NUTRITIONAL STATUS, DIETARY PATTERN AND PREVALENCE OF SOME CHRONIC DISEASES AMONG ADULTS IN BIDA LOCAL GOVERNMENT AREA, NIGER STATE, NIGERIA

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NOVEMBER, 2017

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A DISSERTATION SUBMITTED TO THE SCHOOL OF POSTGRADUATE STUDIES, AHMADU BELLO UNIVERSITY, ZARIA IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTER DEGREE IN SCIENCE NUTRITION

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NOVEMBER, 2017

DECLARATION

I declare the work in this dissertation entitled "**NUTRITIONAL STATUS, DIETARY PATTERN AND PREVALENCE SOME CHRONIC DISEASES AMONG ADULTS IN BIDA LOCAL GOVERNMENT AREA, NIGER STATE"** has been carried out by me in the Department of Biochemistry, Faculty of Life Sciences. The information derived from the literature has been duly acknowledged in the text and a list of references provided. No part of this project was previously presented for another degree or diploma at this or any other institution.

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CERTIFICATION

This dissertation entitled "NUTRITIONAL STATUS, DIETARY PATTERN AND PREVALENCE OF SOME CHRONIC DISEASES AMONG ADULTS IN BIDA LOCAL GOVERNMENT AREA, NIGER STATE" by MOHAMMED, Maryam Maude meet the regulation governing the award of the degree of Masters of Science in Nutrition of the Ahmadu Bello University, and is approved for its contribution to knowledge and literary presentation.

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DEDICATION

I dedicated this work to Almighty ALLAH (SWT) and my lovely children Maimunat, Zahra and Rahma Muhammad Yusuf.

ACKNOWLEDGEMENTS

All thanks be to Allah the Almighty for sparing my life in good health throughout my study.

I wish to appreciate the effort of my supervisors Prof. S. Ibrahim and Prof. A. J. Nok for their guidance, support and contribution to the success of this work. Also big thanks goes to all the lecturers in Department of Biochemistry most especially Mr. O. A. Owolabi for his contribution to the success of this work.

I want to appreciate the effort, support and prayer of my late parents Alhaji Mohammed Maude Usman and Hajiya Aishatu Mohammed, may Allah have mercy on their soul.

My special thanks goes to my siblings, husband and daughter. Thank you very much and may Allah bless you all. To my friends too numerous to mention, a big thanks goes to you all.

Abstract

Nutritional status, dietary habit and physical activity are recognized as a major determinants of health. The study was conducted to assess the nutritional status, dietary pattern and prevalence of risk factors and chronic diseases among adults in Bida Local Government Area, Niger State. A cross sectional study was conducted among 210 adults between the ages of 18-65 years. The study population comprised of 111 (52.91%) female and 99 (47.1%) male. Food frequency questionnaire (FFQ) was used to collect data on dietary habits of the respondents. Data was analyzed using IBM SPPS version 20. BMI showed that 38 (18.1%) of the respondents within the age 30-39 years were overweight while 72% of the respondents are having a waste circumference that is above the normal range. High prevalence of unhealthy eating habits was recorded among the respondents. About 52%, 44% and 40% consumed milk and dairy products, egg and confectionary (snacks) respectively thrice weekly while fruits (25.7%) and vegetables (14.3%) consumption at least 7 times in a week was low. Tobacco use among the respondents between the ages to 30-39 years was 47.5% which indicates a high level of its use. Physical activities of the respondents was very low because about 97% reported having a normal sedentary leisure time. Blood glucose level (36.7%) was high among the respondents about 48% of the respondents are having an elevated blood pressure while total cholesterol, HDL and LDL, of the respondents was normal. The study demonstrated a high prevalence of unhealthy eating habit and life style changes. Several risk factors may be contributing to it such as, nutritional transition, low intake of fruits and vegetables, urbanization, physical nutrition and health awareness. Intervention programme by health professionals are needed to reverse the trend particularly with special focus on promotion of healthy eating and physical activity.

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LIST OF ABBREVIATIONS AND SYMBOLS

LGA	Local Government Area
NPC	National Population Commission
CVD	Cardiovascular Diseases
HDL	High Density Lipoprotein
LDL	Low Density Lipoprotein
BP	Blood Pressure
IDF	International Diabetes Federation
FFQ	Food Frequency Questionnaire
Kg	Kilogramme
m^2	millimeter square
ml	Millimeter
^{0}	degree census
mg	milligram
dl	dose liter
g	gramme
<	less than
>	greater than
%	Percentage
BMI	Body Mass Index
WC	Waist Circumference
DM	Diabetes Mellitus
NS	Nutritional Status
WHO	World Health Organization
HIV	Human Immune Virus

AIDS	Acquired Immune Deficiency Syndrome
U.S	United States
CDC	Centers for Disease Control & Prevention
CFNI	Caribbean Food and Nutrition Institute

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background Introduction

The major cause of mortality in developed and developing countries of the world are diseases in which nutritional lifestyle plays an important role. The choices of what people eat are determined by various factors such as religions, customs and socio-economic differences (Shehu *et al.,* 2011). The environments affect individual's lifestyle. Changing these factors in the direction of nutritional lifestyle patterns could postpone the age of onset of permanent mobidity, disability, disease occurrences and death and could have a major effect on quality of life (Waijers *et al.,* 2006). Nutrition as the science of food and its relationship to health has been recognized in recent years as the cornerstone of socioeconomic development (Parks, 2009). Adequate nutrition is important for a variety of reasons, including optimal cardiovascular function, muscle strength, respiratory ventilation, protection from infection, wound healing and psychological well-being (Martin, 2006). Adequate nutrition entails a diet that contains the constituents (carbohydrate, fats, proteins, vitamins and minerals) that are required for body building, energy supply, body defense and regulatory functions in quantities commensurate with the body need. Malnutrition refers to either inadequate intake of nutrients due to lack of food, ignorance, socio cultural factors, and diseases among other causes, resulting in underweight and other nutrient deficiency diseases; or intake of nutrients in excess of body requirements due to poor dietary habit (erroneously perceived as a sign of affluence), resulting in overweight and obesity.

Poor diet (high consumption of sugar, salt, saturated fat, etc) and unhealthy lifestyle (smoking, alcohol consumption and physical inactivity) have been identified as major risk factors of cardiovascular disease and other non-communicable diseases (NCDs)

According to the World Health Organization (WHO) estimates, 36 million, out of the 57 million deaths (almost two thirds) that occurred globally in 2008 were due to non-communicable diseases (NCDs), comprising mainly cardiovascular diseases, cancers, diabetes mellitus and chronic lung diseases (WHO, 2009).

Rural population depends on available natural foods like green vegetables, fresh fruits and dairy products in their immediate environment. Although, significant amount of refined foods could also be noticeable in the rural areas such as bread, soft drinks and other refined or processed food products. Rural people have a high physical activity related energy expenditure compared to urban subjects (Lestra *et al*., 2005).

Food choice is an important determinant of people quality of life. Poor or unbalanced diets as in the case of excessive eating and undernutrition, are risk factors for several chronic diseases (Haveman *et al.,* 2003). Poor food intake reduces the level of nutrients in the body thereby exposing the individual to nutritional health related problems (Haveman *et al.,* 2003). The choice of good nutrition is not only important in preventing health problems and promoting active living, but it is a critical part of managing diseases among those who are infected or sick (Haveman *et al.,* 2003) .

As has been reported for several developing countries (Delisle, 2010), West Africa has also undergone periods of changes in dietary habits and shifts in eating patterns in response to socio-economic and socio-political factors. Increasing urbanization and large movements of populations to urban centres with reduced access to traditional and indigenous food resources also exacerbated the nutrition transition phenomenon (Albala *et al.,* 2002). This reduced access to indigenous food resources has resulted in the replacement in diets of the hitherto diversified food resources by energy dense and nutrient poor convenience foods.

Nupe people are Nupoid-speaking people living near the confluence of the Niger and Kaduna rivers in west-central Nigeria. The *Nupe* people live in the heart of Nigeria, spread over the low basin formed by the two rivers, Niger and Kaduna (Usman, 2002). *Nupe* land is made up of an agrarian population, where the economy and social life revolve round agriculture and the people are active farmers. Major crops grown are rice, sorghum, sugar cane, millet, melon, vegetables, yam, homestead livestock management and fishing. Cassava, maize, and sweet potatoes (grown inland) are of secondary importance (Yahaya, 2003).

The *Nupe* are found in Gbako, Lavun, Bida, Bia and Agai local government area of Niger State (Yahaya, 2003). A major staple food that is common to many households in *Nupe* land is rice. Other common foods are porridge from millet, sorghum or maize called "*Kunu*" (Yahaya, 2003). This is consumed along with certain snacks like *akara* (bean cake), "*masa*" sorghum cake, "*mashe*" (early millet cake) or "*Dakuwa*" special confectionery from a combination of fried ground nut and maize and lastly *Kuli-Kuli* made from groundnut after extraction of the oil (Yahaya, 2003).

Chronic diseases, often referred to as non-communicable diseases (NCDs), usually emerge in middle age after long exposure to an unhealthy lifestyle involving tobacco use, a lack of regular physical activity, and consumption of diets rich in highly saturated fats, sugars, and salt, typified by "refined foods. Nutrition and nutritional qualities of food are widely considered to be crucial for health and well-being of the humans (Levy-Costa *et al.*, 2005). The well documented evidences from epidemiological studies indicate several diseases (Nikoo *et al.*, 2010), such as cardiovascular diseases and some types of cancers are linked with diet and nutrition uptake and its regulations. All these diet-related diseases are likely to change in eating habits, processing technologies, and products (Shils, 2005).

Obesity has occurred in parallel with the globalization of food systems and the expansion of trade and foreign direct investment. Intake of excessive refined foods has been connected to most major health issues including: osteoporosis, cancer, hypoglycemia, cardiovascular disease, adrenal exhaustion, metabolic, endocrine, and reproductive disorders, parasitic and yeast infections. Increased consumption of refined food with less activity leads to an increased incidence of obesity and diet-related diseases like diabetes, coronary heart disease (CHD) and certain types of cancer (Shetty, 2002).

The change in lifestyle has brought about a dramatic nutrition transition characterized by a decrease in the consumption of traditional foods and an increasing reliance on refined foods (Mead *et al.,* 2010; Sharma *et al.,* 2010). There is significant and valid concern for the health implications of consuming increased amounts of these fat- and sugar-rich foods (Kuhnlein *et al.,* 2004)

Traditional foods are those eaten by people over the longer course of civilization and which have supported health – cultivated, produced, and harvested from the earth and out of nature – foods which are wholly unaltered and organic, and contain the highest levels of nutrition or are nutrient-dense (Umeh, 2007). Traditional foods by their very nature contain the highest levels of nutrition available because they are grown with sustainable methods which increase nutrient content and without chemicals and other harmful substances which have been found to diminish nutritional value (Umeh, 2007).

Lifestyle diseases are diseases that appear to increase in frequency as countries become more industrialized (Mercola, 2014). Lifestyle diseases share risk factors similar to prolonged exposure to three main modifiable lifestyle behaviors--smoking, unhealthy diet (including

alcohol abuse), and physical inactivity can result in the development of non-communicable and chronic diseases, substantially degenerative diseases (heart disease, stroke, diabetes, obesity, metabolic syndrome, chronic obstructive pulmonary disease, and some types of cancer), that can actually be considered consequence of "contagious" behaviors. These conditions imply loss of independence, years of disability, or death, and impose a considerable economic burden on health services (Mercola, 2014).

1.1 Statement of Research Problem

The current burden of chronic disease reflects the cumulative effects of unhealthy lifestyles and the resulting risk factors over the life span of people. Three decades ago, the food available was mostly fresh and grown locally (Marcola, 2014). The majority of foods served, whether at home, in school or in restaurants, are highly refined foods, filled with sugars, harmful processed fats, and chemical additives (Marcola, 2014). Trends in food availability in households in the last three decades reveal that diverse traditional foods have been replaced by industrialized convenience foods (Levy-Costa *et al.,* 2005).

Obesity is a worldwide phenomenon that has reached both developed and developing countries. The increasing prevalence of obesity and other cardiovascular risk factors (Batsis *et al.*,2007) have been partially attributed to changing nutritional habits and reduced level of regular physical activity. The obesity epidemic is also influenced by social network phenomena characterized by behavioural person-to-person interaction (Christakis and Fowler, 2007). Refined food consumption, defined as inexpensive food, sold by means of self-service systems or carry-out eating locales without waiter services has been implicated as a potential reason for the epidemic (Rosenheck,2008). The rapidly increasing burden of chronic diseases is a key determinant of global public health. Already 79% of deaths

attributable to chronic diseases are occurring in developing countries, predominantly in middle-aged men (Barker, 2000). There is increasing evidence that chronic disease risks begin in fetal life and continue into old age (WHO, 2002). Adult chronic disease, therefore, reflects cumulative differential lifetime exposures to damaging physical and social environments.

Closely linked to refined food is another version of out-of-home food consumption termed *Street Food* (SF). This entity has old, historical roots with complex social-economic and cultural implications (Parente, 2010). Street food is present even in less developed countries, and has occasionally been considered to be the hallmark of the early development of fast food (Winarno and Allain, 2014). It is quickly available and consumed, and generally affordable to large parts of the population.

1.2 Justification

The primary role of diet is to provide sufficient nutrients to meet the nutritional requirements of an individual. There is now increasing scientific evidence to support the hypothesis that some foods and food components have beneficial physiological and psychological effects over and above the provision of the basic nutrients (WHO, 2013). Many traditional food products including fruits, vegetables, soya, whole grains and milk have been found to contain components with potential health benefits (Ene-Obong, 2001).

Traditional foods consumed by people over a long period of time, play an important role in establishing local identity, culture, and custom, and they transfer cultural heritage from generation to generation (Albayrak and Gunes, 2010; Inamdar, *et al.*, 2005). During the past two decades, several researchers have claimed that traditional foods are healthier products

and good sources of micronutrients. Therefore, there is an ardent need to study the dietary patterns of local people and also assess their health status as this will be useful in policy planning and understanding trends to reduce most diseases of affluences.

1.3 Aim and Objectives

The general aim of this study is to assess the nutritional status, dietary pattern, prevalence of chronic diseases (obesity and blood pressure) and risks factors among adults in Bida Local Government Area, Niger State.

The specific objectives are to:

i. Assess the anthropometric parameters (BMI, waist circumference) of adult in Bida Local Government Area of Niger State.
ii. Assess the dietary pattern among adult in Bida Local Government Area, Niger State.
iii. Determine the prevalence of chronic diseases (Medical History and On-Point measurement of Blood pressure and obesity) and risks factors (blood sugar level and lipid profile) among adults in Bida Local Government Area, Niger State.
iv. Assess the level of physical activities among adult in Bida Local Government Area, Niger State.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Introduction

Food is a substance, either solid or liquid, which, when eaten, supplies the body with some necessary materials called nutrients which the body needs for the performance of its daily functions (Oluwole, 2009). Foods are made up of chemical substances and a good knowledge of the nature and composition of foods is necessary for their proper and effective utilization, cooking and processing as well as preservation and storage.

Ene-Obong (2001) defined food as any substance, liquid or solid which when consumed is capable of performing one or more of the following functions: Provide the body with energy for work; Provide materials for growth, repair, and maintenance as well as for reproduction; Protect the body against diseases; Regulate body processes. Oluwole (2009), defines food as any substance when absorbed into the body yield energy and materials for growth, repairs of damaged tissues and regulation of body processes without harming the living organism.

The foods we eat contain nutrients. Nutrients are substances required by the body to perform its basic functions. Nutrients must be obtained from diet, since the human body does not synthesize them. Nutrients are used to produce energy, detect and respond to environmental surroundings, move, excrete wastes, respire, grow, and reproduce.

Nutrients are chemical component of foods which the body uses to build tissues, produce energy and keep healthy. The body uses the nutrients to build the body, produce fluids and repair worn out tissues; to produce energy so that the body can keep warm and can move and grow; assist chemical processes and protect the body from disease (Justina, 2009). Nutrition

is said to be the science of nourishing the body and deals with foods and their effects on health. Good nutrition is therefore fundamental and an important prerequisite to good health. Health as defined by WHO (2011) is said to be a state of complete physical, social and mental well-being and not just the absence of disease or infirmities. Nutrition is an important avenue through which the indicators for good health can be achieved. Proper nutrition promotes good nutritional status thus satisfies the requirement for good physical health. Once a person is food and nutrition secured, he or she has the peace of mind to divert energy into more profitable areas since the basic needs have been satisfied. A person healthy in all these three areas of health will increase production and in a way stop the vicious cycle of poverty (WHO, 2016).

2.2 Dietary patterns and the Nutritional Status of Adults

Under consumption and over consumption of calories tend to result in malnutrition. For one to have a very good or optimum nutritional status, one must be both food and nutrition secured. However most people are on borderline nutrition because nutrition security is difficult to achieve (WHO, 2013). Therefore, even though a person may be food secured, he or she may not necessarily be nutrition secured. Individual nutritional status depends on the interaction between food that is eaten, the overall state of health and the physical environment (WHO, 2013). A model developed by UNICEF (1997) provides a widely accepted framework that shows the most likely causes of malnutrition. This framework indicates that malnutrition, as an outcome is as a result of immediate, underlying and basic causes in a hierarchal manner. Food, health and care are major requirements for nutritional well-being. However, food preferences that are developed early in life influence adult food preference. Furthermore, it is during this period that they experiment and start developing

dietary habits. Poor dietary patterns once developed eventually become permanent dietary habits (WHO, 2013).

As described by WHO (2011), "malnutrition essentially means bad nourishment. It concerns not enough, as well as too much food, the wrong types of food and the body's response to a wide range of infections that result in mal absorption of nutrients or the inability to use nutrients properly to maintain health". Though malnutrition is in two forms: over nutrition and under nutrition. Most people however associate malnutrition to under nutrition only. As described by WHO (2011), factors such as famine, starvation, fasting, economic instability, skipping meals are potent reasons for not have enough food or eating less which will thus lead to bad nourishment or under nutrition. During such times, dietary patterns change. People tend to reduce the amount and number of times they eat as well as the quality of food. However, in over nutrition one might consider factors such as over eating nutrient dense foods or increased physical inactivity levels.

2.3 Assessment of Nutritional Status

The importance of nutritional assessment cannot be overstressed. However, nutritional assessment enables the identification of nutrient(s) whose supply are adequate or inadequate, and makes appropriate decision possible in relation to the scope of the nutritional support that is necessary. In addition, when such nutritional support is finally given, further assessment allows for proper evaluation of its effectiveness and success.

There are four major ways of assessing the nutritional status of an individual or given population. These methods include anthropometric studies, Nutritional surveys or direct assessment, biochemical and clinical assessments. All the four methods are important and,

where possible, they should be conducted for a given population so as to obtain a complete and conclusive assessment (Oluwole, 2009).

2.3.1 Anthropometric Studies

Anthropometric measurements refers to the determination of the size and proportion of the human body, especially height and weight, fats and skin folds, which are then compared with standard to determine deviation or conformance. Other body measurements that are used include the triceps (the large muscle at the back of the upper arm, midpoint between the elbow and the shoulder tip), and the sub capular, below the tip of the scapula (or shoulder blade). Head circumference, chest, abdomen, buttocks, thigh, calf and ankle measurements are also commonly used to determine physical proportions of the human body as a measure of nutritional status (Oluwole,2009).

2.3.1.1 Anthropometric Measurements of Malnutrition

Anthropometric measurements are always used to indicate malnutrition. Ene-Obong (2001) explain anthropometry as the science of measuring the size, weight and height of a human body. Height and weight measurements usually vary according to the person's age and sex. These measurements are used to derive indices such as body mass index, weight-for-age, weight-for-height as well as height-for- age.

Direct assessment of nutritional status involves the measurement of the actual food consumption by the individual in a household or community in the society. The most common direct method of assessing nutritional situation is the food intake survey which supplies information on the different foods and drinks consumed either by an individual, a household or a country over a given period of time (Oluwole, 2009).

Survey is usually in different segments of the population by age, sex, occupation, education, socio-economic status etc. Surveys are used to identify persons who are at high risk or are malnourished. They act as a monitoring force for a given population in terms of nutritional education and what could be done to improve health. They can also be used to establish the basis for programmes of nutritional public health that meet the needs of the population (Oluwole, 2009).

2.3.2 Biochemical Assessment

Biochemical assessment involves the evaluation of body fluids and tissues in order to assess either the stored or mobile forms of nutrients (Oluwole, 2009). The most common tissue for biochemical assessment is the blood, since it is the means by which most nutrients, metabolites and waste products are transported in the body. Moreover, blood samples for evaluation are easy to take and such samples are easily stored without any offensive odour unlike, urine and faeces (Oluwole, 2009).

Changes in the levels of blood constituents are indicative of changes in nutrition and metabolism, which may be a direct consequence of poor or inadequate nutrition. Apart from the blood, biochemical assessment may be carried out by urine and stool studies, but such samples may be offensive due to their nature, which may adversely affect reliability (Oluwole, 2009).

2.3.4 Clinical Assessment

Physical signs are the occurrences in the development of nutritional abnormalities and they result after gradual depletion of tissue reserves of nutrients over a period of time, which may be between weeks and months, depending on the type of nutrient. Changes in nutritional

status often result in clinical signs in the body organs or tissues including hair, eyes, mouth, tongue, teeth, skin and mucous membrane (Oluwole, 2009).

2.5 Effects of Dietary Patterns on Health

Health and nutrition are known to be closely related. Nutrition can have an effect on one's health either by improving it, or making it deteriorate. During growth there is high incidence of nutrition deficiencies and poor eating habits which leads to many risk factors leading to the development of chronic diseases such as diabetes, osteoporosis, hypertension, heart diseases, chronic kidney failure, cancer and many others (Lopez *et al.,* 2006). The leading causes of mortality and disease burden include risk factors for communicable, maternal, perinatal and nutritional conditions such as under nutrition.

Non communicable diseases such as obesity, hypertension, diabetes mellitus, chronic renal failure, cancer and gout are major contributors to the global disease burden (Lopez *et al.,* 2006). Though some of these conditions may not necessarily originate from diet, they require dietary management to improve quality of life and reduce mortality. According to WHO (2010), out of a total of 57 million deaths in 2008, 36 million were from non-communicable diseases. In the United States also, five of the ten leading causes of death are directly associated with diet thus; diabetes, cancer, heart disease, cerebrovascular disease (stroke) and kidney disease, with cancer being the top most cause (U.S Center for Disease Control, 2007).

Likewise in South Africa among the 10 leading causes of death 5 can also be linked to diet in one way or the other, these are diabetes, hypertension, stroke, diarrheal disease and heart diseases (Norman, 2011). HIV/AIDS was the leading cause of death in South Africa in the year 2000. However HIV is a condition that if properly managed with diet can slow the progression of the disease. Besides it is important to note the food-drug interaction in HIV

therapeutic management. In palliative care of HIV positive patients, adequate dietary management is considered to manage the side effects of the drugs (WHO, 2010).

2.5.1 Obesity

Today**,** most people in the affluent world look upon obesity as undesirable; and obesity is regarded as a form of malnutrition, which is most prevalent among the lower socio-economic groups, especially among women.

Overweight and obesity are defined as abnormal or excessive fat accumulation that may impair health (WHO, 2016). In 2014, more than 1.9 billion adults aged 18 years and older were overweight. Of these over 600 million adults were obese. WHO 2016, also reported that about 13% of the world's adult population (11% of men and 15% of women) were obese in 2014. The worldwide prevalence of obesity has doubled between 1980 and 2014**.** However, most people in the affluent world look upon obesity as undesirable; and obesity is regarded as a form of malnutrition, which is most prevalent among the lower socio-economic groups, especially among women.

Among many Nigerian populations, until relatively recently, being fat, as characterized by excess accumulation of body fat, was considered an indication of affluence, beauty and health. Indeed, many Nigerians, still view fatness (obesity) without any concern, as it is often believed to add to the prestige of an individual (Alade, 2001).

In the last 30 to 40 years, interest in the study of obesity, world-wide, has vastly increased, bringing together such various groups as nutritionist, surgeons, psychiatrists, psychologists, exercise physiologists, sociologists, economists and even politicians (Howard and Herbold,2008).

At the present time, the world faces the two extremes of malnutritrition- deficiency and excess. In Nigeria, opulence and abject poverty co-exist. It is not uncommon to find kwashiorkor/marasmus and obesity in the same 'immediate' family (WHO, 2010).

On the basis of "desirable weight", which conforms with or correlates with the greatest longevity, overweight has been defined as the weight which is 10% above an ideal or desirable weight and obesity as 20% or more above this point (Abraham *et al.,* 2006). It has been reported that 50% of adult women with weights greater than 18% of ideal body weight had been obese since adolescence (Abraham *et al.,* 2006). Furthermore, 30% of adults who are obese become obese during childhood and 80% of obese adolescents become obese adults and they tend to be fatter than those who become obese as adults (Abraham *et al.,* 2006). In a New York Study" of obesity, socio-economic status and the prevalence of obesity were found to be inversely related. And the relationship was found to be stronger in women than in men (Abraham *et al.,* 2006).

The few studies that have been conducted in Nigeria indicate a rising trend in the prevalence of obesity. It was reported that in Lagos, 3.1% of male and 14% of the female adult population are obese (Norman, 2011). In an Abeokuta study of children and adolescents aged 6-19 years of age it was shown that 8.3% and 17.2% of them were obese and over-weight respectively (Abraham *et al.,* 2006). A similar unpublished study in Ilorin among elite children showed that 24.1 and 14.6% incidence of obesity was found respectively among the male and female children and adolescents, with an average of 19.4% incidence of obesity among both sexes. In addition, 53.7% of these children were overweight. A study of adult Igbos in Nsukka and Enugu area of Nigeria showed a 78.1% incidence of obesity among business executives, market women, 54.3% and 40.6% civil servants (Alade, 2001). Another

unpublished study of semi-rural Mopa (Kogi State) adult farming population showed that 7.2% were over-weight, while 10.4% of them were obese. Furthermore, 26.3% of the female undergraduate students of the University of Ilorin (unpublished data) and 44.6% of the female nurses of the University of Ilorin Teaching Hospital were found to be obese (Alade, 2001).

In Nigeria, like many developing countries, affluence is measured by the number of cars, television sets and other modern conveniences that an individual possesses (Humphrey, 2007). In the 20 to 30 years, the Nigeria 'oil boom' has brought into the country a large number of imported cars, which jumped from 16, 803 per year in 1965 to 80, 180 per year in 1976. The number of motor-cycles also jumped from 10, 721 per year in 1965 to 221, 980 per year in 1977 (Alade, 2001). Whereas in the past, it was a common sight for Nigerian mothers to engage in the physically-demanding home chores as grinding foods and condiments, walking long distances to fetch water for cooking, drinking and washing clothes, such activities have become a rarity in most Nigerian urban homes nowadays. The automobile, together with these modern conveniences, tend to limit physical exertion, while promoting more sedentary lifestyle. In the course of the day, the official duties of the typical Nigerian elite expose him to very limited physical activities. Usually at the end of his "working" day, he stops over at his favorite "staff club" to gulp down a few bottles of beer or other alcoholic or non-alcoholic beverages which increase his caloric consumption. He returns home to rest, watching video or his regular/favorite television programs until his dinner. This is followed by session of video and, or television until bedtime. Thus, in the course of the day or week, few of these elites utilize the physically-demanding recreational facilities such as swimming pools and lawn-tennis courts, especially as it is the erroneous view of the typical Nigerian adult that physical exercise such as jogging, is an activity meant for children and adolescents, but not for responsible adults. The adolescents too, suffer from the lack of adequate

recreational facilities which are in very short supply in most Nigerian communities (Alade, 2001).

Unfortunately, an aversion to physical activities usually develops after the onset of obesity which further compounds the adult obesity problems. In a society where physical exercise is not available or highly valued, especially in the adult population, genetic potential for obesity has a greater opportunity to be expressed (Mayer, 2003).

2.5.2 Body Mass Index

Body mass index (BMI) is a simple index of weight-for-height that is commonly used to classify overweight and obesity in adults. It is defined as a person's weight in kilograms divided by the square of his height in meters (kg/m^2) (WHO, 2016). For adults, WHO defines overweight and obesity as follows: overweight - BMI greater than or equal to 25; and obesity - BMI greater than or equal to 30. BMI provides the most useful population level measure of overweight and obesity as it is the same for both sexes and for all ages of adults. However, it should be considered a rough guide because it may not correspond to the same degree of fatness in different individuals.

2.5.3 Diabetes

Diabetes is a chronic condition, in which there is high blood glucose level in the blood as results of inability of the body to either make or use insulin. According to WHO (2016), Diabetes is a chronic disease, which occurs when the pancreas does not produce enough insulin, or when the body cannot effectively use the insulin it produces which leads to an increased concentration of glucose in the blood (hyperglycaemia). There are three types of diabetes:

1. Type 1 diabetes (previously known as insulin-dependent or childhood-onset diabetes) is characterized by a lack of insulin production. It is a form of diabetes mellitus that results from the autoimmune destruction of the insulin-producing beta cells in the pancreas. The subsequent lack of insulin leads to increased blood and urine glucose (WHO, 20016).
2. Type 2 diabetes (formerly called non-insulin-dependent or adult-onset diabetes) is caused by the body's ineffective use of insulin. It often results from excess body weight and physical inactivity. It is a metabolic disorder that is characterized by hyperglycemia (high blood sugar) in the context of insulin resistance and relative lack of insulin. In type 2 diabetes, the cells in the body don't respond to insulin, and glucose builds up in the bloodstream. This is called insulin resistance. This could lead to other conditions in the future, like heart disease, blindness, and kidney failure (WHO, 2016).
3. Gestational diabetes is hyperglycaemia that is first recognized during pregnancy (WHO, 2016).

Diabetes is not a benign disease. It poses a major health threat in the developed countries. Prevalence studies in the developed parts of the world have shown an increase, with the U.S. reporting a 6.5 fold increase (Akinkugbe, 2007). There, more than 5 million people were believed to suffer from the disease in 1984. In several developing countries, the prevalence of diabetes is relatively high when compared with that in developed countries. In Nigerian, the prevalence of Diabetes Mellitus (DM) is not certain but a recent figure puts the number of affected people at 1 million (Akinkugbe, 2007). Although there are no firm data on the prevalence of diabetes, hospital records show a yearly increase in the number of newly diagnosed cases. This means that some 4 million Nigerians may be suffering from diabetes. A change from a more traditional life-style to a modern one has been suggested as the major

contributing cause (Dixon *et al*., 2007). One of the highest prevalence rates of diabetes yet reported in the literature (40% of the adult population) was that of the Micronesian population of Naruru (Dixon *et al*., 2007). This figure is similar to that reported in American Pima Indians Humphrey (2007), reviewed evidence which indicates that dietary carbohydrate protects the body against diabetes. Furthermore, caloric intake is low in relation to energy expenditure in most of these populations. Epidemiological studies have also shown an increasing prevalence of the disease among urban dwellers in the developing countries to the extent that diabetes mellitus can no longer be regarded as a "disease of affluence."(WHO, 2009).

Diabetes mellitus causes 50% of all amputations of the lower extremities in adults, 25% of all kidney failures and is the leading cause of blindness in adults in the U.S. where it ranks sixth as a primary cause of death; and when its complications are considered, it ranks third. A proper care and good management of the diabetic is therefore essential since there is no known cure for the disease. Thus, a good management of diabetes reduces the frequency of complications. Diabetes management requires education and communication, and patient knowledge is vital because diabetes health care is primary self-care. A good nutrition plan serves as the cornerstone of any successful diabetes management plan. This plan must entail short-term as well as long term goals which foster an optimal life-style, while maintaining desirable blood glucose concentration (West,2007).

2.5.4 Hypertension

Hypertension, also known as high or raised blood pressure, is a condition in which the blood vessels have persistently raised pressure. Blood is carried from the heart to all parts of the body in the vessels. Each time the heart beats, it pumps blood into the vessels. Blood pressure

is created by the force of blood pushing against the walls of blood vessels (arteries) as it is pumped by the heart. The higher the pressure the harder the heart has to pump (WHO,2013).Hypertension is as a result of the extra effort needed to circulate blood due to excess fat or plaque buildup in the veins. Hypertension is defined as a systolic blood pressure (SBP) of 140 mm Hg or more, or a diastolic blood pressure (DBP) of 90 mm Hg or more. Diet amongst other factors such as physical inactivity, lifestyle; age, family history, as well as stress are all risk factors of hypertension. Poor dietary habits may lead to obesity or overweight as well as sedentary lifestyles and physical inactivity. Salt and potassium are other factors that need to be taken into consideration in the diet. This is because too much salt (sodium) can cause hypertension in some people (CFNI, 2004). Low potassium in the diet too can increase sodium levels in the body.

2.5.5 Cardiovascular Diseases

Cardiovscular Diseases (CVD) is known to be one of the major causes of death worldwide (WHO, 2013). Cardiovascular diseases (CVDs) are a group of disorders of the heart and blood vessels and they include: coronary heart disease which are disease of the blood vessels supplying the heart muscle; cerebrovascular disease of the blood vessels supplying the brain; peripheral arterial disease of blood vessels supplying the arms and legs; rheumatic heart disease which damage the heart muscle and heart valves from rheumatic fever, caused by streptococcal bacteria; congenital heart disease causes malformations of heart structure existing at birth; deep vein thrombosis and pulmonary embolism causes blood clots in the leg veins, which can dislodge and move to the heart and lungs. About 60% of the world's heart disease cases in 2010 were recorded from India (Norton, 2010).

2.5.6 Cerebrovascular Disease

Stroke occurs when blood flow to a region of the brain is obstructed, causing brain tissue death. Ischemic stroke is usually caused by a blood clot in an artery that supplies blood to the brain. Heart disease and hypertension are major contributors to stroke. Other risk factors include diabetes, atherosclerosis, high cholesterol levels and family history. According to Swierzewski (2010), "maintaining healthy blood pressure through diet, exercise and medication, if necessary, can decrease the risk for stroke".

2.5.7 Adulthood and Chronic Diseases

There is a global epidemic of non-communicable diseases (NCDs) and the four primary risk factors for these chronic diseases are tobacco, alcohol, lack of exercise, and poor nutrition (WHO, 2011). The fetal origins of adult chronic diseases play a particularly important role. The adequacy of the mother's nutrition before and during pregnancy is the first key component in determining the infant's birth weight. The latter in its own right is associated with the emergence of chronic disease risk factors in these children (Barker, 2000).

CHAPTER THREE

3.0 MATERIALS AND METHODS

3.1 Study Area

Bida is a Local Government Area in Niger state, Nigeria and a city on the A124 highway which occupies most of the area. Bida is situated at 9.08° North latitude, 6.02° East longitude. It has a population of 185,553 (NPC, 2006).

3.2 Study Population

The study population comprised primarily of adults in Bida Local Government Area, Niger state.

3.3 Inclusion and Exclusion Criteria

Inclusion Criteria

Adults (18-65 years) living in Bida Local Government Area, Niger State that consented to.

Exclusion Criteria

Non adults

3.4 Study Design

A cross-sectional study targeting adults in Bida Local Government Area, Niger State.

3.5 Sample Size Calculation

The sample size for this study was obtained using the formula:

$n = z^2pq/d^2$ (Thrusfield, 2005).

Where:

n= the desired sample size

z= the standard normal deviation, usually set at 1.96

p= the proportion in the target population having the particular trait or prevalence (the prevalence of Chronic Diseases in Bida LGA, Niger State is 0.01).

q= 1.0- prevalence of Chronic Diseases in Bida LGA, Niger State

d= degree of accuracy desired, usually set at 0.05

Therefore, $n= (1.96)^2(0.01)\ (9.99)/\ (0.05)^2 = 153$

Sampling Design Effect=1.5

Therefore n x 1.5 = 230

Then addition of 5% of total due to non-response

5% of 230=12 and 12+230= 242.

3.6 Sampling Technique

A purposive sampling technique was use to select the Local Government Area and all the 14 wards were used for the study.

3.7 Ethical clearance

Ethical clearance was obtained from Niger State Ministry of Health and also from Bida Local Government Area secretariat signed by the chairman of the LGA. Individual informed concept was also obtained.

3.8 Data collection

Based on the objectives of the study, data was collected using a semi structured questionnaire consisting of the following sections:

- Socio-economic and demographic Information
- Dietary Intake/food consumption Pattern

- Lifestyle (Physical Activity, Tobacco use)
- Biochemical examination (hypertension, diabetes and lipid profile)
- Anthropometric Measurements (BMI, waist circumference)

3.8.1 Socio- demographic characteristics

Social and demographic information were collected using interviewer administered with questionnaires viz Age, sex, marital status, religion, tribe, educational level and economic status. Previous illnesses such as diabetes, as well as current drug intake, were also documented.

3.8.2 Measurement of weight and Height

Weight and height were determined according to standard anthropometric methods (Isak, 2006). Height was measured to the nearest 0.1 centimeter (cm) in bare feet with subject standing upright against a mounted stadiometer. Weight was measured to the nearest 0.1 kilogram (kg) with participants lightly dressed using a UNICEF SECA scale. Values obtained were used to assess level of malnutrition by comparing to the Body Mass Index (BMI) standard ranges for adults and the average was taken.

3.8.3 Measurement of waist circumference

This was done according to the procedures outlined by WHO (2010) using a flexible double-graduated tape measured to the nearest 0·1 cm, the top of the hip bone and the bottom of the ribs were located (level of the umbilicus). Participants were asked to breathe out normal and the tape was placed mid-way between the identified points then the measurement was taken.

3.8.4 Measurement of High Blood Pressure and Heart Rate

The measurements of diastolic and systolic blood pressure were taken on the left arm using an automatic validated device (OMRON M5-Iw) and size cuff for obese subjects. The arm was placed on a support and the elbow was in the plane of the heart. The length of the cuff's was equal to 80% of the circumference of the upper arm. The cuff was wrapped around the upper arm with the cuff's lower edge one inch above the antecubital fossa. Lightly press the stethoscope's bell over the brachial artery just below the cuff's edge. Rapidly inflate the cuff to 180mmHg. Release air from the cuff at a moderate rate (3mm/sec). Listen with the stethoscope and simultaneously observe the sphygmomanometer. Record the pressure. A second run of measurements was carried out after 20 minutes and the average was calculated.

3.8.5 Measurement of Blood Glucose

Random blood glucose was measured using a glucometer (Accu-check active). A drop of capillary blood is placed on the filter paper whereby the patient sample is obtained by pricking the fingertip with a lancet and placed on the reagent bonded to the paper strip for 1 minute and the concentration is then estimated by using a portable reflectance meter specific to the reagent strip.

3.8.6 Lipid Profile

A peripheral blood sample was taken, appropriately 3ml was collected from each participant. Samples were collected and frozen in containers and transported to Niger State General Hospital Minna for analysis. Blood samples were immediately centrifuged when appropriate and analysed for total cholesterol and HDL-cholesterol.

3.8.6.1 Estimation of Serum Total Cholesterol

The serum total cholesterol concentrations was estimated using the enzymatic method of Allain *et al.* (1974) using test kit to be procured from Agape Diagnostic, Switzerland.

Principle:

This is based on hydrolysis of cholesterol and subsequent oxidation step to produce hydrogen peroxide (H_2O_2).The peroxidase act as oxidative coupling between phenol and 4-aminophenazone. The formed dye quinoneimine is a red chromogen which is measured at 505nm. The intensity of the color is proportional to the concentration of cholesterol in the sample.

Cholesterol ester + H_2O $\xrightarrow{\text{Cholesterol esterase}}$ Cholesterol + Fatty acid

Cholesterol + O_2 $\xrightarrow{\text{Cholesterol oxidase}}$ Cholesterol -3-one + H_2O_2

$2H_2O_2$ +phenol + 4-aminophenazone $\xrightarrow{\text{Peroxidase}}$ Quinoneime + $4H_2O$

Procedure:

One thousand microlitres (1000µl) of cholesterol reagent was added into test tube label test, standard and blank respectively, and 10µl of sample (serum), standard and distilled water was added into test tube label test, standard and blank respectively. The tube content was mixed properly and incubated at 37^0c for 5 minutes. The absorbance of the test and standard was read against the reagent blank at 505nm using spectrophotometer.

Calculation:

Total Cholesterol was calculated using the formula:

Cholesterol (mmol/l) =) $\frac{\text{Absorbance of Test}}{\text{Absorbance of standard}}$ x concentration of standard (200mmol/l)

3.8.6.2 Estimation of Serum High Density Lipoprotein Cholesterol

The Serum (HDL-C) High Density Lipoprotein Cholesterol concentration was estimated using the method of Burstein *et al*. (1970) using reagent Kits procured from Agape Diagnostic, Switzerland.

Principle:

The chylomicrons, very low density lipoprotein (VLDL) and low density lipoprotein (LDL) of serum are precipitated by phosphotungstic acid and magnesium ions. After centrifugation, high density lipoproteins (HDL) are in the supernatant.

Procedure:

This procedure involves two stages;

A) Precipitation

Three hundred microlitres (300µl) of sample and HDL reagent was added into a test tube label test, the tube content was mix and allow standing for 10 minutes at room temperature, the content was mixed again and centrifuged for 10 minutes at 4000rpm. The supernatant was extracted from the precipitate, and HDL-C cholesterol was estimated using cholesterol reagent.

B) HDL Cholesterol Estimation

One thousand microlitres (1000µl) of cholesterol reagent was added into test tube labeled test, standard and blank respectively, then 50µl of HDL-C standard solution was added into standard, 50µl of distilled water into blank and 50µl of HDL supernatant into test respectively. The tube content was mixed properly and incubated at 37^0c for 5 minutes. The absorbance of the test and standard was read against the reagent blank at 505nm using spectrophotometer.

Calculation:

HDL-Cholesterol was calculated as shown below:

$$\text{HDL-Cholesterol (mmol/l)} = \frac{\text{Absorbance of Test}}{\text{Absorbance of standard}} \times 100$$

3.8.6.3 Estimation of Serum Triglyceride (TG)

The serum triglyceride (TG) concentration was estimated using the method of Trinder (1969) using reagent Kits procured from Agape Diagnostic, Switzerland.

Principle:

The triglyceride method is based on an enzymatic procedure in which combination of enzymes are employed for the measurement of serum triglycerides. The sample is incubated with lipoprotein lipase (LPL) enzymes reagent that convert triglyceride into free glycerol and fatty acid. Glycerol kinase (GK) catalyze the phosphorylation of glycerol by adenosine 5-triphosphate (ATP) to glycerol 3-phosphate. Glycerol 3-phosphate-oxidase oxidizes glycerol 3-phosphate to dihydroxyacetone phosphate and hydrogen peroxide (H_2O_2), aminoantipyrine and 4-chlorophenol. The change in the absorbance is due to the formation of quinoneimine is directly proportional to the total amount of glycerol and its precursors in the sample and is measure using colorimetric method described by (Trinder, 1996).

Triglyceride + H_2O $\xrightarrow{\text{LPL}}$ Glyceride + Fatty acid

Glycerol + ATP $\xrightarrow{\text{GK}}$ Glycerol-3-phosphate +ADPS

Glycerol -3- phosphate + O_2 $\xrightarrow{\text{GOP}}$ Dihydroxyacetone phosphate + H_2O_2

$2H_2O_2$ +Aminoantipyrine $\xrightarrow{\text{POD}}$ Red Quinoneimine + HCL 4 H_2O +4-Chlorophenol

Procedure:

One thousand microlitres (1000µl) of triglyceride working reagent was added into test tube labeled test, standard and blank respectively, 10µl of sample, standard and distilled water was added into test tube labeled test, standard and blank respectively, the tube content was mixed

properly and incubated at 37^0c for 5 minutes. The absorbance of the test and standard was read against the reagent blank at 546nm using spectrophotometer.

Calculation:

The serum triglyceride was calculated using the formula:

$$\text{Triglycerides (mmol/l)} = \frac{\text{Absorbance of Test}}{\text{Absorbance of standard}} \times \text{concentration of standard (200mmol/l)}$$

3.8.6.4 Estimation of Serum Low Density Lipoprotein Cholesterol

The serum Low density lipoprotein cholesterol (LDL-C) concentrations were calculated according to Friedewald *et al*. (1974).

Serum LDL-C (mmol/l) = TC – (HDL-C + TG/2.2)

3.9 Dietary Pattern

A total of 210 adult completed the Food Frequency Questionnaire. An un-quantified Food frequency Questionnaire (FFQ) was used to collect dietary information from the subjects. The frequency of eating different type of food was categorized into four groups (7 or more times, 4 to 6 times, 2 to 3 times and 1 or less time per week).

3.10 Physical Activity

Physical activity was assessed in three categories, at work, during transportation and at leisure time. Physical activity at work was defined in three categories, firstly as work involving mostly sitting or standing with walking for no more than 10 minutes at a time, secondly work that does not involve vigorous activities like heavy lifting, digging or construction work for at least 10 minutes at a time and thirdly in term of number of days per week one does vigorous activities as part of one's work. While physical activity on transportation was defined by walking or cycling for no more than 10 minutes continuously

to get to and from places. On leisure it was defined as recreation or sport or leisure time which involve mostly sitting, reclining or standing with no physical activity lasting more than 10 minutes at a time and whether during leisure time one does not do any vigorous activities like running, or strenuous sports, weight lifting for at least 10 minutes at a time.

3.11 Statistical Analysis

Data were collected and analysed using IBM SPSS for windows, version 20.0. Descriptive statistics was used to display data in means, frequencies and percentages. Correlation analysis were used to assess the relationship between variables. P-values less than 0.05 were considered significant.

CHAPTER FOUR

4.0 RESULTS

4.1 Socio- Demographic Characteristics of Respondents in Bida Local Government Area

Data was collected from a total of 210 instead of 242 adults aged 20- 60 years. Thirty two (32) of the respondents failed to give their full information such as refusal to give their blood sample for lipid profile. The demographic characteristics of respondents are summarized in Table 4.1. Majority of respondents were married (90.5%), followed by the divorced (4.3%) and singles were lowest at 2.4%. females (52.9%) and over 50% are in the age range of 30-39 years. Sex ratio was 0:0.9 which shows that, there is a slightly lower male to female sex distribution of respondents. Islam was the predominant religion practiced (91.9%) followed by Christianity (8.1%). Over 60% of the respondents are Nupe, 18.6% Fulani and 9% were Hausa respectively. Those with tertiary education accuted for 45%, secondary was 21% while primary school was 14.4%

Majority (37.6%) of respondents were civil servants, 23.8% engaged in business followed by farmers (16.7%) and full time housewives were about 10%.

Table 4.1: Socio-Demographic Characteristics of the Respondents in Bida Local Government Area

Variable	Frequency	Percentage (%)
AGE (Years)		
20-29	34	16.2
30-39	115	54.8
40-49	50	23.8
>49	11	5.2
SEX		
Male	99	47.1
Female	111	52.9
MARITAL STATUS		
Single	5	2.3
Married	190	90.5
Divorced	15	7.2
RELIGION		
Islam	193	91.9
Christianity	17	8.1
TRIBE		
Nupe	127	60.5
Fulani	39	18.6
Yoruba	25	11.9
Hausa	19	9.0
EDUCATIONAL LEVEL		
Informal (IE)	15	7.1
Islamic (IE)	25	11.9
Primary (PE)	30	14.4
Secondary (SE)	45	21.4
Tertiary (TE)	95	45.2
OCCUPATION		
House wives	20	9.5
Farmers	35	16.7
Self-employed	10	4.8
Menial jobs	16	7.6
Business	50	23.8
Civil servants	79	37.6

4.2 Nutritional Status of Adults Respondents in Bida Local Government Area, Niger State.

4.2.1 Body Mass Index (BMI)

The mean Body Mass Index (BMI) of those aged 20-49 years was 30.40 kg/m^2 and classified as overweight. The mean BMI in women was 30.35 kg/m^2, while the mean BMI in men was 30.40 kg/m^2.The Body Mass Index (BMI) of adult people in Bida Local Government Area of Niger State was distributed into six (6) group namely; underweight, normal, overweight, class1 obesity, class 2 obesity, class 3 obesity, according to the WHO reference standard for BMI for Age.

The distribution of BMI showed that 38 (18.1%) of the adults within the age of 30-39 years were overweight with the highest frequency seen in adult male (10.5%) and 1 (0.5%) of adult female were underweight and 1 (0.5%) of adult male were in 3 obesity between the age of 20-29. The BMI of adult in Bida by age and sex distribution respectively shows that adults between the age of 30-39 years had the highest frequency while according to the sex distribution, the females are leading except for obesity class 3 as shown in Table 4.2.

4.2.2 Waist Circumference of Adult Respondents in Bida Local Government Area, Niger State.

Mean waist circumference for women was 90.85cm, and 94.26cm for men. Normal waist circumference is > 88cm for women and > 102cm for men. The distribution was divided into two groups; normal and above.

From Table 4.2.2, the distribution shows that about 64%of adults male are having a normal waist circumference while 71.7% of the female are having a waist circumference above the normal range.

Table 4.2: Nutritional Status of Adult Respondents in Bida Local Government Area, Niger State.

Classification	% Distribution of Nutritional Status		
	Male (n=99)	**Female (n=111)**	**Total n=(210)**
Underweight (BMI <18.5)	1.0	3.6	2.4
Normal (BMI =18.5 - 24.99)	19.2	19.8	19.5
Overweight (BMI = 25.0 -29.99)	30.3	29.7	30.0
Class I obesity (BMI =30.0 – 34.99)	28.3	27.0	27.6
Class II obesity (BMI = 35.0 – 39.99)	11.1	13.5	12.4
Class III obesity (BMI ≥ 40.00)	10.1	6.3	8.1

Table 4.2.2: Waist Circumference Distribution by Sex among Adult Respondents in Bida Local Government Area.

Waist Circumference Classification	% Distribution	
	Male (n=99)	**Female (n=111)**
Normal (Not at risk)		
Men (≤102cm)	71	64
Women(≤88cm)	40	36
Total	111	100
Above (At risk of Disease)		
Men (>102cm)	28	28.3
Women(>88cm)	71	71.7
Total	99	100

4.3 Dietary Pattern of Adult Respondents in Bida Local Government Area, Niger State

According to Table 4.3, the percentage of respondents that consumed fruits and vegetables at least once a day was low (25.7% and 14.3%) respectively. Only 11.9% of respondents took vitamin supplements per day. Almost half (41%) of respondents consumed animal meat daily including about 13 % also consuming eggs daily.

4.4 Blood Pressure of Adult Respondents in Bida Local Government Area, Niger State.

Mean blood pressure was 123.83/87.58mmHg (Normal BP is classified as 120/80 mmHg and elevated BP is classified as ≥ 140/90 mmHg).

The blood pressure of the respondents was distributed into six (4) group namely; normal, Prehypertension, 1 Hypertension, 2 Hypertension.

From the study, about 47.6% of the respondent are prehypertensive and 4.8% are in hypertension 2. Twenty nine percent (29%) of adult respondents between 30-39 years were Pre-hypertensive with the males (15.7%) having the highest percentage. Less than one percent (0.5%) of adult respondents between 20- 29years are in class 2 hypertension.

Table 4.3: Dietary Pattern of Adult Respondents in Bida Local Government Area, Niger State.

Food Type	% Frequency of Intake (n=210)			
	≤ 1 time /week	1-3 times/week	4-6 times/week	≥ 7 times/week
Milk & Dairy Products	19.0	51.9	25.7	3.3
Meat, Fish & Poultry	16.2	20.0	22.4	41.4
Eggs	18.1	44.4	24.8	12.9
Cereals & Legumes	8.6	29.0	36.2	26.2
Fruits	9.0	26.2	39.0	25.7
Vegetables	13.8	27.1	44.8	14.3
Pasta &Bread	9.5	19.5	33.8	37.1
Confectionary	24.3	40.0	19.5	16.2
Soft Drinks	17.6	26.7	36.2	19.5
Coffee & Tea	16.2	42.9	29.5	11.4
Vitamin Supplements	38.1	18.6	31.4	11.9

4.5 Prevalence of Risk Factors among Adult Respondents in Bida Local Government Area of Niger State

For cholesterol, 51% of the respondents between the age of 30 and 39 years were having a normal cholesterol level with the male having the highest. Less than 3% were hypercholesteremia (Table 4.5). Triglyceride level was normal in 45.7% of adults between the ages of 30 and 39 years while by sex, males had the highest percentage of 24.3%.

The results revealed a normal cholesterol, HDL and LDL 93.3%, 87, 6% and 99.5% respectively. Thirty seven percent of the respondents are hyperglycermic. The blood pressure of the respondents indicates that 47.6% are pre hypertensive while mild and severe hypertension were 15.2% and 4.8% respectively.

4.6 Tobacco Use

A total of 200 (92.5%) people responded to the question on tobacco consumption and less than a hundred % admitted the use of tobacco. The rate of tobacco consumption raises with age across all the wards, with the highest tobacco consumption being noted in Cheniyan ward (TakoAlhaji) among the 30year and above. Males consume more tobacco products compared to the females (Table 4.5).

Table 4.4: Distribution of Risk Factors among Adult Respondents in Bida Local Government Area, Niger State.

Indicators	Frequency	%
Random Blood Glucose		
Normal 6.0 – 9.0 mmol/l	133	63.3
Hyperglycemia > 9.0 mmol/l	77	36.7
Cholesterol		
Normal 3.5 – 7.5mmol/dl	202	96.2
Hypercholesteremia > 7.5 mmol/dl	8	3.8
Blood Pressure		
Normal		
120 / 80	68	32.4
Prehypertension > 120/80	100	47.6
Mild hypertension > 140/90	32	15.2
Severe hypertension > 160/100	10	4.8
HDL		
Normal 35-65 g/dl	191	90.9
High HDL > 65 g/dl	19	9.1
LDL		
Normal 0-160 mg/dl	209	99.5
High LDL > 160 mg/dl	1	0.5

4.6.1 Physical activity at work of Adult Respondents in Bida Local Government Area, Niger State.

Generally the prevalence of physical activity during normal working hours was high (50%) in all the age groups. The age group 30-39 years had the highest activity particularly in males.

Table 4.5 Percentage Distribution of Adult Respondents Smoking Tobacco by Age and Sex in Bida Local Government Area, Niger State

Age Groups (Years)	% Distribution					
	Male		Female		Total	
	Freq	%	Freq	%	Freq	%
20-29	15	16.3	3	42.8	18	18.2
30-39	46	50.0	1	14.3	47	47.5
40-49	23	25.0	2	28.6	25	25.3
≥50	8	8.7	1	14.3	9	9.0
Total	92	100	07	100	99	100

Table 4.5.1 Percentage Distribution of Adult Respondents by Sex and Age during Normal Physical Activity in Bida Local Government Area, Niger State.

Age Groups (Years)	% Distribution					
	Male		Female		Total	
	Freq	%	Freq	%	Freq	%
20-29	4	17.4	7	15.2	11	15.9
30-39	10	43.5	21	45.7	31	44.9
40-49	2	8.7	13	28.3	15	21.7
≥50	7	30.4	5	10.8	12	17.5
Total	23	100	46	100	69	100

4.6.2 Physical inactivity at work (no vigorous activity) of Adult Respondents in Bida Local Government Area, Niger State

Percentage of female respondents reporting no vigorous physical activity during working hours was more than 30% in all the age groups. Physical inactivity was more prevalent in the 20+ age group. (Table4.5.2)

4.6.3 Sedentary travelling (transportation) of Adult Respondents in Bida Local Government Area, Niger State

Females shows a high report of sedentary travelling across all age and there was an increasing trend with age. (Table 4.5.3)

4.6.4 Sedentary leisure time of Adult Respondents in Bida Local Government Area, Niger State

The proportion of respondents reporting sedentary leisure time ranged from 91% to 99%. Overall 96.7% of the respondents reported sedentary leisure time (Table 4.5.4).

Table 4.5.2 Percentage Distribution of Adult Respondents with No Vigorous Physical Activity by Sex and Age Group in Bida Local Government Area, Niger State.

Age Groups (Years)	% Distribution					
	Male		Female		Total	
	Freq	%	Freq	%	Freq	%
20-29	14	66.7	5	38.5	19	55.9
30-39	2	9.5	7	53.8	9	26.5
40-49	3	14.3	1	7.7	4	11.8
≥50	2	9.5	0	0.00	2	5.9
Total	21	100	13	100	34	100

Table 4.5.3: Percentage Distribution of Adult Respondents Reporting Sedentary Travelling By Sex and Age Group in Bida Local Government Area, Niger State

Age Groups (Years)	% Distribution					
	Male		Female		Total	
	Freq	%	Freq	%	Freq	%
20-29	10	31.3	4	8.7	14	17.9
30-39	8	25.0	7	15.2	15	19.3
40-49	2	6.3	12	26.1	14	17.9
≥50	12	37.5	23	50.0	35	44.9
Total	32	100	46	100	78	100

Table 4.5.4 Percentage Distribution of Adult Respondents Reporting Sedentary Leisure Time by Sex and Age Group in Bida Local Government Area, Niger State.

Age Groups (Years)	% Distribution					
	Male		Female		Total	
	Freq	%	Freq	%	Freq	%
20-29	5	29.4	4	33.3	9	31.0
30-39	3	17.6	5	41.7	8	27.6
40-49	3	17.6	1	8.3	4	13.8
≥50	6	35.4	2	16.7	8	27.6
Total	17	100	12	100	29	100

CHAPTER FIVE

5.0 DISCUSSION

5.1 Socio-Demographic Characteristics of Adult Respondents in Bida Local Government Area, Niger State.

Findings on socio-demograhic characteristics revealed that 60.5% of the respondents are nupes who formed the majority of ethnic group in Bida Local Government Area of Niger State. Fourty six percent of the respondents have attained tertiary level education while economic status of 79 out of 210 respondents which account for 37.6% indicates them as civil servant have a steady monthly income

5.2 Nutritional Status of Adult Respondents in Bida Local Government Area, Niger State.

Nutritional status is an integral component of the overall health of an individual (Som *et.,al*, 2007), and provides an indicator of the well-being of individuals (Dutta *et al.*,2009) living in a particular region. In this regard, the importance of the nutritional status of adults in the developing countries should be emphasized, not only for the improvement of health, but also for the overall development of the concerned region in near future (Rao *et al.*, 2005). The findings of this present study reflect a seemingly prevalence of malnutrition (57%) among respondents in Bida Local Government Area of Niger State. The study shows that the respondents were overweight and obese, this study support Wellman *et al.*, (2008) prevalence of obesity has increased in all ages, and obesity is associated with increase in mortality and contribute to many chronic diseases (Marais, Marais and Labadarios, 2007).

More than two third of the respondents falls within the range of overweight, class 1, class 2 and class 3 obesity with the female having the highest frequency. The high prevalence of overweight (30%) and obesity class 1 (27%) recorded in this study compared with the report

prevalence of overweight and obesity among female traders in Ibadan, Nigeria (Balogun and Owoaje, 2007). This could be related to the high prevalence of unhealthy eating habits and sedentary lifestyle among the participants in this study. A study by Bhargava *et al*. (2002) had reported negative association between physical activity and body weight.

Studies have also shown that attitudinal and cultural changes are associated with obesity (Patel, 2009). Traditional Nigerian societies are highly mobile, often walking several miles to visit relations, access markets, or just for leisure. These have been replaced by a sedentary lifestyle and low energy-demanding vocations, facilitated by the availability of mass transportation systems across various parts of the country, and further complemented by more people using private vehicles to commute. Advancements in technologies, such as live television broadcasts, computers, the internet, and electronic games, have also made the Nigerian populace less ambulatory.

The 20.0% prevalence of hypertension observed among the participants in this study is higher than the 13.16% prevalence of hypertension reported by Asekun-Olarinmoye *et al*., (2013) in a rural adult population of Osun State, Nigeria, it compares well with the 31.0% prevalence of hypertension reported by Ogah *et al*., (2013) in Abia State, Nigeria, and less than half of the 68.9% prevalence of hypertension reported by Ordinioha and Brisibe (2013) among an elderly population of traditional chiefs in an urban population in south - south Nigeria.

The findings in these studies not only highlight the high burden of hypertension across the populations in Nigeria, but also gave the documented pattern of rise in the prevalence of hypertension with age. There is high burden of hypertension and it has become a big challenge to public health in Nigeria, with its prevalence in rural and semi-urban populations across the country. This underscores the need for a re-invigorated and consistent implementation of public health interventions for its prevention and control in Nigeria.

The International Diabetes Federation (IDF) had estimated that in 2003 the number of people aged 20 to 79 years with diabetes in Sub-Saharan Africa was over 7 million for a population of more than 295 million, giving a prevalence rate of 2.4%. About 65% of those affected with diabetes lived in the urban areas, whereas 35% lived in the rural communities. Nigeria is the first of the top five countries with the highest number of people affected by diabetes in Sub-Saharan Africa with about 1.2 million people affected by the disease (IDF, 2003).

5.3 Dietary Pattern of Adults Respondents in Bida Local Government Area, Niger State

High prevalence of unhealthy eating habits was recorded among the participants in this study. There is also relatively high prevalence of animal protein (41.4%) among the participants was observed. The low prevalence of consumption of fruits and vegetables among the participants in this study is of serious concern. These was in line with the findings of Awosan *et al.,* (2013) that reported the high level of participants that eat fruits (56.0%) and vegetables (58.8%) less than three times in a week.

5.4 Physical Activity Characteristics of Adult Respondents in Bida Local Government Area, Niger State

According to this study, 50% of the respondents were physically active during normal working hour particularly in the age group 30-39 years with the male having the highest. This was in line with the research on gender differences that males and females exhibit different aspects that encourage the practice of physical activity. Men seek to gain muscular mass and do the activity for challenge or competition (Molananorouzi *et al.*,2015) and strength, which may explain the fact that they are more active and practice more vigorous activities (Egli *et al.*, 2011).

Physical inactivity has become a public health problem all over the world. Globally, around 31% of adults aged 15 years and over were insufficiently active in 2008 (men 28% and women 34%). Approximately 3.2 million deaths each year are attributable to insufficient physical activity. This study also noticed that about 96.7% reported sedentary leisure time which is in line with WHO, (2013) were it was stated that the current high level of physical inactivity is believed to be partly due to insufficient participation in physical activity during leisure time and an increase in sedentary behavior during occupational and domestic activities.

5.5 Tobacco Use of Adult Respondents in Bida Local Government Area, Niger State

Figure 4.1 shows the prevalence of tobacco consumption in Bida Local Government Area. Smoking and obesity are leading causes of morbidity and mortality worldwide. The co-occurrence of smoking has substantial consequences for health. According to the study, the rate of tobacco consumption increases with age having the males with the highest frequency which is in line with WHO estimates of 2010 were it was stated that 9% of Nigerian males and 0.2% of females smoke cigarette (Labonte and Schrecker, 2007). A relatively high prevalence of current cigarette smoking (42.1%) was recorded among the participants in this study and well compared to the high prevalence of smoking (29.3%) and alcohol consumption (38.4%) reported in a study among 11 to 16 years old adolescents in Boenos Aires, Argentina (Mulassi *et al.*, 2010).

CHAPTER SIX

6.0 CONCLUSION AND RECOMMENDATION

6.1 Conclusion

Overweight and central obesity were noted to be generally high in Bida LGA, Niger State. These were due to their unhealthy eating habit and inadequate physical activities which has lead to the developments of chronic disease. Over 38% of the adult population in Bida LGA are either overweight or obessed which had led to a high prevalence of non-communicable diseases. The level of tobacco use was high especially among males across all the wards. Other lifestyle factors such as sedimentary lifestyle were noted to be generally high especially among female. Hypertension and diabetes mellitus was found to be high.

6.2 Recommendations

- It is recommended that adult should engage in regular physical activities.
- Adults should also avoid the consumption of refined foods and focus on locally available natural foods.
- Adults should also be enlighten of the harmful health effects of tobacco use through publicity campaigns using all the media .

REFERENCES

Abraham, S. and Nordsieck, M. (2006). Public Health Reports 75: 253-73 activity levels: Surveillance progress, pitfalls, and prospects. *Lancet* 2012, *380*, 247–257.

Akinboboye O, Idris O, Akinboboye O, Akinkugbe O. (2003). Trends in coronary artery disease and associated risk factors in sub-Saharan Africans. *Journal of Human Hypertension*; 17:381-7.

Akinkugbe O. O. (2007). The non-communicable diseases in Nigeria-Report of a national survey. Ibadan, Nigeria: intec printers limited.

Alade, I.O. (2001) Principle of The Nutritional Management of Diabetes Mellitus in Adult 1st edition, Nathadex Publishers, Ilorin. 2-4

Albala, C., Vio, F., Kain, J., Oauy, R. (2002), 'Nutrition transition in Chile: determinants and consequences', Public Health Nutrition, 5, no 1A, 123–128

Albayrak, M., & Gunes, E. (2010).Traditional Foods: Interaction between Local and Global Foods in Turkey. *African Journal of Business Management*, 4, 555-561.

Asekun-Olarinmoye E, Akinwusi P, Adebimpe W, Isawumi M, Hassan M, Olowe O, Makanjuola O, Alebiosu C, Adewole T (2013). Prevalence of hypertension in the rural adult population of Osun State, southwestern Nigeria. *International Journal of General Medicine* 6:317-22.

Awosan, K. J., Ibrahim, M. T. O., Essien, E., Yusuf, A. A. and Okolo, A. C. (2014). Dietary pattern, lifestyle, nutrition status and prevalence of hypertension among traders in Sokoto Central market, Sokoto, Nigeria. *International Journal of Nutrition and Metabolism*.

Balogun MO, Owoaje ET (2007). Work condition and health problems of female traders in Ibadan, Nigeria. *African Journal of Medical Science* 36(1): 57-63.

Barker DJP. (2000). Growth in utero and blood pressure levels in the next generation. *Journal of Hypertension*, 18: 843—846.

Batsis JA, Nieto-Martinez RE, Lopez-Jimenez F. (2007). Metabolic syndrome: from global epidemiology to individualized medicine. *Clinical Pharmacological Therapeutics*, 82: 509-524.

Bhargava A, Guthrie JF (2002). Unhealthy eating habits, physical exercise and macronutrient intakes as predictor of anthropometric indicators in the Women's Health Trial Feasibility Study in Minority Population. British. *Journal of Nutrition* 88 (6):719-28.

CFNI - Caribbean Food and Nutrition Institute, (2004). Protocol for the Nutritional Management of Obesity, Diabetes and Hypertension in the Caribbean. http://www.paho.org/english/cfni/cfni-protocolnmo dh.pdf Accessed on 17th April, 2016.

Christakis NA, Fowler J. H. (2007). The spread of obesity in a large social network over 32 Years. *New England Journal of Medicine*, 357:370-379.

Delisle, H. (2010) 'Findings on dietary patterns in different groups of African origin undergoing nutrition transition', Applied Physiology Nutrition Metabolism, 35, pp.224–228.

Dixon HG, Scully ML, Wakefield MA, White VM, Crawford DA (2007). The effects of television advertisements for junk food versus nutritious food on children's food attitudes and preferences. Soc Sci Med 65: 1311-1323

Dutta A, pant K, Puthia R, Sah A. (2009). Prevalence of under nutrition among children in the Garhwal Himalayas. Food and Nutrition Bull. 30:77–81. [PubMed]

Egli, T., Bland, H. W., Melton, B. F., & Czech, D. R. (2011). Influence of age, sex, and race on college students' exercise motivation of physical activity. *Journal of American College Health*, 59, 399-406.

Ene-Obong, H. N. (2001) Eating Right. A Nutrition Guide, Calabar, The University of Calabar Press

Haveman, N.A., P.G.M. Lisette, J.A. Amorin and J. Burema, 2002. Dietary quality and lifestyle factors in relation to 10-year mortality in older Europeans. *American Journal of Epidemiology*, 156: 962-968.

Howard, R.B. and Herbold, N.H. (2008). In: Nutrition in Clinical Care, McGraw- Hill Book Co., N. Y., U.S.A.

Humphrey, J. (2007). 'The Supermarket Revolution in Developing Countries: Tidal Wave or Tough Competitive Struggle?. *Journal of Economic Geography*, 7(4):433–450.

IDF (2003).Diabetes Atlas 2003.2nd ed. International Diabetes Federation, Brussels.

Iestra, J.A., D. Kromhout, Y.T. van der Schouw, D.E. Grobbee, H.C. Boshuizen and W.A. van Staveren, (2005). Effect size estimates of lifestyle and dietary changes on all-cause mortality in coronary artery disease patients. Circulation, 112: 924-934.

Inamdar, V., Chimmad, B. V., & Naik, R. (2005).Nutrient Composition of Traditional Festival Foods of North Karnataka. *Journal of Human Ecology*, 18, 43-48.

Justina N.O., (2009) Basic Nutrition and Diet Therapy, 1st edition, University of Nigeria Press Nsukka.pp.3-5

Kuhnlein HV, Receveur O, Soueida R, Egeland G. M. (2004). Arctic indigenous peoples experience the nutrition transition with changing dietary patterns and obesity. *Journal of Nutrition*. 2004;134:1447–1453. [PubMed]

Labonté R, Schrecker T. (2007). Globalization and social determinants of health: The role of the global marketplace (part 2 of 3). *Global Health* 2007; 3:6.

Levy-Costa RB, Sichieri R, Pontes NS, Monteiro C. A. (2005). Household food availability in Brazil: distribution and trends (1974-2003). *Rev Saúde Pública* 2005, **39:**530-540.

Lopez, A., D.C. Mathers, M. Ezzati, D.T. Jamison, C.J.L. Murray, 2006. Global Burden of Disease and Risk factors, Oxford University Press, Washington D.C.

Marais M.L, Marais D and Labadarios D (2007) Assessment of the nutritional status of older people in homes for the aged in the Somerset West area, South African *Journal of Clinical Nutrition* 20 (3), 102-108.

Marcola P. I. (2014). How to lose belly fats. Natural Health Newsletter. https://fitness.mercola.com/how-to-lose-belly-fat.aspx. Accessed on 7 August,2017

Martin AC (2006). Clinical chemistry and metabolic medicine. 7thed. London, UK: Edward – Arnold (Publishers) Ltd.

Mayer, J. (2003). Physiology of hunger and satiety: Regulation of food intake. In R. S. Goodhart and M.E. Shils, (ed.), Lea and Febiger Publishers, Philadelphia, Chap.4.

Mead E, Gittelsohn J, Kratzmann M, Roache C, Sharma S. (2010). Impact of the changing food environment on dietary practices of an Inuit population in Arctic Canada. *Journal of Human Nutrition and Diet*. 2010; 23 (Suppl. 1):18–26. [PubMed]

Molanorouzi, K., Khoo, S., & Morris, T. (2015). Motives for Adult Participation in Physical Activity: Type of Activity, Age, and Gender. BMC Public Health, 15, 66. http://dx.doi.org/10.1186/s12889-015-1429-7.

Mulassi AH, Hadid C, Borracci RA, Labruna MC, Picarel AE, Robilotte AN, Redruello M, Masoli O (2010).Eating habits, physical activity, smoking and alcohol consumption in adolescents attending school in the province of Boenos Aires. Arch. Argent. Paediatric. 105(1):45-54.

Nikoo M, Ghomi MR, Rahimabadi EZ, Benjakul S, Javadian B (2010) The Effects of Deep Frying, Refrigerated Storage and Reheating on the Fat Content, Oxidation and Fatty Acid Composition of the Fish Rutilus frisii kutum. *Journal of Food Process Technology* 1: 103

Norman, R., D. Bradshaw, M. Schneider, D. Pieterse and Groenewald, (2011).Ten leading causes of death in South Africa. Burden of disease research unit. Retrieved from www.mrc.ac.za/bod/Revised Burden of Disease Estimates1.pdf. Accessed on 3rd April, 2011.

Norton, A., (2011). Heart disease cases in India. Journal of the American College of cardiology. Retrieved from Reuter's database. Accessed on 14th March, 2014.

NPC (2006). .National Population Commission of Nigeria. Available at: http://www.population.gov.ng

Ogah OS, Madukwe, O. O., Chukwuonye I, Onyeonoro, U. U., Ukegbu, A. U., Akhimien M. O., Onwubere, B. J., Okpechi, I. G. (2013). Prevalence and determinants of hypertension in Abia State, Nigeria: results from the Abia State Non- Communicable Diseases and Cardiovascular Risk Factors Survey. Ethn. Dis. 23(2):161-7.

Oluwole, A. (2009). Fundamental of Human and Applied Nutrition 1st editon, Concept Publications, pp. 91-97

Ordinioha B, Brisibe S (2013). Prevalence of hypertension and its modifiable risk factors amongst traditional chiefs of an oil – bearing community in south – south Nigeria. *Sah. Med. Journal*. 16(1):24.27.

Parente G (2010): Ciboveloce e cibo di strada. Le tradizioniartigianali del fast-food in Italia alla provadella globalizzazione. [http://www.storicamente.org/03parente.htm] webcite

Park K (2009). Park's textbook of preventive and social medicine. 20thed. Jabalpur, India: M/s Barnasidas Bhanot.

Patel SR, Hu F. B. (2008). Short sleep duration and weight gain: A systematic review. Obesity (Silver Spring). 16:643-53.

Rao VG, Yadav R, DollaCK, Kumar S, Bhondeley MK, Ukey M. (2005). Undernutrition and childhood morbidities among tribal preschool children. *Indian Journal of Medical Research.* 2005;122:43–47. [PubMed]

Rosenheck R: (2008). Fast food consumption and increased caloric intake: a systematic review of a trajectory towards weight gain and obesity risk. *Obesity Rev*, 9:535-547.

Sharma S, Gittelsohn J, Rosol R, Beck L. (2010). Addressing the public health burden caused by the nutrition transition through the Healthy Foods North nutrition and lifestyle intervention programme. *Journal of Human Nutrition and Diet*. 23 (Suppl. 1):120–127. [PubMed]

Shehu, R.A., L. A. Yahaya, S. A. Onasanya, E. A. Ogunsakin and S. O. Oniyangi (2011). Influence of Demographic Factors on the lifestyles of students of Tertiary Institution in Kwara State, Nigeria. *Journal of Research in Education An official Journal of the collaboration of Education Faculties in West Africa Journal*. (1), pp. 89-96.

Shetty P. (2002). Nutrition transition in India. Public Health Nutrition. 5, 175–182 (doi:10.1079/PHN2001291) [Public Medicine]

Shils *A.* (2005). Modern Nutrition in Health and Disease. Lippincott Williams and Wilkins. *Storicamente* 2007, 3. via the INTERNET. Accessed 2015 July 11.

Som S, Pal M, Bharati P. (2007). Role of individual and household level factors on stunting: a comparative study in three Indian states. Ann Hum Biol. 34:632–646. doi: 10.1080/03014460701671772. [PubMed][Cross Ref]

Swierzewski, S., (2010). Risk factors for stroke. www.healthcommunies.com/coperate/stan.shtml. Accessed on 10 May, 2017.

Thrusfield M (2005). Veterinary Epidemiology. 2nd ed. UK: Black Well Science. p 180.

U.S Center for Disease Control, 2007.National Diabetes Fact Sheet, 2007.http://www.cdc.gov/ diabetes/pubs/pdf/ndfs_ 2007.pdf Accessed on 13th April, 2011

UNICEF, The Progress of Nations 1997, UNICEF, New York, 1997.

Waijers, P.M., M.C. Ocke, C.T. van Rossum, P.H. Peeters and Bamia, C. (2006). Dietary patterns and survival in older Dutch women. *American Journal of Clinical Nutrition,* 83: 1170-1176.

West, K.M. (2007). In: Present Knowledge in Nutrition, 4th edition, The Nutritional Foundation, Inc., pp. 356-64

Wellman N. and Barbora J.K (2008). Nutrition in aging krause‟s Food and Nutrition Therapy 286-308 12 edition Saunders publisher

WHO (2002). Programming of chronic disease by impaired fetal nutrition: evidence and implications for policy and intervention strategies. Geneva, World Health Organization, 2002 (documents WHO/NHD/02.3 and WHO/NPH/02.1).

WHO (2011).Non-communicable Diseases, Country Profiles 2011. World Health Organization, Geneva, Switzerland

WHO (2013).Global strategy on diet, physical activity and health. WHO Fact Sheet. World Health Organization, Geneva, Switzerland. Available at: http://www.int/dietphysicalactivity/

WHO (2016). Obesity and Overweight. WHO Fact Sheet. World Health Organisation, Geneva, Switzerland. Available at: http://www.who.int/mediacentre/factsheets/fs311/en/

Winarno FG, Allain A. (2014). Street foods in developing countries: lessons from Asia. [http://www.fao.org/docrep/u3550t/u3550t08.htm assessed at 12.10 p.m; December, 15 2014]

World Health Organization. Global health risks: mortality and burden of disease attributable to selected major risks. Geneva: World Health Organization; 2009. p. 62 p.

World Health Organization. Obesity and overweight [webpage on the Internet] Geneva, Switzerland: World Health Organization; 2010. [Accessed September 17, 2016]. [updated Mar 2014]. Available from: http://www.who.int/mediacentre/factsheets/fs311/en/print.html

Yahaya, M.K. (2003). Indigenous Music for Entertainment Education: Lessons from AIDS Bata na ewu eza na in Bida Emirate, Nigeria. Ibadan: Stirling Horden Publishers, p58.

APPENDIX I

CONSENT TO PARTICIPATE IN RESEARCH
NUTRITIONAL STATUS, DIETARY PATTERN AND PREVALENCE OF CHRONIC DISEASES IN BIDA LOCAL GOVERNMENT AREA NIGER STATE

INTRODUCTION

You are kindly being asked to participate in a research study conducted by Mohammed Maryam Maude for Master of Science degree under the supervision of Prof. S Ibrahim from the Department of Biochemistry, Faculty of Sciences, Ahmadu Bello University, Zaria.

If you have any questions or concerns about the research, please feel free to contact: Mohammed Maryam Maude, Faculty of sciences, Ahmadu Bello Zaria University, Tel: 07098375355; Prof. S Ibrahim, Department of Biochemistry, Faculty of sciences, Ahmadu Bello University, Tel: 08037037821.

PURPOSE OF THE STUDY

The purpose of this project is to study the "Nutritional Status, Dietary Pattern and prevalence of Chronic Disease in Bida Local Government Area of Niger State". This study is in partial requirement for the award of M.Sc degree in Nutrition, Department of Biochemistry, Ahmadu Bello University, Zaria.

WHY ARE YOU BEEN ASKED TO PARTICIPATE?

Information pertaining demographics (i.e. age, sex, etc.), and 24 hour dietary intake will be collected using a questionnaire. Anthropometric measures will also be taken and sample of blood will be collected.

POTENTIAL RISKS AND DISCOMFORT

This study does not pose any form of physical, emotional or psychological risk to you.

POTENTIAL BENEFITS TO PARTICIPANTS

The result of this study help in assessing your nutritional status and factors that affect it. It can also help you make healthy choices pertaining to diet and health. This research work can also be used in planning, evaluation and advocacy in Niger State and can lead to the implementation of interventions to improve health and survival.

WILL THERE BE ANY COST FOR PARTICIPATING

Aside from time, there are no costs in taking part in the study.

RENUMERATION FOR PARTICIPATION

Participation will not attract any financial benefit.

CONFIDENTIALITY

Every effort will be made to ensure confidentiality of any identifying information provided by participants' in. you will not be identified in any reports or publications resulting from the study.

PARTICIPATION AND WITHDRAWAL

You can choose whether to be in this study or not. If you volunteer to be in this study, you may withdraw at any time without consequences of any kind. You may excise the option of removing your data from the study. You may also refuse to answer any questions you don't want to answer and still remain in the study. The investigator may withdraw you from this research if circumstances arise that warrants doing so.

Right of research participants

You may withdraw your consent at any time and discontinue participation without penalty. You are not waiving any legal claims, right or remedies because of your participation in this research study. This study has been reviewed and received ethics clearance through Ahmadu Bello University Research Ethics Board .if any questions regarding your right as a research participant, you can obtain further information about the research or voice your concerns to:

Prof. S. Ibrahim,

Department of Biochemistry,

Faculty of Sciences,

Ahmadu Bello University.

Tel: 08037037821

NUTRITIONAL STATUS, DIETARY PATTERN AND PREVALENCE OF CHRONIC DISEASES IN BIDA LOCAL GOVERNMENT AREA OF NIGER STATE

Name: Mohammed Maryam Maude

Position: M.Sc Student

Contact address: Department of Biochemistry, Faculty of Life Sciences, Ahmadu Bello University, Zaria

1. I confirm that I have read and understand the information sheet for the above study have had the opportunity to ask questions. [ ]
2. I understand that my participant is voluntary and that I am free to withdraw at any time, without giving reason. [ ]
3. I agree to take part in the above study. [ ]

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Name of Participant	Date	Signature
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Name of Researcher	Date	Signature

NUTRITIONAL STATUS, DIETARY PATTERN AND PREVALENCE OF CHRONIC DISEASES IN BIDA LOCAL GOVERNMENT AREA OF NIGER STATE SURVEY QUESTIONNAIRE

Section 1: Background of Information

Date:……	questionnaire
No:……..	
Ward…….	Name of

1. Sex…….
2. Ethnicity…….
3. Place of birth…….
4. Martial status…….
5. Religion……
6. Level of education……..
7. Occupation……
8. Physical activities……..
9. Do you have any medical history of…….
10. Do you have any medical history of Chronic diseases, if yes specify……

Section 3: Anthropometric measurements

1. Weight_____(Kg)
2. Hight_____(cm)
3. Waist circumference_____(cm)

Section4: Lipid Profile

1. Cholesterol_____(mg/d1)
2. Triglycerides_____(mg/d1)
3. HDL Cholesterol_____(mg/d1)
4. LDL Cholesterol_____(mg/d1)
5. Cholesterol/HDL Ratio_____

Section 5: Blood level

1. Are you hypertensive yes [ ] No [ ]

2. Systolic_____(mmHg)
3. Diastolic_____(mmHg)
4. Heart rate_____(bpm)
5. Glucose level_____

Section 6: Physical Activities

1. Physical activities at work Yes [ ] No [ ]
2. Physical inactivity at work Yes [ ] No [ ]
3. Sedentary traveling Yes [ ] No [ ]
4. Sedentary leisure time Yes [ ] No [ ]

Section7: 24hr Dietray Recall

Food eaten	Time taken	Amount

Section 8: food frequency questionnaire

Please kindly fill in the questionnaire below as accurately as possible

How often do you eat the following? (check inside the box)

	1 or less Time/week	1-3times per week	4-6times per week	7 or more time/weel
1. Milk, yogurt, diary products	[ ]	[ ]	[ ]	[ ]
2. Meat fish, poultry	[ ]	[ ]	[ ]	[ ]
3. Egg	[ ]	[ ]	[ ]	[ ]
4. Dry beans, peas, soyabeans, akara (kosai_, moimoi, groundnut, kulikuli	[ ]	[ ]	[ ]	[ ]
5. Citrus fruits (oranges), grapefruits), tomatoes etc.	[ ]	[ ]	[ ]	[ ]
6. Carrots, sweet potatoes, ugu, spinach, green leafy vegetable	[ ]	[ ]	[ ]	[ ]
7. Bread, cereals (guinea corn, maize, weat, semovita, etc).pasta (macaroni) spaghetti, noodles, etc, rice……	[ ]	[ ]	[ ]	[ ]

8. Cakes, doughnuts, pies, sweets burns, puff-puff

[ ] [ ] [ ] [ ]

9. Soft drinks (coke, fanta, malt, etc.

[ ] [ ] [ ] [ ]

10. Alcohol (burukutu, pito, gulder)

[ ] [ ] [ ] [ ]

11. Coffee, tea…… [ ] [ ] [ ] [ ]

12. Vitamin supplements…… [ ] [ ] [ ] [ ]

13. Smoking……yes [ ] No [ ]

Thank you for your time and response