The highest sodium content among food samples was lower than the amount found to be the highest among meals sampled by Musaiger & D'souza (2007). High sodium in FFR meals is as a results of added salt and monosodium glutamate in forms of sauces and bouillon cubes used to enhance the taste and offer preservative factors to meals. High sodium content of meals has implications for the incidence and aggravation of hypertension among consumers.

Majority of meals have higher Na/K ratio > 0.60, also a clear indication of the higher sodium content of sampled meals which may favour the enhancement of high blood pressure disease (Adeyeye *et al.*, 2012).

Collectively, meals from FFRs will generally increase ones' daily energy intake, energy density of overall day's diet, and increase sodium intake, leading to the conclusion that simultaneous efforts to reduce fast food consumption and consumer advocacy for healthy meals may be beneficial in improving the diets of consumers and reduce the future health risk associated with consumption of these FFR meals of high fat, sodium and energy content.

5.7 Limitations of Study

- Due to constraints in time and resources, estimated sample size was not a representative of the entire population. A large and a more representative sample from Greater Accra Metropolis would allow for broader assertions about EO behaviour and health implications.
- The subject criteria was limited to those who eat out from ≥ 4/ week and not EO and so predictors of EO among the population cannot be ascertained and may be biased or inappropriate to generalize findings to the entire population.
- Proxy data questions of income was not considered as a demonstrative of socio- economic status that influence EO.

CHAPTER SIX

6.0 CONCLUSION AND RECOMMENDATION

This chapter presents conclusions drawn from this study, and a compilation of recommendations, which are based on the results of the study.

6.1 Conclusions

Based on the findings of this present study the following conclusions may be drawn:

- The average Ghanaian who eat out at least four times a week is likely to be EO on an average frequency of four (4) to six (6) times out of the twenty- one (21) eating events. Employment status is associated with EO. Meals from street vendors are main source of EO and as a choice of restaurant, preferred restaurant is a take away /fast food restaurants.
- Perceived convenience of EO is the main promoter behind EO lifestyle behaviour, and reasons for EO as a males differ from that of a females.
- The average BMI of subjects was 26.50±4.31kg/m^2 and the overall prevalence was found to be 62%, 18.7%, 19.3% for overweight/obesity, T2DM and hypertension respectively among the sub- sample and 69.6% of all subject indulged in moderate PA.
- Higher frequency of EO is associated with overweight/obesity, T2DM and hypertension.
- Meals from FFRs contribute to the selected essential nutrients daily recommendation however, the sodium, fat and energy content of some of these meals are high exceeding more than a third of recommendation but with lower iron and potassium content.

6.2 Recommendations

- Observations and findings from this study have implications for further research and policy. The following recommendations have been made as a result the findings of this research:
- Further studies across the country need to be conducted on EO lifestyle to give a greater insight of major trends and offer context in terms of documenting regional differences.
- EO from other sources such as street vendors and *chop bars* should be sampled to ascertain their nutrient profile.
- Development and implement of governmental and non- governmental policies and interventional approaches (cost effective and sustainable) such as establishing regulatory unit bodies to regulate and monitor periodically the nutritional composition of FFR meals due to their significant health implications.
- Educational awareness should be created to inform sources of eat out on the importance of regulating components of meal of health significance and offering healthier meal options.
- To the general public, awareness must be created on the importance of eating healthy during EO and be empowered to demand healthy meals from food manufacturers.

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APPENDICES

APPENDIX 1 - Study Protocol Consent Form

UNIVERSITY OF GHANA

COLLEGE OF BASIC AND APPLIED SCIENCES

Ethics Committee for Basic and Applied Sciences (ECBAS)

Official Use only Protocol number

PROTOCOL CONSENT FORM

Section A- BACKGROUND INFORMATION

Title of Study:	The Determinants of Eating Out: Nutrition and Health Implications
Principal Investigator:	Babette Naa Ahimah Nunoo
Certified Protocol Number	**ECBAS 023/17-18**

Section B– CONSENT TO PARTICIPATE IN RESEARCH

Please seek the consent of the research participants by informing them (research participants) about your research using the guide below. Develop your form as would be used on the field.

General Information about Research

This is a research study with the purpose of investigating the determinants of eating out among adult men and women; nutrition and health implications and also assessing the nutrient composition of meals usually consumed away from home found on the Osu Oxford Street in Accra. You are kindly invited to participate in this study. If you agree to take part in this study, you will be asked questions about your background such as age, religion, educational level,

marital status and what, where and why you eat out and physical activities. Body measurements such as weight, height and waist as well as blood pressure measurements and blood sample to determine your blood glucose level will be taken from you by a trained professional and assessed. This will take about 30 minutes of your time in the early hours of your day.

Benefits of the study

The assessment tests involved in the study will immediately inform you on your nutritional/ health status. The study findings will also aid in policy making and structuring of educational programs as well as contributing to the advancement of nutritional scientific knowledge in Ghana and in general.

Risk of the study

There are no risks involved in taking part in this study. The inconveniences you may experience from participation are we coming to your location early in the morning before you consume breakfast and/or any medication and your time input in completing the questionnaire. Also, you may experience some discomfort during body measurements and pricking of finger for a sample of your blood.

Confidentiality

All information we obtain from you will be protected and kept strictly confidential, and may be accessed only by the researcher and the under listed contacts for additional information. You will never be personally identified in any report from the study, but the information you provide will be used collectively with information from other volunteers for any analysis.

Compensation

You will be given one (1) kitchen napkin at the end of the interview in appreciation for your time and participation.

Withdrawal from Study

Your participation in this study is fully voluntary. You can chose to leave the study at any point in time or refuse to answer any question. There will be no consequences for those actions taken by you.

Contact for Additional Information

If you have any question or concerns regarding the study and your participation, feel free and contact any of the following:

Prof. Matilda Steiner- Aseidu (Dean of Biological Sciences)

Department of Nutrition and Food Science

P. O. Box LG 134, Legon, Accra.

Tel: +233541260704

Dr. Frederick Vuvor

Department of Nutrition and Food Science

P. O. Box LG 134, Legon, Accra.

Tel: +233244608344

Babette Nunoo (Graduate Student)

Department of Nutrition and Food Science

P. O. Box LG 134, Legon, Accra.

Tel: +233248168142

If you have any issues on your rights as a participant you can contact the address below:

Administrator, Ethics Committee for Basic and Applied Sciences
College of Basic and Applied Sciences
University of Ghana
P. O. Box LG 68
Legon – Accra
Tel: + 233 277493259
Email: ekacquaah@ug.edu.gh

Section C- VOLUNTEER AGREEMENT

"I have read or have had someone read all of the above, asked questions, received answers regarding participation in this study, and I am willing to give consent for me, my child/ward to participate in this study. I have not waived any of my rights by signing this consent form. Upon signing this consent form, I will receive a copy for my personal records."

_____
Name of Volunteer

_____ _____
Signature or mark of volunteer Date

If volunteers cannot read the form themselves, a witness must sign here:

I was present while the benefits, risks and procedures were read to the volunteer. All questions were answered and the volunteer has agreed to take part in the research.

_____
Name of witness

_____ _____
Signature of witness Date

I certify that the nature and purpose, the potential benefits, and possible risks associated with participating in this research have been explained to the above individual.

_____

Name of Person who obtained Consent

_____ _____

Signature of Person who obtained Consent Date

APPENDIX 2 - Study Questionnaire

DEPARTMENT OF NUTRITION AND FOOD SCIENCE

UNIVERSITY OF GHANA, LEGON

Project Title:

THE DETERMINANTS OF EATING OUT: NUTRITION AND HEALTH IMPLICATIONS

Date…….. Serial Code……..

***Please indicate in the brackets the code that bears the right response, otherwise specify in writing*:**

SECTION A: Background Information

A1. **Age** (years): **1**=18- 25 **2**= 26- 39 **3**=40- 60 [ ]

A2. **Sex** : **1**= Male **2**= Female [ ]

A3. **Educational Level**: **1**=None **2**= Primary **3**=JSS **4**= SSS **5**= Tertiary **6**=other specify……. [ ]

A4. **Religion**: **1**= Christianity **2**= Islam **3**=Traditional **4**= other specify…… [ ]

A5. **Ethnicity**: **1**= Ga/Adangbe **2**= Akan **3**= Ewe **4**=Northerner [ ]

A6. **Marital Status**: **1**= Single **2**= Married **3**= Divorced **4**=Widow/widower [ ]

A7. **Occupation Status**: **1**= Unemployed **2**= Self- Employed **3**= Employed **4**=Others……

SECTION B: Eat Out Information

B1. How often do you eat out in a week?

1= (4-6)/times **2**= (7-10)/times **3**= (11- 15)/times **4**= (>15)/times [ ]

B1a. How many of this is breakfast outside the home?

1= (0-2)/times **2**= (3-4)/times **3**= (5-7)/times [ ]

$B1a_1$ What time do you usually consume breakfast? (.....)am

B1b. How many of this is lunch outside the home?

1= (0-2)/times **2**= (3-4)/times **3**= (5-7)/times [ ]

$B1b_1$ What time do you usually consume lunch? (….....)pm

B1c. How many of this is dinner/supper outside the home?

1= (0-2)/times **2**= (3-4)/times **3**= (5-7)/times [ ]

$B1c_1$ What time do you usually consume dinner/supper? (….....)pm

B2. Where do you usually obtain your breakfast outside the home?

1= Restaurant **2**= Chop Bar **3**= Street vendor [ ]

B3. Where do you usually obtain your lunch outside the home?

1= Restaurant **2**= Chop Bar **3**= Street vendor [ ]

B4. Where do you usually obtain your dinner/supper outside the home?

1= Restaurant **2**= Chop Bar **3**= Street vendor [ ]

B5. What type of restaurant do you usually obtain your food outside the home?

1= Sit-in restaurant **2**= Fast-food or take-out restaurant [ ]

B6. What are some of the foods you usually buy from the restaurant?

i. _____

ii. _____

iii. _____

iv. _____

v. _____

B7. What are the reasons for eating or obtaining your food outside the home?

B7a. Breakfast

_____

B7b. Lunch

_____

B7c. Dinner/supper

_____

B8. How many times in the week do you usually eat from home? [ ]

B9. What are some of the foods you usually eat at home?

i. _____

ii. _____

iii. _____

iv. _____

v. _____

Section C: Physical Activity Levels

C1.Work

a. Does your work involve vigorous-intensity activity that causes large increases in breathing or heart rate like [carrying or lifting heavy loads, digging or construction work] for at least 10 minutes continuously? 1= Yes 2= No (If **NO**, go to question d)

b. In a typical week, on how many days do you do vigorous intensity activities as part of your work? **No days** ……..

c. How much time do you spend doing vigorous-intensity activities at work on a typical day? Hours (……): Minutes(……)

d. Does your work involve moderate-intensity activity that causes small increases in breathing or heart rate such as brisk walking [or carrying light loads] for at least 10 minutes continuously? 1= Yes 2= No (If **NO**, go to question g)

e. In a typical week, on how many days do you do moderate intensity activities as part of your work? **No days** ……..

f. How much time do you spend doing moderate-intensity activities at work on a typical day? Hours (……): Minutes(……)

C2. Travel to and from places

g. Do you walk for at least 10 minutes continuously to get to and from places?
1= Yes 2= No (If **NO**, go to question j)

h. In a typical week, on how many days do you walk or bicycle for at least 10 minutes continuously to get to and from places? **No days** ……..

i. How much time do you spend walking on a typical day? Hours (……): Minutes(……)

C3. Recreational Activities (Leisure)

j. Do you do any vigorous-intensity sports, fitness or recreational (leisure) activities that cause large increases in breathing or heart rate like [running or football] for at least 10 minutes continuously? 1= Yes 2= No (If **NO**, go to question m)

k. In a typical week, on how many days do you do vigorous intensity sports, fitness or recreational (leisure) activities? **No days** ……..

l. How much time do you spend doing vigorous-intensity sports, fitness or recreational activities on a typical day? Hours (……): Minutes(……)

m. Do you do any moderate-intensity sports, fitness or recreational (leisure) activities that cause a small increase in breathing or heart rate such as brisk walking, [cycling, swimming, volleyball] for at least 10 minutes continuously? 1= Yes 2= No (If **NO**, go to question p)

n. In a typical week, on how many days do you do moderate intensity sports, fitness or recreational (leisure) activities? **No days** ……..

o. How much time do you spend doing moderate-intensity sports, fitness or recreational (leisure) activities on a typical day? Hours (……): Minutes(……)

C4.Sedentary behavior

p. How much time do you usually spend sitting or reclining on a typical day?

Hours (……): Minutes(……)

SECTION D: Anthropometry, Biochemical and Clinical Measurements

D1. Anthropometry Data

Variable	Measure 1	Measure 2	mean
WEIGHT/kg			
HEIGHT/m			
BMI/kgm^{-2}			

D2.Biochemical Data (Fasting blood Sugar)

Variable	Reading 1	Reading 2	Mean
FBS/(mmol/L)			

D3. Clinical Data (Blood Pressure)

Variable	Reading 1	Reading 2	Mean
Systolic Pressure/mmHg			
Diastolic Pressure/mmHg			

THANK YOU FOR YOUR COOPERATION

APPENDIX 3 - Ethical Clearance

UNIVERSITY OF GHANA

ETHICS COMMITTEE FOR BASIC AND APPLIED SCIENCES (ECBAS)

P. O. Box LG 1195, Legon, Accra, Ghana

Ref. No: ECBAS 023/17-18

2nd February, 2018.

Miss Babette Naa Ahima Nunoo
Dept. of Nutrition and Food Science
University of Ghana
Legon, Accra

Dear Miss Babette Nunoo,

ECBAS 023/17-18: THE DETERMINANTS OF EATING OUT: NUTRITION AND HEALTH IMPLICATIONS

This is to inform you that the above reference study has been presented to the Ethics Committee for Basic and Applied Sciences for a full board review and the following actions taken subject to the conditions and explanation provided below:

Expiry Date:	1/02/19
On Agenda for:	Initial Submission
Date of Submission:	15/11/2017
ECBAS Action:	Approved
Reporting:	Quarterly

Please accept my congratulations.

Yours sincerely,

Professor Daniel Bruce Sarpong
ECBAS Chairperson

ETHICS COMMITTEE FOR BASIC AND APPLIED SCIENCES
APPROVED
02 FEB 2018
UNIVERSITY OF GHANA

Tel: +233-277493259

Email: ekacquaah@ug.edu.gh / ethicscbas@ug.edu.gh

APPENDIX 4 – List of Twenty Communities Selected within Accra Metropolis

Sub Metro	**Communities**
Ablekuma Central	Abossey Okai Mataheko
Ablekuma North	Darkuman Odorkor
Ablekuma South	Dansoman Korle- Bu
Ashiedu Keteke	Jamestown Korle- Wonkon
Ayawaso Central	Kokomlemle Roman Ridge
Ayawaso East	Kanda Nima
Ayawaso West	Dzorwulu Legon
Okai- Koi North	Achimota Akweteman
Okai- Koi Soth	Bubiashie Kaneshie
Osu Klottey	Asylum Down Osu