DIETARY PATTERNS AND THE RISK OF HYPERTENSION AMONG ADULTS IN EHIME MBANO LOCAL GOVERNMENT AREA. IMO STATE

BY

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REG. NO: 20174079378

A PROJECT SUBMITTED TO POSTGRADUATE SCHOOL,
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IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
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CERTIFICATION

This is to certify that this work "**DIETARY PATTERNS AND THE RISK OF HYPERTENSION AMONG ADULTS IN EHIME MBANO L.G.A. IMO STATE**", was carried out by **DURU, LOVEDAY ONYEWUCHI** (Reg. No: **20174079378**) in partial fulfilment for the award of the Degree of (MPH in Epidemiology and Biostatistics) in the department of public health, Federal University of Technology, Owerri.

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DEDICATION

This work is dedicated to God Almighty for his mercies and kindness towards me. Also to my late beloved Mother Ezinne Roseline Omuruzuo Duru whose death occurred before I could conclude the programme.

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ABSTRACT

The present study was aimed at assessing the dietary pattern and the risk of hypertension among adults in Ehime Mbano LGA, Imo State. Nigeria. It was designed as a descriptive community based cross sectional study for a rural setting in Nigeria. The study population involved adults of age 18 years to 65years who were residents of the study LGA. Multi-stage sampling technique was used to sample the study population. The participants were measured of their hypertension status and were also assessed of their food dietary patterns using a modified food frequency questionnaire that captured foods consumed in the area and the quantities consumed. Initial data analysis was performed using descriptive technique. Principal component analysis method was used to identify the dietary pattern in the area and Chi-square test was used to test for association in the independent categorical data with hypertension. Logistic regression was used to relate the dietary patterns and hypertension, while adjusting for other variables of age, gender, income, and family history of hypertension. There were a total of 424 subjects involved in the study, total of 156 (36.8%) were within 36-45 years old, 128 (30.2%) were of 46 – 55 years of age, 81 (19.1%) were between 18-35 year and the remaining 59 (13.9%) were above 55 years of age. The male subjects were 246 (58%) while the females were 178 (42%). The prevalence of hypertension was found to be 41.5%. In this study Age, gender and education showed significant association with hypertension among the study group, age ($p = 0.018$, $\chi 2 = 10.06$), gender ($p = 0.030$, $\chi 2 = 4.73$), and education ($p = 0.033$, $\chi 2 = 8.717$). After adjusting the socio-demographics factors (alcohol intake, smoking status, Family history of hypertension) for hypertension and dietary patterns, local diet pattern is the only significant pattern found in this study ($p = 0.035$,, 95% CI = 0.108 – 0.922). About 63.5% of the study participant with family history of hypertension had 4-fold risk of hypertension when compared to those with non-family history of hypertension (OR=4.146, 95% CI = 2.483 - 6.924). In this study, three dietary patterns comprised of local diet foods, Fruits and vegetable diets and combined food diets were extracted. study participants comprising of Local diet foods, ($p<0.001$), fruits and vegetable patterns ($p< 0.002$) showed significant association with hypertension as independent variables, while only the local food diets showed significant inverse relationship with hypertension after adjustment ($p=0.35$, AOR=0.316). There is need to adequately study the local diet foods consumed in the study area while at the same time, other factor of age, income, family history associating with hypertension should be addressed. There is need to encourage the consumption of some of the local foods from rural communities, this will help to improve the quality of life of people with respect to their dietary patterns.

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LIST OF ABBREVIATIONS

BP – Blood Pressure

CVD – Cardiovascular disease

DASH – Dietary approaches to stop hypertension

DBP – Diastolic blood pressure

ESH – European Society of Hypertension

HDL – High density lipoproteins

HIP – Hypertension Improvement Project

JNC – Joint National Committee

LDL – Low density lipoproteins

MD – Mediterranean diet

NRV – Nutrient reference values

PCA – Principal component analysis

SBP – Systolic blood pressure

WHO – World Health Organization

OPERATIONAL DEFINITION OF TERMS

DIETARY PATTERNS: Is the quantities, proportions, variety, or combination of different foods, drinks, and nutrients in diets, and the frequency with which they are habitually consumed.

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.

RISK FOR HYPERTENSION: Of primary hypertension include family history, advancing age, obesity, high sodium diet, alcohol consumption and physical inactivity.

FOOD FREQUENCEY QUESTIONNAIRE (FFQ): Is a questionnaire used to obtain frequency and in some cases, portion, size information about food and beverage consumption over a specified period of time typically the past one month or year.

CHAPTER ONE

INTRODUCTION

1.1 Background Information

Hypertension is the leading cause of morbidity and mortality worldwide (WHO, 2000). It is a disease with global public health concern due to its high prevalence and risk for cardiovascular disease mortality both in developed and developing countries (Sarki, Nduka, Stranges, Kandala &, Uthman, 2015). Up to 26% of the world's adult population are affected with hypertension and this figure is projected to rise to 29% by 2025 (WHO, 2011). Hypertension is a major risk factor of heart disease and stroke, as well as the first and third leading causes of death around the globe with enormous public health problem (GBD, 2015). Similarly in the 2017 Global Burden Disease (GDB) report, Hypertension- associated diseases such as ischaemic heart disease and cerebrovascular disease were also rated the two most leading causes of DALYs and years of life lost (YLLs) around the globe. (GBD, 2017)

Considering the dangers of hypertension disease, the World Health Organization and the International Society of Hypertension (WHO/ISH) have recommended for a comprehensive and holistic approach in dealing with hypertension in order to ideally achieve meaningful prevention and control in cardiovascular diseases (Chobanian *et al*, 2003; WHO & ISH, 2003). The problem with hypertension is that it is mostly asymptomatic in nature, so that many people with the disease could be unaware of their condition until a certain stage of the disease development.

The rates of occurrence of hypertension among adult populations differ geographically across the globe as it may have been affected by environmental factors. Hypertension is a major public health problem in most African and other developing nations (Gu, Dillon, Burt, and Gillum, 2010). It has

been reported that 13.5% of deaths and 6% of disability adjusted life years (DALYs) were attributed to hypertension globally, and for low- and middle income people, these figures were 12.9 and 5.6%, respectively over the period 1990 to 2001 (Lim *et al.,* 2012). Earlier study has estimated that by 2025, approximately 1.17 billion people in developing countries, comprising of three-fourths of the worlds' hypertensive population will develop the disease (Kearney, *et al.,* 2005).

In Nigeria, hypertension is a serious major public health and clinical problem that causes disability and death among the adult population as well as playing an important role in the causation of heart failure, heart attack, stroke, renal failure, and arterio-sclerosis in the population (Ayodele, alebiosu, Salako, Awoden, Adigun, 2005; Arodiwe, Ike , Nweokediuto, 2009). The prevalence of the disease has be estimated to be and 27.5% (the JNC7 2003 guidelines respectively) as at 2003, and was also found as 55.0% (based on the ACC/AHA 2017 guideline) with high burdens in 2019 and (Okubadejo *et al.,* 2019).

Recent CDC survey on morbidity and Mortality has shown that Hypertension rates in rural areas are more than 10% higher than in most urban areas, Samanic, *et al.,* 2017. Other studies have shown that while the risk factors of hypertension is common in both rural and urban areas, hypertension rate in the rural areas is constantly on the increase and could be very devastating if not checked (Kuehn, 2020; Wang, *et al.* 2018; Shukuri, Tewelde & Shaweno, 2019).

Among other lifestyle measures such as weight reduction and physical exercise, taking health diets as the Dietary Approaches to Stop Hypertension (DASH) is one of the recommended ways of tackling hypertension (James *et al.,* 2014). It has been reported that foods rich in salt (sodium chloride) tends to increase BP while foods rich in potassium tends to reduce BP (Chobanian *et al.,*

2003). Hence dietary patterns made up of food intake with higher salt consumption are likely to increase the rate of BP among adults. On the other hand, it has been demonstrated that dietary patterns that comprised with greater intake of fruit, vegetables, whole grains, legumes, seeds, nuts, fish, and dairy and reduced intake of meat, sweets, and alcohol could lead to significant drops in blood pressure among adults (Ndanuko, Tapsell, Charlton, Neale, & Batterham, .2016). A chinese study found that a combination of "fruit and milk" has lowering effect on BP among adult Chinese men (Lee *et al.,* 2010).

Diet based on food combinations have earlier been reported to have shown varying associating risk to hypertension (Margerison, Riddell, McNaughton, & Nowson, 2020; Ndanuko, Tapsell, Charlton, Neale & Batterham, 2016). Most notable adult dietary patterns based on individual food combinations around the world are the vegetarian diet, Mediterranean diet, and the Dietary Approaches to stop Hypertension (Dash) recommended diet. The three food patterns have been associated with lowering blood pressure in adults with most food contents in each having some combinations of foods related to fruits, vegetables, poultry and others. A meta-analysis study on healthy diet pattern indicated that a health pattern comprised of food combinations high with vegetables, fruits, whole grains, olive oil, fish, soy, poultry and low fat dairy have likelihood for significant reduction in high blood pressure (Wang *et al., 2016*).

Although the mineral contents of the food items are usually of help in classifying their dietary patterns, most time food combinations in the rural areas are either under estimated or not accounted for, making it quite difficult to come up with the actual dietary pattern in such areas, and consequently may lead to complexities in associating the patterns with hypertension. Therefor the following research questions were thus formulated to guild the study,

- What is the prevalence of hypertension among adults in Ehime Mbano L.G.A?.
- What is the dietary pattern associated with hypertension among adults in Ehime Mbano L.G.A?
- Is there any relationship between Socio-economic status and risk hypertension among adults in Ehime Mbano L.G.A.

1.2 Problem Statement

Most of the studies between diet and hypertension laid emphasis on separate foods and nutrients while less attention were directed towards the dietary pattern consisting of the combination of the food items. Hypertension has been linked to patterns of diet (Margerison, *et al.,* 2020; Ndanuko, *et al.,* Sabate & Wien, 2015). It has also been reported that intake of certain dietary patterns could lead to more positive correlation with blood pressure than another (Margerison, *et al.,* 2020). Vegetarian dietary pattern which comprises foods rich in vegetables, fruits, grains, poultry, legumes, nuts, vegetable oils, soya, and possibly dairy products and/or eggs has shown association for lower risk of developing hypertension (Sabate & Wien, 2015). Considering the fact that foods are mostly consumed in combinations at most times in adult stage, differences exist in patterns of diet consumed at adult stage, in different environments. It therefore remains unclear on actual dietary patterns free from hypertension, especially in most rural places where the actual dietary combinations of food consumed by adults are yet to be ideally articulated. This leaves behind, some unexplored gaps existing on the actual relationship between hypertension and adult dietary patterns in rural most communities.

In Nigeria, a limited number of studies have investigated the relationship between hypertension and diet patterns especially in a rural setting. Many adults in Ehime Mbano LGA (a rural LGA in Nigeria) have hypertension and just like some others residing in rural Local Governments in Nigeria, they have taken the disease as a common aging disease due to economic hardship in the country, while less attention has been given to the common dietary patterns of foods consumed frequently in the area. The implications is that while the disease continues to rise in the area, only little effects are being made to prevent the disease in terms of food combinations consumed in the area. Hence, it is on these grounds that this study, was deemed necessary to determine the dietary patterns in the area and relationship between dietary patterns and hypertension among adults in Ehime Mbano L.G.A.

1.3. Objectives of the Study

1.3.1. General Objectives

The overall objective of this study is to determine the relationship between dietary patterns (a broader frame of nutrients and food consume) and risk of hypertension Among Adults in Ehime Mbano L.G.A.

1.4. Specific Objective.

- To establish the prevalence of hypertension among adults in Ehime Mbano L.G.A.
- To identify the dietary patterns associated with hypertension among adults in Ehime Mbano L.G.A

- To determine the relationship between Socio-economic status and risk hypertension among adults in Ehime Mbano L.G.A.

1.5. Research Hypothesis

- There is no prevalence of hypertension among adults in Ehime Mbano LGA.
- There is no significant Relationship between body mass index and risk of hypertension among adults in Ehime Mbano L.G.A?.
- Is there no significant relationship between Socio-economic status and risk of
- hypertension among adults in Ehime Mbano L.G.A.

1.6 Significance of the Study

- This study will help establish the actual health diet for a setting in Nigeria and other countries of similar environmental pattern so as to reduce hypertension.
- Institutional dwelling in lifestyle activities and nutrition are expected to benefit from the findings of this study in improving the health statues of the adults.
- It will also form a basis for further research by interested researchers who may wish to further explore the contents in the study.

1.7. Scope of Study

The research is delimited to adults in Ehime Mbano L.G.A. of Imo State. The study involved adult residence in the LGA (18 –65 years), residing in the area for at least 1 year before the

commencement of the study. It concentrated on dietary pattern and the risk of hypertension among adults in the study area.

CHAPTER TWO

LITERATURE REVIEW

This chapter deals with review of literatures on dietary pattern and risk of hypertension Among Adults in Ehime Mbano L.G.A.

2.1. Conceptual Framework

2.1.1 Hypertension

The World Health Organizations (WHO) defined hypertension (otherwise known as High Blood Pressure) as a non-communicable health disorder characterized by persistent rise in blood systolic pressure and /or of diastolic of above normal range in persons 15 years and above (World Health Organization, 2013). The definition considered the rise in blood pressure at a level above normal for that age and that sex. However, the expert panel on the classifications of hypertension (HTN), defined the disease as systolic blood pressure (SBP) ≥140 mmHg and/or diastolic blood pressure (DBP) ≥90 mmHg, or taking anti-hypertensive medicine (Chobanian *et al.,* 2003).

Hypertension or high blood pressure is a chronic medical condition in which the blood pressure in the arteries is elevated, requiring the heart to work harder than normal to circulate blood through the blood vessels (Kumar & Clark, 2009; Akpa, Emem-Chioma & Odia, 2013). It has been described as the "silent killer" because the disease could be quite asymptomatic at the initial stage with no apparent symptoms, so that the individuals involved may not realize that they have hypertensionb at that early stage (Bani, 2011). The danger about hypertension is that is usually an associating factor of other chronic diseases. For instance, hypertension has been reported as a single risk factor for heart disease and stroke and as well as a predicting factor in premature death and disability from cardiovascular complications (Chobanian *et al.,* 2003). High sodium intake and

insufficient potassium intake contribute to high blood pressure, which in turn increases the risk of heart disease and stroke (WHO, 2011).

Hypertension is the most important preventable risk factor for cardiovascular disease in Nigeria. It is estimated that 325 million Chinese adults, 29.6% of the Chinese adult population had HTN in 2010. However, this number does not include the prehypertension (Prehypertension, representing a SBP of 120—139 mmHg and/or a DBP of 80—89 mmHg) which is also identified as being independently associated with increased risk of HTN and CVD (Zhang *et al.,* 2019).

Nigeria, currently with a population of over 160 million, is the most populous African country and the prevalence of hypertension in the country hugely contributes to the overall burden in Africa, in 2008 the WHO estimated Hypertension prevalence of 42.8 % in Nigeria (WHO, 2008).

The link between hypertension and diet has been well documented (Margerison, *et al.,* 2020; Ndanuko, *et al.,* Sabate & Wien, 2015). It has been reported that unhealthy diet and lifestyle could play a significant role in the development and progression of hypertension and its related complications (Eaton & Eaton, 2003).

2.1.2. Diet

Keown and Damien (2004) defined diet as the sum of food consumed by a person or other organism. The word diet often implies the use of specific intake of nutrition for health or weight management reasons (with the two often being related). Although humans are omnivores, each culture and each person holds some food preferences or some food taboos. This may be due to personal tastes or ethical reasons. Individual dietary choices may be more or less healthy.

Complete nutrition requires ingestion and absorption of vitamins, minerals, and essential amino acids from protein and essential fatty acids from fat-containing food, also food energy in the form of carbohydrate, protein, and fat. Dietary habits and choices play a significant role in the quality of life, health and longevity.

2.1.3. Dietary Pattern

According to Matthias, Martínez-González, Teresa, Lichtenstein and Forouhi, (2018) dietary patterns can be defined as the quantities, proportions, variety, or combination of different foods and drinks in diets, and the frequency with which they are habitually consumed. Dietary pattern analysis is a method of dietary analysis that considers the cumulative and interactive effects among dietary components to reflect the complexity of the human diet. It is a modern, comprehensive, and "holistic" approach that can overcome several methodological limitations in studying the association between human diet and health Dietary patterns (Claudia, Pounis and Vittorio, 2019).

In Panagiotakos (2008) dietary patterns were regarded as a set of habits regarding consumption of foods and beverages. They are often influenced by environmental or cultural particularities, and by religion. Examples of dietary patterns include the Mediterranean, Asian, Western diets, and the Vegetarian Dietary Pattern. The majority of these dietary patterns suggest portion sizes for different food items, as well as giving information on the number of servings from each food group to be consumed on a daily, weekly or monthly basis. In the past, many epidemiological studies assessing the role that diet plays in health have focused upon single nutrients or food items. However, people do not eat isolated nutrients; instead they consume meals consisting of a variety of foods, with complex combinations of micro- and macronutrients. Dietary pattern analysis in relation to diseases has recently received growing attention because individuals do not consume foods or

nutrients in isolation, but rather as components of their daily diet (Panagiotakos, 2008; Bernice, Chaung, Chaung, Ho, Chan & Sea, 2014).

Dietary pattern analysis has been used to fill in the gap between diet as a whole and health outcomes. Two approaches have been used to define dietary pattern, a priori approach defines dietary patterns based on existing knowledge about the relationships between foods, nutrients, and diseases (Panagiotakos, 2008). Several dietary scores or indexes are used to measure the degree in which an individual's diet conforms to specific dietary recommendations, for example, healthy eating index (HEI), Mediterranean Diet (MeDi) score and Dietary Approaches to stop Hypertension (DASH).

Since this approach quantitatively measures the quality of dietary habits against several dietary patterns that have been established as "healthy" or beneficial for disease prevention, it is selflimited to the existing and current knowledge between diet and health (Panagiotakos, 2008).

2.1.4 Classes of Dietary Patterns

Vegetarian diet, Mediterranean diet, and Dash diet are three food patterns have been associated with lowering BP.

- **Vegetarian Diet**

A Vegetarian diet is a diet made up of high consumption of fruits, vegetables, legumes, and nuts, it's content include potassium, magnesium, and fiber. But with reduced amount of fats. They can be supplemented with eggs and dairy products. In a large cross-sectional study performed by the seventh-day Adventists Church Califonia USA, a total of 34192 church members were studied, it was discovered that rise in blood pressure recorded a rise of almost 100% among the subjects who

consumed the usual American diet (comprising of animal based products, and others) than in the Adventists members who were vegetarians (Melby, 1993). Another study (Berkow & Barnard, 2005) has indicated a reduction in SBP of up to 3 - 14 mmHg and DBP by 5 - 6 mmHg among the vegetarians than in the non-vegetarians.

On the other hand, it is not very certain whether vegetarian diet alone is not enough to effect significant reduction in blood pressure, as they usually require other lifestyle adjustments, such adjustment s leading to reduction in body weight and salt intake, and abstention from alcohol consumption and tobacco smoking. Therefore, despite the fact that a vegetarian diet could be a specific recommendations in BP prevention/treatment other lifestyle adjustments need to be considered in order to achieve better results.

- **Mediterranean Diet**

Mediterranean diet comprised of food combinations that are possibly found around the Mediterranean areas. It is made up of foods that are rich in plant food, legumes, fiber, and antioxidant vitamins. This diet includes 2 - 3 servings for vegetables in a day, intake of unrefined cereals and cereal products, 4–6 servings for fruits, 1 or 2 for dairy products, 1–2 wine glasses for olive oil, and red or white wine; fish consumption at 4– 5 servings per week, 4–5 servings for potatoes, more than 4 servings for pulses, olives, and nuts and 1–3 servings for sweets and eggs monthly. It has been shown in a large cohort study of 28,082 women who were followed up for over 12 years that a higher fruit and vegetable intake (more than 8 serves of fruit and vegetables per day) is significantly associated with reduced risk of hypertension (Wang *et al.,* 2012).

The Mediterranean diet (comprising of the use of olive oil at 40 g daily for adult males and 30 g daily for adult females) showed significant BP control effects on high blood pressure leading to improved health and longevity in a study of 23 hypertensive patients (Rasmussen, *et al.,* 1993).

Mediterranean diet, has also been explored in a seven countries study and it was generally considered as a healthy diet associating with decreased cardiovascular and other related morbidity and mortality (International Consensus, 2000).

- **Dietary Approaches to stop Hypertension (DASH)-Style Dietary Patterns**

DASH diet is comprised of fruits, vegetables, and reduced amount of saturated fat and dairy foods. It also include more whole grains, poultry, fish, and nuts, and lower amounts of fats, red meat, sweets, and sugar-containing beverages. DASH diet is well loaded in potassium, magnesium, calcium, and fiber in comparison to the Western diet.

DASH dietary pattern was developed as part of a study to test the effects of modifying the whole diet on Blood pressure (Carson *et al.,* 2016). This dietary pattern is broadly effective in lowering Blood pressure and is particularly effective on hypertensive persons. In a trial, the DASH-Sodium trial, combined the DASH dietary pattern with 3 levels of sodium: low (1500 mg/d), intermediate (2400 mg/d), and high (3300 mg/d). The greatest reductions in BP occurred when the DASH diet was coupled with sodium reduction. Again, blacks and individuals with hypertension achieved the greatest BP reductions, but BP reductions also occurred in individuals without hypertension. Thus, there is substantial clinical and public health relevance for advocating a DASH-style diet with reduced sodium intake (Rumawas, *et al.,* 2009)

In Schulze, *et al.,* (2018) research, a contradiction to DASH dietary pattern was reported in relation to Mediterranean diet characterized by rich fruits and vegetables, whole grains and fatty fish. It however comprised of total dietary fat (range: 32% to ≥35% of total energy intake with 9% to 10% of energy) from Saturated Fatty Acids and relatively high amounts of monounsaturated and polyunsaturated fatty acids, with an emphasis on omega-3 fatty acids.

The 2015 US Dietary Guidelines Advisory Committee defined a healthy dietary pattern as being high in vegetables, fruit, whole grains, seafood and fatty fish, legumes, and nuts; moderate in reduced fat and nonfat dairy products; lower in red and processed meat; and low in refined grains and foods and beverages containing added sugars. (Eckel *et al.,* **2013**). The typical

Fruits, vegetables, and whole grains contribute to a dietary fiber intake of 27 to 37 g/d, double the current US dietary fiber intake. Compared with the DASH and USDA patterns, the Mediterranean dietary pattern is lower in dairy and red and processed meats, higher in olive oil and seafood, and moderate with regard to intake of wine. Several different scoring systems have been reported in an effort to quantify the extent of adherence to the Mediterranean dietary pattern. Cross-cultural variability in the application of the Mediterranean diet limits the development of precise associations or conclusive findings on the specific benefits in risk factor reduction, including effects on serum lipids (Farmer, Larson, Fulgoni, Rainville, and Liepa, 2004; IN Martínez González, Teresa, Lichtenstein and Forouhi, 2018).

The Vegetarian Dietary Pattern according to Guo *et al.,* (2016) is defined as dietary pattern comprises predominantly plant-based foods without (vegan) and with dairy products, eggs (lactoovo vegetarian), or fish (pesco-vegetarian). These patterns include predominantly vegetables, fruits, whole grains, legumes, seeds, and nuts. Other common adaptations of vegetarian diets

include poultry, “white meat,” or dairy products and eggs but not poultry or red meat. Such variability complicates the assessment of true risk factor associations. Randomized controlled trials and observational studies of vegetarians have consistently demonstrated beneficial effects on LDL-C, systolic and diastolic BPs, and body weight. Some trials have reported lowering of high-density lipoprotein cholesterol concentrations and the ratio of total cholesterol to high-density lipoprotein.40 Vegetarian dietary patterns are characterized as predominantly including fruits, vegetables, whole grains, and nuts, similar to the DASH diet. Whether vegetarian diets, with or without dairy products, achieve benefits similar to those of the DASH diet is unknown. Likewise, whether there are cardio-protective effect differences between vegan and lacto-ovo vegetarian diets is unknown (Nutrition Evidence Library, 2015).

Vegetarian diets are generally less prescriptive than the DASH diet, but compared with non-vegetarian diets, cardiovascular outcomes are typically favourable. Care must be taken to ensure that individuals who wish to follow a vegetarian diet are including the recommended nutrient dense foods rather than simply avoiding meat and resorting to sugar-added or SFA-laden foods (Anderson, 2015).

2.1.5 American Heart Association/American College of Cardiology (AHA/ACC) Heart Healthy Eating Pattern and Physically Active.

This dietary pattern achieves the recommended 5% to 6% of calories from SFAs and <2400 mg/d sodium (<2300 mg/d to align with the 2015 DGA) at all calorie levels as recommended in the AHA/ACC guideline. In addition, it meets the added sugars recommendations (that are based on total calories), given that women typically require fewer calories than men. It can also be safely

applied to children's diets on the basis of their calorie requirements. The following list offers expanded information and examples of the AHAs recommended dietary pattern see in Table 1.

- Vegetables: Beneficial sources of potassium, magnesium, and fiber. Examples include broccoli, carrots, collards, green beans, green peas, kale, lima beans, sweet potatoes, spinach, squash, tomatoes, and peppers.

- Fruits: Beneficial sources of potassium, magnesium, and fiber. Examples are apricots, bananas, dates, grapes, oranges, orange juice, grapefruit, grapefruit juice, mangoes, melons, papaya, peaches, pears, pineapples, raisins, raspberries, strawberries, and tangerines.

3) Grains: Major sources of energy and fiber that provide satiety. Whole grains are recommended for most grain servings as a good source of fiber and nutrients. Examples are whole-wheat bread and rolls; whole-wheat pasta; cereals such as grits, oatmeal, and brown rice; and popcorn. Portion sizes vary and should be monitored.

4) Fat-free or low-fat milk and dairy products and non-dairy products: Major sources of calcium, potassium, protein, and vitamin D in fortified products. Examples include fat-free or low-fat milk or buttermilk, low-fat or reduced-fat cheese, and fat-free or low-fat regular or frozen yogurt. Non-dairy nut/ grain/soy-based milks that are fortified with calcium and vitamin D and low in sugar are acceptable alternatives. Caution is needed in considering added sugars in yogurts and flavoured milks.

5) Lean and extra-lean meats, poultry, and fish: Beneficial sources of protein and magnesium.

6) Nuts, seeds, and legumes: Beneficial sources of energy, magnesium, protein, and fiber. Examples are almonds, hazelnuts, mixed nuts, peanuts, walnuts, pistachios, sunflower seeds, pumpkin seeds, peanut butter, kidney beans, lentils, and split peas. However, individuals should be mindful of calories, choose smaller portion sizes, and select salt-free products.

7) Fats and oils: The AHA/ACC diet recommends avoiding trans fats and limiting SFAs to <6% of total calories. Polyunsaturated and monounsaturated fatty acids should be substituted for SFAs and trans-fat. An upper limit on total fat was not set, but total energy intake should support weight-control efforts.

8) The DASH diet has smaller serving sizes for higher-fat foods from the fats and oils group. For instance,1 tablespoon of regular salad dressing is 1 serving, and 2 tablespoons of lowfat dressing is 1 serving, Examples include soft margarine, vegetable oil (canola, corn, olive, soybean, safflower), low-fat mayonnaise, and light salad dressing. Caution is needed to avoid sources with added salt or sugar.

9) Sweets and added sugars: Should be limited. The recommendation for added sugars is no more than100 kcal/d for women or 150 kcal/d for men and <100 kcal for children on the basis of total energy needs.

10) Sodium: The AHAs recommended eating pattern limits sodium intake to ≤2300 mg/d (1500 mg/d) as patient needs dictate. The "salty six," foods providing the most sodium in the US diet, include bread and rolls, cured meats, pizza, poultry, soup, and sandwiches, which contribute excess sodium to the diets of most Americans. In general, >75% of

sodium intake is derived from processed and restaurant foods (Centers for Disease Control and Prevention (CDC, 2012)).

Table 2.1: American Heart Association (AHA) Eating Pattern Recommendations

Food/Factor	Examples	Portion per Serving
Fruits, unsweetened preferred	Whole fresh fruits, unsweetened frozen fruits, canned (or in its own juice) fruit, dried fruit	1 cup equivalent is 1 cup fruit or ½ cup of fruit juice (orange juice, etc) or ⅓ cup of a fruit juice blend
Vegetables (cups/wk)*	Whole fresh vegetables, canned or frozen without added sauces	1 cup equivalent is 1 cup raw vegetable or vegetable juice, 2 cups leafy salad greens
Dark green vegetables	Spinach, kale, broccoli, collard, or mustard greens	Same as above
Red/orange vegetables	Red/orange peppers, tomatoes, carrots, radish, beets	Same as above
Beans and peas	Kidney, black, garbanzo, lima, navy, pinto, white (cooked or canned, drained and rinsed), peas (green or black-eyed), lentils	½ cup
Starchy vegetables	Corn, white potatoes, sweet potatoes, plantains, yucca, butternut squash	½ cup/wk
Other vegetables	Leafy greens, lettuces, cucumber, mushrooms, green beans, okra, cabbage	1 cup eq/wk

Grains: whole grains, grains high in-dietary fiber preferred (oz eq/wk)	Whole-wheat flour, whole oats, barley, brown rice,	
	whole rye, popcorn, wild rice, bulgur, quinoa, millet,	
	sorghum, buckwheat	
Whole grains	Breads, tortillas made from the above, cooked cereals, sides of brown rice, barley	½ cup cooked rice, pasta, or cooked cereal; 1 oz dry pasta or rice; 1 slice bread;
Other grains	Breads and cereals made with enriched flour	1 cup ready-to-eat
		Other grains Breads and cereals made with enriched flour cereal flakes
Protein Foods		
Meat, poultry, eggs (oz eq/wk)	Lean beef, pork, lamb. goat, skinless poultry, eggs	1 oz equivalent is 1 oz lean meat, poultry, or
Fish, preferably oily fish (oz eq/wk)	Salmon, mackerel, herring, lake trout, sardines,	seafood; 2 egg whites or 1 egg; ¼ cup cooked
	albacore tuna, other fish and seafood	beans; 1 Tbsp peanut butter;
		½ oz unsalted nuts/ seeds
	(not breaded and fried)	Note that ¼ cup cooked beans=1 oz protein
Fish, preferably oily fish (oz eq/wk)	Salmon, mackerel, herring, lake trout, sardines,	equivalent but ½ cup cooked beans=1 vegetable serving
Nuts seeds, legumes (oz eq/wk)	Almonds, walnuts, pistachios, hazelnuts, peanuts,	
	sunflower seeds, pumpkin seeds	

Table 2.2: American Heart Association (AHA) Eating Pattern Recommendations CONTD

Food/factor	Examples	Portion per Serving
Dairy, fat free or low fat	Fat-free or low-fat milk, lowfat cheese, fat-free or low-fat yogurt	1 cup equivalent is 1 cup milk or yogurt, 1½ oz natural cheese such as cheddar cheese, or 2 oz processed cheese
Oils, unsaturated sources	Soybean, corn, olive, canola, safflower, other vegetable oils except tropical oils	Up to 2 Tbsp/d polyunsaturated oil
Other nutrients/factors to be addressed		
Fiber	Whole grains (see above), fruits, vegetables, legumes, nuts, and seeds	To achieve 28—30 g/d
Saturated fat	Choose soft margarines; avoid butter, cream, beef tallow, lard, and tropical oils (eg, palm, palm kernel, and coconut oils)	To achieve no more than 5%—6% of kcal
Added sugars (kcal)	Limit sweetened beverages, candies, grain-based or other desserts (see above)	Women: up to 100 kcal (6 tsp)/d Men: up to 150 kcal (9 tsp)/d Children: up to 100 kcal (6 tsp)/d
Sodium	Compare Nutrition Facts labels and select foods with the lowest sodium content available	Limit to 2300 mg/d (1500 mg/d if hypertensive or prehypertensive)

2.1.6. Hypertension Stages

Schulze, (2018) explained that healthy dietary practices, at all stages of life, are integral to the prevention and treatment of cardiovascular disease (CVD) and other conditions. Dietary recommendations have evolved from nutrient-based to food-based dietary patterns that are more easily translated for counselling patients/clients. Hypertension a risk factor for cardiovascular disease is a non-communicable health problem characterized by persistent increase in blood pressure of systolic 140mmHg and /or of diastolic of 90mm/Hg in persons 15 years and above (World Health Organization, 2013). Hypertension (HTN), also defined as systolic blood pressure (SBP) ≥140 mmHg and/or diastolic blood pressure (DBP) ≥90 mmHg, or taking anti-hypertensive medicine It is a major public health problem in most African countries (Gu, Dillon, Burt, & Gillum, 2010), (Chobanian *et al.,* 2003).

Hypertension is the most important preventable risk factor for cardiovascular disease, it is a chronic medical condition in which the blood pressure in the arteries is elevated, requiring the heart to work harder than normal to circulate blood through the blood vessels (Kumar and Clark, 2009; IN Akpa, Emem-Chioma & Odia, 2013). It has been described as the "silent killer" because initially the disease presents no apparent symptoms, and hence an individual can have hypertension without realizing it (Bani, 2011). High sodium intake and insufficient potassium intake contribute to high blood pressure, which in turn increases the risk of heart disease and stroke. It has been reported that 13.5% of deaths and 6% of disability adjusted life years (DALYs) were attributed to hypertension globally, and for low- and middle income people, these figures were 12.9 and 5.6%, respectively over the period 1990 to 2001 (WHO, 2011). Elevated BP results from environmental factors, genetic factors, and interactions among these factors. Environmental factors that affect BP

includes; (diet, physical inactivity, toxins, and psychosocial factors), dietary factors have a prominent, and likely predominant role in BP homeostasis. Dietary changes that lower BP have the potential to prevent hypertension and more broadly to reduce BP and thereby lower the risk of BP-related clinical complications (Stamler, Stamler & Neaton, 1993; IN Strauer, 2012).

According to Joint National Committee on prevention, detection, evaluation and treatment of high blood pressure (JNC7) in Chobanian *et al.,* **(**2003) the blood pressure levels of individuals are grouped into four classes see in table 3 below:

1) Normal blood pressures (systolic blood pressure less than 120mmHg and diastolic blood pressure less than 80mmHg).

2) Pre-hypertension (systolic pressure between 120 and 139mmHg or diastolic pressure between 80 and 89mmHg).

3) Stage 1 hypertension (systolic pressure between 140 and 159mmHg or diastolic pressure between 90 and 99mmHg)

4) Stage 2 hypertension (systolic pressure ≥160mmHg or diastolic pressure≥100mmHg)

Table 2.3: Classification of blood pressure in the adult Nigerian > 15years

Blood Pressure	**SBP**	**DBP**
Classification	mmHg	mmHg
Normal	<120	and <80
Prehypertension	120—139	or 80—89
Stage 1 Hypertension	140—159	or 90—99
Stage 2 Hypertension	≥160	or ≥ 100

Source: Chobanian *et al.,* 2003

2.1.7. Classifications of Hypertension

CDC (2012) stated that hypertension can be classified as either primary (essential), secondary or Eclampsia (Hypertension during pregnancy). Over 90% of all cases of hypertension are primary hypertension, with no obvious identifiable cause, although there are recognizable risk factors. The remaining 10% of cases are usually secondary hypertension, and this is hypertension that results from other diseases present in the body such as kidney disease, cardiovascular disease (CVD), coronary heart disease.

- **Essential Hypertension**

Essential hypertension is a type of high blood pressure that has no clearly identifiable cause**,** but is thought to be linked to genetics, poor diet, lack of exercise and obesity. It is by far the most common form of high blood pressure, affecting the majority of those who experience hypertension**.** It is also known as primary hypertension**.**

Essential, hypertension is defined as high Blood Pressure (BP) with no clear cause. In this type of hypertention, the secondary causes namely renovascular disease, renal failure, pheochromocytoma, aldosteronism, or other are absent. It is the most common type of hypertension and accounts for up to 95% of all hypertension cases. Different patients may have different causal factors of the disease and could occur as a result of a combination of poor lifestyle choices and genetics. Lifestyle factors that may play a role including poor diet (high sodium, low fruit and vegetable intake), tobacco use, limited physical activity, stress, and overweight/obesity (Carretero, & Oparil, 2000).

- **Known Etiological Factors in Essential Hypertension**

Although it has frequently been indicated that the causes of essential hypertension are not known, this is only partially true because we have little information on genetic variations or genes that are over expressed or under-expressed as well as the intermediary phenotypes that they regulate to cause high BP A number of factors increase BP, including Obesity, Insulin resistance, High alcohol intake, High salt intake (in salt-sensitive patients), aging , sedentary lifestyle, stress, low potassium intake, and low calcium intake Furthermore, many of these factors are additive, such as obesity and alcohol intake (Maron, Pellicia & Spataro, Granata 1993; IN Marshall, Wolfe & McKevitt, 2012).

- **Secondary Hypertension**

Secondary hypertension is defined as increased systemic blood pressure (BP) due to an identifiable cause. Only 5-10% of patients suffering from arterial hypertension have a secondary form whereas the vast majority has essential (idiopathic or primary hypertension (Kearney *et al.,* **2005**).

Secondary Hypertension arises as a result of another disease, most often associated with the endocrine system (the body's gland system, responsible for secreting hormones). Secondary hypertension may be resolve with treatment of the underlying condition. Moreover, while the majority of young patients (<40 years old) with secondary hypertension respond to specific treatment, in 35% of elderly patients target BP values are not achieved even after specific treatment (Streeten, Anderson & Wagner, 1990).

This suggests that on the one side, early detection and treatment of secondary hypertension are important to minimize irreversible changes in the systemic vasculature (Muiesan *et al.,* **2002**). On the other side, the prevalence of concomitant primary and secondary rises with increasing age (Streeten, Anderson &Wagner *et al.,* 1990).

2.1.7.1. Eclampsia Hypertension

Eclampsia is defined by the occurrence of seizures resulting from hypertensive encephalopathy on the background of preeclampsia. The development of hypertension during pregnancy, a serious and potentially fatal condition, is a leading cause of maternal and fetal morbidity and death in the United States (Albert *et al.,* **2009**). It is a disease with preventable complications. The pathophysiology of hypertension during pregnancy is unclear, but there is consensus that aggressive treatment is warranted to prevent complications to both fetus and mother.

2.1.8. Risk Factors of Hypertension

Cooper *et al.,* (1997); IN Marshall, Wolfe & McKevitt, (2012) opined that although the exact cause of primary hypertension is unknown, there are several risk factors that have been associated with the condition. These risk factors are also associated with other non-communicable diseases (NCDs) such as diabetes mellitus, cancers, CVD, chronic respiratory disease, asthma, musculoskeletal disorders, etc. These factors can be categorized into modifiable and non-modifiable risk factors. The non-modifiable risk factors are attributes or characteristics in the individual that cannot be changed or adjusted, hence they are out of our control and little or nothing can be done to control them; such factors include age, sex, race, Family history, genetic composition, etc. On the other hand modifiable risk factors of hypertension are attributes,

characteristics, exposures or life style patterns that can be adjusted or changed to prevent the development of the disease. These modifiable risk factors include; obesity, excessive salt intake, inactivity or lack of exercise, high fat diet, tobacco use, alcohol consumption, etc. Hypertension that is sustained elevation of the blood pressure to 140/90 mmHg is the most common Non Communicable Disease (NCD) globally and it affects all races with variable prevalence.

2.2. Empirical Studies

2.2.1. Body mass index and risk of hypertension among older adults

In a cross-sectional study done by Becquey , Mathilde, Peggy, Dabire, Tapsoba, & Martin-Prevel *(*2010) to describe dietary patterns of adults in Ouagadougou and to study their relationship with anthropometric status of the subjects. Using a qualitative food frequency questionnaire, administered to 1,072 adults living in two contrasted districts of Ouagadougou. Dietary patterns were defined by principal component analysis and described by multivariate analysis. Logistic regression was used to study their association with overweight.

The result revealed that their diet was mainly made of cereals, vegetables and fats from vegetable sources. The two first components of the principal component analysis were interpreted respectively as a "snacking" score and as a "modern foods" score. Both scores were positively and independently associated with the economic level of households and with food expenditures ($p \leq 0.001$ for both). The "snacking" score was higher for younger people ($p = 0.004$), for people having a formal occupation ($p = 0.006$), for those never married ($p = 0.005$), whereas the "modern foods" score was associated with ethnic group ($p = 0.032$) and district of residence ($p < 0.001$). Thirty-six per-cent of women and 14.5% of men were overweight (Body Mass Index > 25 kg/m2). A higher

"modern foods" score was associated with a higher prevalence of overweight when confounding factors were accounted for (OR = 1.19 [95% CI 1.03-1.36]) but there was no relationship between overweight and the "snacking" score. The research then concluded that Modernisation of types of foods consumed was associated with the living conditions and the environment and with an increased risk of overweight. This should be accounted for to promote better nutrition and prevent non communicable diseases.

A cross-sectional study done to assess the relationship between eating patterns and body mass index (BMI) in children and adolescents in Northeastern Brazil involving 1,247 male and female students, aged between 6 and 12, from public elementary schools in São Francisco do Conde, Bahia State, Brasil. BMI was used to analyze the children's nutritional status. Food consumption frequencies, in addition to demographic and socioeconomic information, were collected for each participant. Dietary patterns were identified through a factor analysis. The prevalence of overweight and obesity was 17.3% (10.2% overweight and 7.1% obese). Two eating patterns, "obesogenic" and "prudent", were identified. The former is characterized by sweets and sugars, typical Brazilian dishes, pastries, fast food, oils, milk, cereals, cakes, and sauces, and was positively associated with increased BMI (ßi = 0.244; p = 0.018). An "obesogenic" dietary pattern was associated with increased BMI (Wolfe & McKevitt, (2012).

In a cross sectional study by Amirhamidi *et al.,* **(**2019), with the aim of investigating the relationship between weight status, dietary behavior and diet diversity in 10 to 15- year-old students in the city of Tehran. A sample of 487 students (51.8% girls) aged 10 - 12 years. Weight, height as well as age- and sex-specific BMI z-scores were determined. Demographics (sex, age, birth order and parental age) and socioeconomic characteristics (family size, parent's educational level, occupation, ethnicity and housing status) were assessed by a questionnaire. Dietary intake

was assessed through interview using 3-day 24-hours dietary recalls. Based on the BMI z-scores of the children, 1.9%, 47.9%, 27.2% and 22.8% were thin, normal, overweight and obese, respectively. In boys, mothers educational level; and among girls, being at post-menarche stage and paternal job position were significantly associated with their weight status (P = 0.08, P = 0.05, P = 0.05, respectively). Boys in the lowest tertile for energy intake were at lower risk of obesity (OR = 0.04; 95% CI: 0.02 - 0.97) and those in the middle tertile of grains diversity score had a greater risk of obesity (OR = 5.84; 95% CI: 1.29 - 26.42) in comparison with those in the highest tertile. In girls, those in the lowest tertile of dairy diversity had higher risk of overweight compared to those in the highest tertile (OR = 9.77; 95% CI: 1.60 - 58.57). The researcher then concluded that the findings of the study indicate that energy intake and dietary diversity can affect the risk of overweight and obesity in preadolescents. The researcher then recommended further studies to explore a more generalizable relationship between dietary intake and weight.

In a cohort study done to examined associations between dietary patterns identified in a diverse cohort of adolescents and weight status cross-sectionally and over a 5-year period, using Project EAT (Eating among Teens) (Time 1) data was collected among 4746 middle (younger cohort) and high school (older cohort) students in 1998—9. EAT-II (Time 2) resurveyed 2516 of the original cohort in 2003—4. The relationship between dietary patterns identified previously (vegetable, fruit, vegetable & fruit, starchy food, sweet & salty snack food, and fast food) and weight status was examined using logistic regression. All analyses were adjusted for socioeconomic status, race/ethnicity and activity level (longitudinal analyses were also adjusted for baseline weight status). The result showed higher adherence to dietary patterns loading heavily on vegetables was associated with lower risk of overweight/ obese weight status in older and younger girls, whereas higher adherence to a sweet & salty snack food pattern was associated with lower risk in older and

younger boys. These associations were found prospectively in older boys and girls, but were no longer significant in analyses adjusting for baseline weight status. We did not find consistent or intuitive associations between dietary patterns and weight status. Identified patterns may not capture the elements of diet that are truly important in determining adolescent weight, or diet may not be the primary driver in determining weight status at this age. The researcher then concluded that Methodological difficulties in assessing diet must also be taken into consideration (Cutler, Flood, Hannan, Slavin and Neumark-Sztainer, 2012).

2.2.2. Dietary Patterns Associated with Hypertension

In a case-control study aimed to explore the association between diet-related factors and the risk of hypertension in China. A total of 200 patients with hypertension were recruited from January 2018 to June 2018. Two hundred healthy people were selected as the control group. Differences about the baseline characteristics of the subjects between the hypertension group and the healthy control group were analyzed by two-tailed unpaired student's t-test for continuous data and the Chisquare test for categorical data. The odds ratio (OR) and 95% confidence intervals (CI) were calculated. Results showed that after adjustment for sex, age, area, smoking status, family history of hypertension, activity, education, employment status, body mass index (BMI) and pulse, higher intake of vegetable and fruits (FVs), vegetable, fruit, eggs, and nuts could significantly reduce the hypertension risk (OR = 0.71, 95% CI = 0.47-0.95; OR = 0.62, 95% CI = 0.42-0.82; OR = 0.54, 95% CI = 0.34-0.74; OR = 0.72, 95% CI = 0.50-0.95 and OR = 0.75, 95% CI = 0.56-0.94, respectively) when compared with never or rarely intake. Findings from this study suggest that intake of FVs, vegetables, fruits, eggs, and nuts is associated with decreased risk of hypertension in China (Zhang, Chen, Qu, Wang & Yin, 2019).

In case control study undertaken to investigate the role of dietary factors in relation to hypertension, a total of 158 newly diagnosed cases were selected from the out-patient department of the 1000-bed Osmania general hospital along with 172 age and gender-matched controls. A detailed diet history was collected and validated. An energy adjustment method was adopted by transforming the data on a log scale as all the nutrients depended upon the intake of energy. A total of 86 hypertensives and 79 controls participated in the study. Among those classified as hypertensives, men reported higher intakes of dietary fat and salt while women reported higher intakes of dietary protein and salt. Risk calculated by Odds ratio revealed that higher intakes of fat, protein and salt increase the risk for hypertension. Multivariate stepwise logistic regression identified salt as the risk factor in men and protein as the risk factor in women. These results suggest a role for dietary fat, protein and salt in hypertension (Kodali, Kodavanti, Tripuraribhatla, Ram, Eswaran & Krishnaswamy, 1999).

In a randomized control trial done to identify the association between dietary patterns and hypertension among 4304 low income urban adult in Karachi, Pakistan. Dietary information was collected by a 33- item food frequency questionnaire and 3 unique dietary patterns namely; fat and sweet, fruit and vegetable, and seafood and yogurt patterns were derived using principal component factor analyses. The result of uni-variate and multivariable logistic regression to examine the association between dietary patterns and hypertensions showed that men were more likely to have hypertension, while increase in age, and body mass index were also associated with hypertension ($p<0.001$). After adjusting for age, gender, education, marital status, body mass index, and tobacco use, the seafood and yogurt pattern was less likely (OR=0.78: 95% CI: 0.63, 0.98; p-value 0.03) to be associated with hypertension, whereas no significant associations were seen for other two dietary patterns. These findings suggest that certain dietary patterns may be

associated with hypertension among Pakistani low income urban adults (Safdar, Bertone-Johnson, Cordeiro, Jafar and Cohen, 2015).

The beneficial effect of fruits, vegetables and dairy products on blood pressure in children has been evidently reported in a systematic review relating dietary habits and blood pressure in the pediatric age group for children and adolescents aged less than 18 years, conducted from November 2015 to August 2016, with 549 studies initially identified for inclusion in the review study which were later streamlined to 161 articles (done by Kelishadi, Gheisari, and HeidariBeni Ashour (2016). It was concluded based on the findings of the study that dietary habits, involving daily salt intake of children is directly associated to their blood pressure level.

A meta-analysis study on healthy diet pattern (Wang *et al.,* 2016) indicated that a health pattern comprised of food combinations high with vegetables, fruits, whole grains, olive oil, fish, soy, poultry and low fat dairy showed significant reduction in high blood pressure compared to a combination of the foods at lowest category (OR=0.81; 95%CI: 0.67-0.97; *P*=0.02).

2.2.3. Socio-Economic Status and Hypertension Risk

In a cross-sectional study done by Abdul-Razak and Zakari (2019) involving 366 pupils in 10 junior high schools in the Tamale metropolis, to determine the dietary patterns and associated factors among schooling adolescents in Northern Ghana. A Food Frequency Questionnaire (FFQ) which consisted of 60 commonly consumed foods was used to assess pupil's 7-day intake. Foods grouped (14) from FFQ data based on shared nutritional value were used to identify dietary patterns using principal component analysis (PCA). Bivariate and multivariate logistic regression analyses were used to determine the association between identified patterns and sociodemographic,

anthropometric status, and household characteristics of pupils. The result showed that (50.3%) of the pupils were female and average age was 15.6 ± 2.0 years. PCA identified two dietary patterns which in total explained 49.7% of the variability of the diet of pupils. The patterns were sweet tooth pattern (STP) with high factor loadings for sugar sweetened snacks, energy and soft drinks, sweets, tea and coffee and milk and milk products, and a traditional pattern (TP) which showed high factor loadings for cereals and grains, local beverages, nuts, seeds and legumes, vegetables, and fish and seafood. Also result from the logistic regression showed that that pupils who lived with their parents are 1.95 times more likely to following the sweet tooth pattern (STP) [AOR = 1.95; 95% CI (1.1—3.4); p = 0.019], those who went to school with pocket money [AOR = 4.73; 95% CI (1.5—15.0); p = 0.008], and those who lived in the wealthiest homes [AOR = 3.4; 95% CI (1.6—7.5); p = 0.002)] had higher odds sweet tooth pattern (STP). The TP was associated with high dietary diversity (p = 0.035) and household wealth [AOR = 3.518; 95% CI (1.763—7.017); p < 0.001)]. None of the patterns was associated with anthropometric status of pupils. The research then concluded that Adolescents in the present study followed a sweet tooth or a traditional diet pattern which associated ore with household- and individual-level factors but not anthropometric status.

2.3 Theortical Frame Work

Hypertension is one of the major risk factors affecting the global burden of disease and is one of the most important risk factors for cardiovascular disease (Zhou *et al.,* 2019). It was reported that a 10 mmHg reduction in systolic blood pressure (BP) could lower the risk of major stroke by 27%, heart failure by 28%, and cardiovascular disease events by 20% (Ettehad *et al.,* 2016). Therefore, the primary prevention of hypertension has now become a top priority for global public health. Accumulating evidence has suggested that diet plays a significant role in the development and

progression of hypertension (Htun *et al.,* 2012: Gay, Rao & Vaccarino 2016). Dietary pattern was more comprehensive to reflect the synthesized effect of foods or nutrients compared with individual food or nutrient (Jaalouk, Matar , Helou , Abou Jaoude ,2019). It has been widely used as an alternative method to assess the relationship between whole diet and hypertension (Hu 2002). Over the past few decades, dietary patterns, such as Dietary Approaches to Stop Hypertension (DASH) (Sacks *et al.,* 1995) and Mediterranean Dietary Pattern (MDP) (Panagiotakos , Pitsavos , Arvaniti & Stefanadis,2007), have been suggested to have a protective effect on hypertension.

In Nigeria the economic burden posed by hypertension and its complications are very high (Abegunde *et al.,* 2007). For example, a study on monthly cost of hypertension treatment per person in a community in the south-western part of Nigeria showed that an average of ten united state dollars (10USD) was spent on drugs alone aside from other direct cost. This is untenable in a population where many live below 2USD a day (Adeloye *et al.,* 2015: Ilesanmi, Ige, Adebiyi. 2012). Moreover, it has been shown that the average monthly cost of treatment of hypertension could be higher especially in cases where the patients have to go back for follow-up more frequently than expected due to complications of management (Ukwaja & Onyedum,2013) The low levels of awareness, treatment and control of hypertension, suggest that rates of cardiovascular complications such as cerebro-vascular accidents, heart failure, and renal failure will increase in coming years (Adeloye *et al.,* 2015).

CHAPTER THREE

MATERIALS AND METHODS

3.1 Study Design

This study was designed as a community based cross-sectional study conducted in a rural community setting in South Eastern Nigeria (Ehime Mbano Local Government Area, Imo State) The study was designed to assess the dietary patterns of adult residents in the LGA with validated tools and as well measure their herpertensive status. This same pattern of study design has been applied in a similar study to determine the Spread of Hypertensive Retinopathy among People with Hypertension in selected communities of Ehime Mbano Local Government Area of Imo State, Nigeria (Amadi, Azuamah, Esenwah, Amadi & Azuamah, 2011).

3.2. Study Area

The study is based on Ehime Mbano Local Government Area, Imo State Nigeria. Imo State consists of 27 local government areas, and Ehime Mbano is one of the largest Local Government Areas in the state, with a population of 204,340 people in 2015 (Ehime Mbano Local Government Council, 2015) and occupying an area of 166 square kilometres (Km). Ehime Mbano Local Government Area is geopolitically situated in Imo North, otherwise known as Okigwe senatorial zone. The LGA was carved out of the former Mbano L.G.A. in 1989 with its headquarters at Umuezeala. The local language of the people is Igbo language, while many of the people do also communicate in English Language and 'Pigin English'.

It is made up of 29 autonomous communities each headed by a traditional ruler. The major clans in Ehime Mbano LGA includes: Ehime, Umueze (Umueze I and Umueze II), Agbaja /Umukabia, Akanu/Umuezeala (Umunakanu and Umuezeala), Umualumaku/ Umuihim, Nneato Ugwumezi

(Umunumo and Nzerem/Ikpem) and Nsu (Ikpe Nsu, Ihite Nsu, Umuakagu Nsu and Umuezeala Nsu). It is bounded at the North by Onuimo and at the South by Ahiazu Mbaise and from the East and West by Ihittte/Uboma and Isiala Mbano/Okigwe L.G.As.

Several healthcare centres exist in different wards and communities within L.G.A to cater for the health & welfare of the people. These include Agbaja health centre, Umuezeala Nsu Health Center in Nsu B, Umuduru/Umuopara Health Centre at Nsu A. Others are Nzerem Healh Centre, Umuakagu Health Centre Umualumaku/Umuihim Health Centre at Umualumaku, Umueleke Health Centre, Umueze I Health Centre and, Umueze II Health Centre and Duruegwele Health Centre Okwe Owerre, Osuru Health Centre, Umunumo Ibeafor Health Centre (Ehime Mbano Local Government Council, 2007). There were also a lot of health post and some private clinics in the area (Ehime Mbano Local Government Council, 2007).

The people of Ehime Mbano are well known for cultural activities which include Onwa ano festival, Egbere ogu festival and Iwa akwa. The major occupation of the people is farming. However, traders, civil servants, teachers, transport workers and various other occupations can also be found among the people.

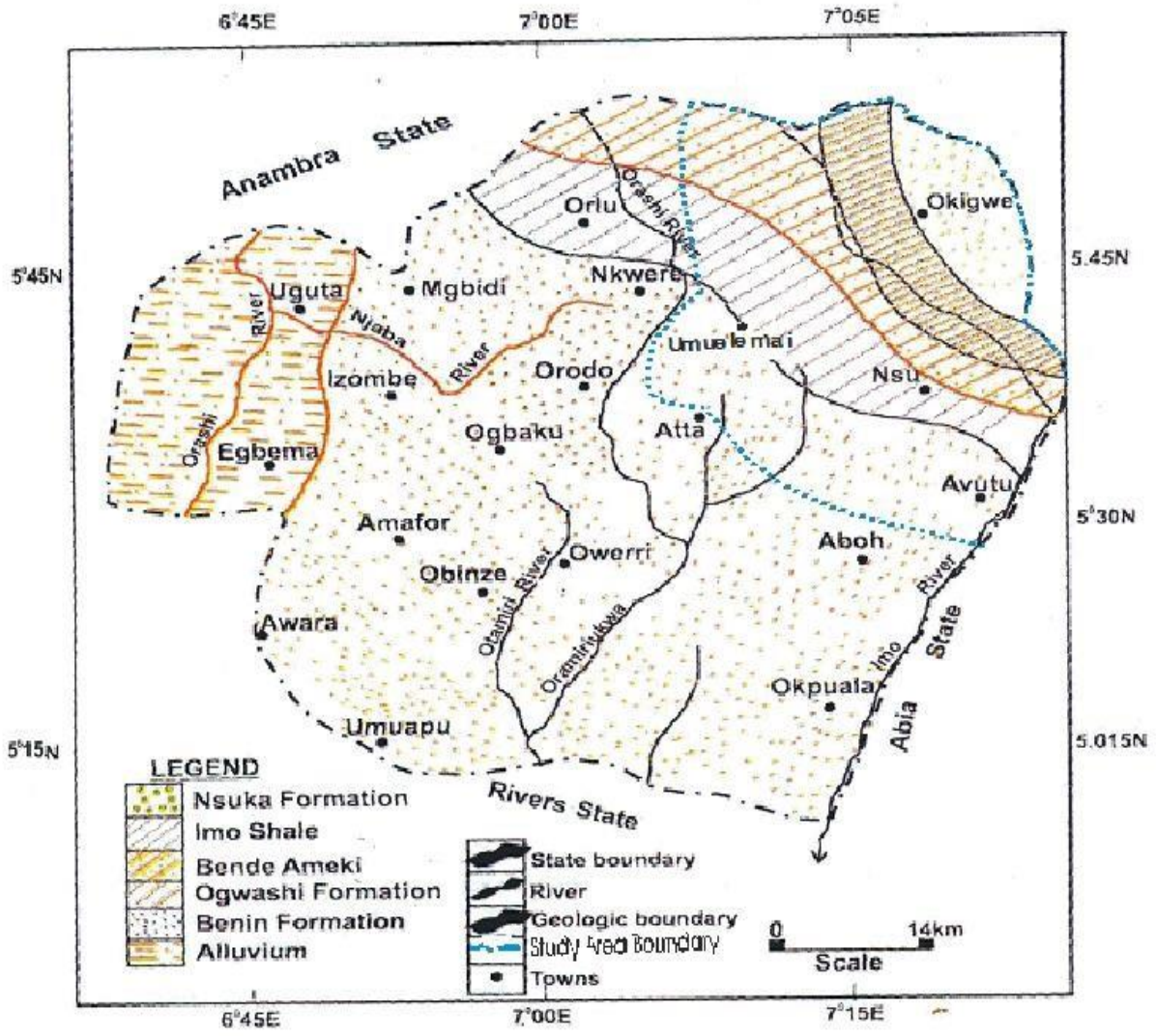

Figure 3.1: Map of Imo State

3.3. Study Population

The study population will consist of all adults (18-65 years) who met the inclusion criteria for the study and are living in the selected wards in Ehime Mbano L.G.A.

3.3.1. Inclusion Criteria

All adults aged 18 years to 65 years who lives in Ehime Mbano, for at least 1 year before the commencement of the study and all adults 18 years and above with persistent increase in blood pressure of systolic 140mmHg and /or of diastolic of 90mm/Hg in the last 4 months before the commencement of the study and on hypertensive medication.

3.4. Sample Size and Sampling Methods

3.4.1. Sample Size

The sample size for this study was determined using the appropriate sample size technique Cochrane equation (Cochran, 1963:75).

Sample size = $n= Z^2pq/ e^2$

Z^2 is the abscissa of the normal curve that cuts off an area α at the tails; e

is the marginal error,

p is the estimated proportion of an attribute that is present in the population, and q is 1-p, with no initial known proportion, from area of study, p is assumed to be 0.5.

$Z_{a/2} = Z_{0.05} = 1.96$ for 95 % level of confidence (From Z table) at type 1 error of 5%

$Z_{B=}$ 0.84 at 80% power

P1= proportion in cases = 50% (0.5)

P2 = proportion in control = 40% (0.4)

The sample size was increased by 10% to compensate or attrition leading to a sample size of 424.

3.4.2. Sampling Method

Multi-stage sampling method was employed to select the study participants from the LGA of study. At first, the LGA was classified into 11 wards that make up the Ehime Mbano LGA, and that was followed by the selection of wards. Six wards were randomly selected using the table of random numbers. The next selection involved selection of the communities from the wards and three communities was randomly selected from each ward. The names of the kindred's in the selected communities were obtained and fifty percent of the kindred's were selected in each community

At each selected kindred, the eligibility of the subjects were assessed for inclusion in the study and all the available adults that met the criteria were considered for inclusion,

A total of six wards were randomly selected using table of random numbers. The selected wards are Umunumo, Umuezeala, Ikpe Nsu, Agbaja, Umunakanu and Umueze 11. Furthermore, two communities were each selected from the wards and they include Ibeafor and Ibenkwo from Umunomo, Umuezeala ama and Umuopara from Umuezeala ward, Umuakagu and Ezeoke from Ikpe Nsu ward, Dinka and Umuchawa communities from Agbaja ward; Umugolo and Umuele communities from Umunakanu ward; Umueleke and Umuokwe communities from Umueze 11

ward. Based on population structure of the area, in proportion to the adult population, the sample size distribution in the wards is shown on Appendix Table,)

3.5. Instruments for Data Collection

A-15 itemed structured questionnaire (instrument) containing open-ended and closed- ended questions was used to collect data from respondents see appendix B. It was prepared in Simple English with the title "DIATERY PATTERNS AND RISK OF HYPERTENSION AMONG ADULTS IN EHIME MBANO L.G.A". The questionnaire contained three (3) questions to identify the demographic data of the respondents in section A, section B contained 4 questions to identified socio-economic profile of the respondents, section C contained 5 questions on Health Status of the respondents, section D contains the dietary pattern profile assessment using Food Frequency Question with 7 questions. Other study instruments include sphygmomanometer for BP measures, in mmHg reading.

3.6. Validity of Instruments

The questionnaire instrument was validated using face and content validity. The questionnaire was carefully prepared with some of the relevant items adopted from the FFQ. It was carefully scrutinized under the supervision of the research supervisor. Further, the questionnaire was reviewed by two expert in hypertension and public health nutrition and their recommendations were used to arrive at the final complied questionnaire for the study.

3.7. Reliability of Instruments

The questionnaire was initially administered to 30 respondents sampled from two communities not included in the study. The questionnaire was administered twice using test retest method and the

reliability of the instrument was tested using Chrombach Alpha, of which Coefficient of Reliability (r) =0.74 was obtained. The instruments used in measuring BP were not tested for validity since they have already certified for use in the past.

3.8. Methods of Data Collection

The researcher used trained research assistants and one health worker in data collection. First the community leaders of the various wards were informed and the purpose of the study was conveyed to them. Verbal informed consent was obtained from all the study participants and the questionnaire were administered to all of them, followed by the Blood Pressure measure performed by the health worker. The respondents who were literate were allowed to fill the questionnaire themselves but for those respondents that are non-literate, the questions were translated to them in local language and their responses were filled by the trained research assistant. Data were collected in the standardized forms include the socio-demographic information, food consumption types and patterns. Each questionnaire took 5-8minutes time to be completed.

The BP measures were performed by a qualified health worker. The subjects were allowed to rest at least for 10 minutes in a sitting position then blood pressure was measured using Aneroid mercury sphygmomanometer and 3 M Littmann classic II SE stethoscope. The systolic and diastolic blood pressure .recorded in mmHg. Blood pressure was measured from the left arms of a participant twice at the interval of 5 min rest, and the mean of the two measurements was used in the analysis.

Food Intake and Dietary Patterns

Food consumption data were collected by a self-administered validated food frequency questionnaire (FFQ). The FFQ contained questions on food items normally consumed by the

participant. The FFQ focused on the 6 months period before the study. Dietary and alcohol data were gathered foods consumed over 6 month period to estimate usual individual intakes. Participants were asked to report types of foods and beverages, and the frequency of consumption (daily, weekly and monthly) and the amounts consumed.

Food consumption data were collected by a self-administered validated food frequency questionnaire (FFQ). The FFQ contained questions on food items normally consumed by the participant.

3.9. Method of Data Analysis

Initial data analysis involved frequency distribution (expressed in percentage). The dietary patterns were established using factor analysis technique. Several food items were included in the study hence data reduction technique such as factor analysis method was used to obtain the dietary patterns of food constantly consumed in the study area. Weights were assigned on the consumed foods through varimax rotation in the factor analysis and number of dietary patterns was identified using eigenvalues > 1.25, as recommended (Schulze *et al.,* 2003) This analysis suggested two meaningful dietary patterns in the data. Based on the factor loadings representing the relative contribution of the suggested dietary patterns, positive loading indicated that the dietary variable is positively associated with the factor, whereas negative loading reflects an inverse association with the factor. Score for each dietary pattern was computed for the subject by summing up intakes of each food group weighted by its factor loading, which represents the relative contribution of that food group. Factor loading was determined for the extracted factors using the Kaiser-criterion of cut off ± 0.3

At the initial test, t test was used to related dietary patterns with hypertension while Chi square test was used to test the association between hypertension and sociodemographic factors. Further test

involves the test for the relationship between the dietary patterns and the BP in a multivariate Logistic regression model. The model was adjusted for other factors alcohol intake, smoking status, Family history of hypertension. Data were analysed using SPSS for WINDOWS (version 23.0; SPSS Inc., Chicago, IL, USA). *P*-values < 0.05 were considered significant.

3.10. Ethical Clearance/ Informed Consent

This study was approved by the department of Public Health, Federal University of Technology Owerri. Verbal informed consent was obtained from all the study participants before they were allowed to participate in the study.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1. Characteristics of the Study Participants

A total of 424 adults in Ehime Mbano Local Government Area were used in the study. Their sociodemographic characteristics are presented on Table 4.1. The table shows that a total of 156 (36.8%) were within 36-45 years old, 128 (30.2%) were of 46 – 55 years of age, 81 (19.1%) were between 18-35 year and the remaining 59 (13.9%) were above 55 years of age. The male subjects were 246 (58%) while the females were 178 (42%). More than half were married (235: 55.4%), up to 101 (23.8%) were singles and 13 (3.1%) were divorced. As large as half of the participants (215: 50.7%) had tertiary education, 177 (41.7%) had secondary education level while 18 (4.2%) had no formal education. so many 35.8% earn below the country's minimum wage (₦30,000), while the number that earn up at least ₦60,000were only 15 (3.5%). In terms of occupation, 110 (26%) and 88 (20.8%) respectively were involved in public service and trading or other business. Close to 5% (20: 4.7%) were unemployed. A total of 96 (22.6%) of the study group have family history of hypertension. In all, 123 (29%) consume tobacco, and 140 (33.0%) consumed alcohol.

Table 4.1: Characteristic of the Study Participants

Characteristics	Frequency (n =424)	Percent
Age 18-35		
	81	19.1
36-45	156	36.8
46-55	128	30.2
56-65	59	13.9
Gender Male		
	246	58.0
Female	178	42.0
Marital Status		
Single	101	23.8
Married	235	55.4
Divorced	13	3.1
Widow	52	12.3
Widower	23	5.4
Education		
Primary	14	3.3
Secondary	177	41.7
Tertiary	215	50.7
Other (Non formal)	18	4.2
Occupation		
Public servant	110	26.0
Trading/Business	88	20.8
Health worker (Doctor, Nurse etc)	77	18.2
Artisan (Hair Dresser seem stress, etc)	82	19.3
other (Farming, etc)	47	11.1
None (unemployed)	20	4.7
Income less		
than ₦30000	152	35.8
₦30000 - ₦39999	141	33.3
₦40000- ₦49999	83	19.6
₦50000-₦59999	33	7.8
₦60000+	15	3.5
Family History of HBP Yes		
	96	22.6
No	328	77.3
Tobacco Smoking Yes		
	123	29.0
No	301	71.0
Alcohol Intake Yes		
	140	33.0
No	284	67.0

4.2 Dietary Patterns Identified

Based on the method of the principal component analysis, a total of 3 dietary patterns were extracted. The first pattern (local diet) comprised of combinations of food containing different sorts of mixture of food contents. The identified foods within this pattern include beans, juice (apple, orange and, canned), Ukwa (bread fruit), honey, fish and sea foods, plantain, orange, and potatoes. The second pattern (Fruits and vegetables) contained foods that are typically of vegetable contents and fruits. The food items contained in this pattern include juice, fresh tomatoes, watermelon, oil and vegetables. The third pattern (combined diet) contained the food combinations of snacks, beverages and meat: meat/ Chicken, Tea/coffee, Milk, biscuits, canned juice and cake as well as starch dominated foods such as bread, maize/corn, rice, Gari/Fufu., the three selected patterns altogether explained 45% variations in the data.

Table 4.2: Different components for dietary patterns and their loadings

Components for dietary patterns			
Food Item	Local Diet	Fruits and Vegetables	Combined diets
Bread			0.724
Beans	0.682		
Corn/maize			0.677
Meat/Chicken			0.71
Tea/coffee			0.607
Milk			0.497
Juice	0.558	0.492	
Biscuits			0.564
Fish and sea foods	0.711		
Canned juice	0.487		0.334
Rice			0.46
Honey	0.323		
Garri/Fufu			789
Cake			
Fresh Tomatoes		0.696	
Plantain	0.659		
Orange	0.595		
Watermelon		0.707	
Oil (palm and vegetable)		0.673	
Vegetables		0.663	
Potatoes	0.586		
Ukwa (bread fruit)	0.516		
Yam			0.463

4.3 Prevalence of Hypertension among the Studied Group

Among the 424 adults studied, a total of 176 (41.5%) were hypertensive while 248 (58.5%) were not hypertensive. Hence the prevalence of hypertension was found to be 41.5% (Figure 4.1).

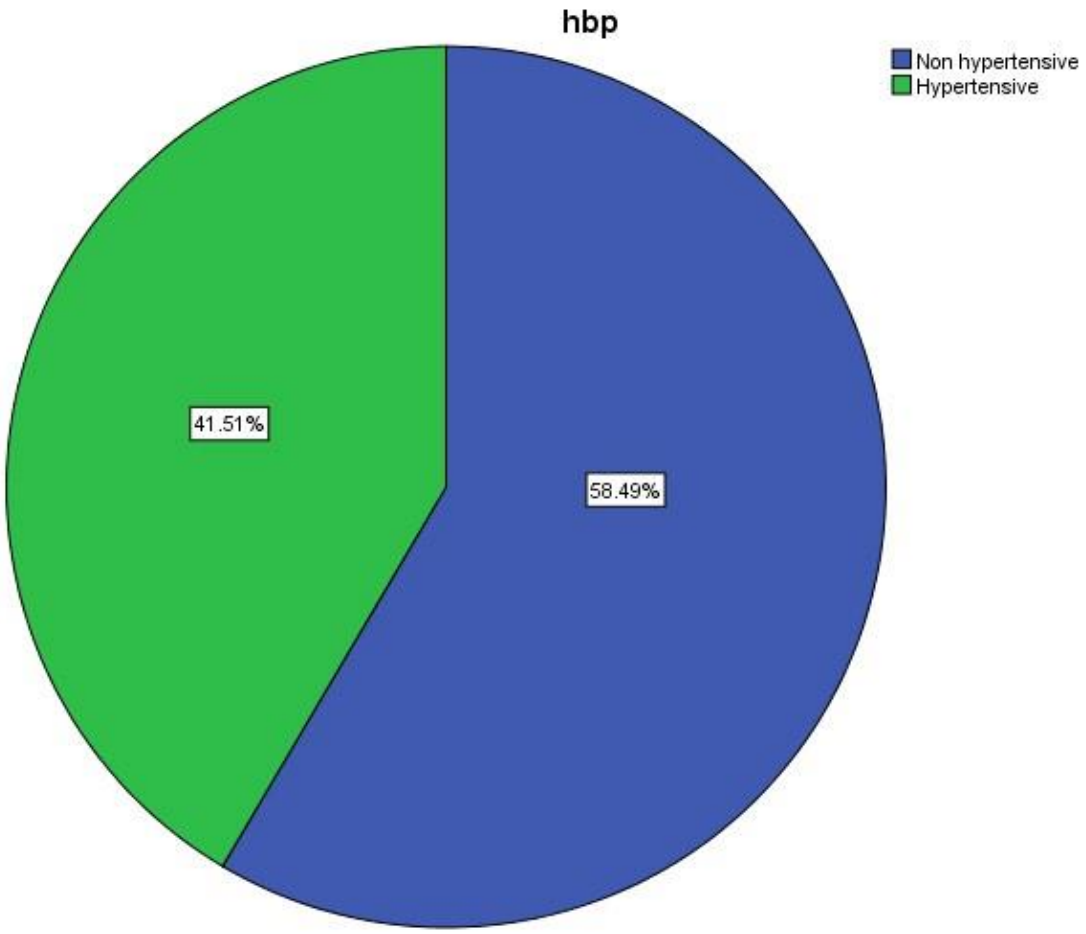

Figure 4.1: **Prevalence of Hypertension among the Studied Group**.

Table 4.3: Dietary Patterns Identified and their Food Component

Local Diet	Fruits And Vegetables	Combined Diet
Beans, juice (apple, orange and, canned), Ukwa (bread fruit), honey, fish and sea foods, plantain, orange, and potatoes.	Juice, fresh tomatoes, watermelon, oil and vegetables.	Snacks, beverages and meat: meat/ Chicken, Tea/coffee, Milk, biscuits, canned juice and cake as well as starch dominated foods such as bread, maize/corn, rice, Gari/Fufu

4.4 Correlation for Dietary Patterns

Table 4.3 contained output from correlation among the dietary in Ehime Mbano LGA. Significant positive correlation (r = 0.635) exist between dietary patterns (local diet) and (combined diet). The correlations between other patterns were relatively poor.

Table 4.4: Correlation for Patterns Identified.

	Local foods	**Fruit & Veg**	**Combined Foods**
Local foods	1.000	.635**	.278**
Fruit & Veg	.635**	1.000	.212**
Combined Foods	.278**	.212**	1.000

** indicate significant at 0.001, * indicate significant at 0.05

4.5 Association between Dietary Patterns and Socio Demographic Factors on Hypertension

On table, differences can be observed in mean for the hypertensive and the non-hypertensive subjects in dietary patterns above. It can also be observed that dietary patterns significantly associated with hypertension were local diet ($p = 0.001$, $t = 3.56$) and fruit and vegetable ($p = 0.020$, $t = 2.35$).

Some of the socio-demographic factors also showed significant association with hypertension among the study group. They include age ($p = 0.018$, $\chi^2 = 10.06$), gender ($p = 0.030$, $\chi^2 = 4.73$), and education ($p = 0.033$, $\chi^2 = 8.717$). Hypertension rate was highest among the oldest age group (50.8%) and was lowest among the youngest age group (28.4%).

Table 4.5: Hypertension in association with dietary patterns and socio-demographic factors among adults in Ehime Mbano LGA

		Hypertensive n=176 (41.5)	Non Hypertensive n=248 (58.5)	t	$\chi 2$	p
Local foods (mean st.dev)	424	1.48±0.33	1.61±0.38	3.56		0.001
Fruit & Veg3 (mean st.dev)	424	1.62±0.37	1.71±0.40	2.35		0.020
combined (mean st.dev)	424	1.34±0.30	1.34±0.26	0.018		0.986
Age						
18-35	81	23 (28.4)	58 (71.6)			
36-45	156	62 (39.7)	94 (60.3)			
46-55	128	61 (47.7)	67 (52.3)			
56-65	59	30 (50.8)	29 (49.2)			
Total	424	176 (41.5)	248 (58.5)		10.06	0.018
Gender						
Male (Ref)	246	113 (45.9)	133 (54.1)			
Female	178	63 (35.4)	115 (64.6)			
Total	424	176 (41.5)	248 (58.5)		4.73	0.030
Marital Status						
Single	101	37 (36.6)	64 (63.4)			
Married	235	105 (44.7)	130 (55.3)			
Divorced	13	5 (35.5)	8 (61.5)			
Widow	52	22 (42.3)	30 (57.7)			
Widower	23	7 (30.4)	16 (69.9)			
Total	424	176 (41.5)	248 (58.5)		3.19	0.527
Education						
Primary	14	3 (21.4)	11 (78.6)			
Secondary	177	87 (49.2)	90 (50.8)			
Tertiary	215	80 (37.2)	135 (62.8)			
Non formal (Ref)	18	6 (33.3)	12 (66.7)			
Total		176 (41.5)	248 (58.5)		8.717	0.033
Occupation						
None	110	9 (45.0)	11 (55.0)			
Public servant	88	40 (38.1)	65 (61.9)			
Trading/Business	77	44 (47.3)	49 (52.7)			

Health worker (Doctor, Nurse etc)	82	29 (37.7)	48 (62.3)		
Artisan (Hair Dresser seem stress, etc)	47	34 (41.5)	48 (58.5)		
other (Farming, etc)	20	20 (42.6)	27 (57.4)		
Total	424	176 (41.5)	248 (58.5)	2.385	0.794
Income					
less than ₦30000	152	62 (40.8)	90 (59.2)		
₦30000 - ₦39999	141	59 (41.8)	82 (58.2)		
₦40000- ₦49999	83	27 (32.5)	56 (67.5)		
₦50000 - ₦59999	33	18 (54.5)	15 (45.5)		
₦60000 + (Ref)	15	10 (66.7)	5 (33.3)		
Total	424	176 (41.5)	248 (58.5)	9.015	0.061

Relationship between Hypertension and dietary patterns, adjusted with socio demographic factors among adults in Ehime Mbano LGA

The adjusted relationship between the dietary patterns and hypertension (adjusted with factors of socio demographics) showed that local diet pattern is the only significant pattern found in this study (p =0.035,, 95% CI = 0.108 – 0.922). The coefficient of the regression (coef) gives a negative relationship between local diet pattern and hypertension indicating that the pattern is probably protective to hypertension.

Age (p=0.04) and income (p=0.04) showed slight significant relationship with hypertension in the adjusted table. The odds to having hypertension was found to be 3 folds more in the larges age group compared to the youngest group (OR= 3.08, 95% CI = 1.25 - 7.63). On the other hand

The odds for hypertension was found to be 75% lower (ie.1- 0.15%) among the lowest income group compared to that of the highest income group (OR=0.15, 95% CI = 0.023 - 0.970). Education was also found significant in the adjusted relationship (p =0.016) and the odds to having hypertension was found to be 1.9 times higher among the tertiary level participants compared to the no formal education level participants (OR=0.194, 95% CI = 0.450 - 8.389).

Table 4.6: Relationship between Hypertension and dietary patterns, adjusted with socio demographic factors among adults in Ehime Mbano LGA

	Non Hypertensive					95% C.I.for AOR		
	n= 176 (41.5)	n=248 (58.5)	Coeff	S.E.	p	AOR	Lower	Upper
Local Diet			-1.153	.547	.035	.316	.108	.922
Fruit and Vegetables			.191	.374	.610	1.210	.582	2.518
Combined diet			.159	.472	.736	1.173	.465	2.961
Age					.040			
18-35 (Ref)	23 (28.4)	58 (71.6)						
36-45	62 (39.7)	94 (60.3)	.508	.361	.160	1.661	.818	3.373
46-55	61 (47.7)	67 (52.3)	.995	.395	.012	2.704	1.246	5.869
56-65	30 (50.8)	29 (49.2)	1.125	.462	.015	3.082	1.245	7.626
Gender								
Male (Ref)	113 (45.9)	133 (54.1)						
Female	63 (35.4)	115 (64.6)	.455	.376	.226	1.576	.754	3.295
Marital Status					. .390			
Single (Ref)								
Married			.597	.355	.093	1.816	.906	3.638
Divorced			.418	.801	.602	1.518	.316	7.299
Widow			.828	.517	.109	2.289	.831	6.300
Widower			-.091	.723	.900	.913	.221	3.768
Education					.006			
Primary	3 (21.4)	11 (78.6)	-.789	.916	.389	.454	.075	2.736
Secondary	87 (49.2)							
Tertiary	80 (37.2)							
Non formal (Ref)	6 (33.3)							
Occupation		**Income**						
None (Ref)		less than 30000		62 (40.8)				
Public servant		30000 -39999		59 (41.8)				
Trading/Business		40000- 49999		27 (32.5)				
Health worker		50000-59999		18 (54.5)				
(Doctor, Nurse etc)		60000+ (Ref)		10 (66.7)				
Artisan (Hair Dresser seem stress, etc)		90 (50.8) 135 (62.8) 12 (66.7)						
			90 (59.2)					

other (Farming, etc)

82 (58.2)				-1.603	.183	.451	.140	1.456		
56 (67.5)					-.685	.532	.199	.504	.178	1.432
15 (45.5)				.872						
			5 (33.3)		-1.441	.658	.029	.237	.065	.860
1.396	.670	.037	4.037	.066						
	1.085	15.017			-1.052	.599	.079	.349	.108	1.129
.664	.747	.374	1.942	.201						
.450	8.389						.048			
				.036	1.112	-1.904	.956	.046	.149	.023	.970
				-.796		-1.968	.754	.009	.140	.032	.612
		.189				-1.837	.754	.015	.159	.036	.698
				.598		-.790	.751	.293	.454	.104	1.979.

Relationship between Hypertension and dietary Patterns and other adjusted factors of family history and lifestyle

In table 4.6, up to 57.1% of the subjects that consume alcohol have hypertension compared to 33.8% among the non-alcohol intake subjects. The odds for hypertension was found to be more than two times higher for those that do take alcohol compared to those that do not take alcohol (OR= 2.05, 95% CI = 1.147 – 3.664).

Family history of hypertension ($p < 0.001$) and alcohol intake ($p = .015$) were both found as significant factors. Among the participants with family history, hypertension occurred to 63.5% compared to 35.1% in the non-family history participants, with significant odds of 4 folds more in the family history group (OR=4.15, 95% CI = 2.483 - 6.924).

Smoking was not found as a significant factor (p=0.086).

Table 4.7: Relationship between Hypertension and dietary Patterns and other adjusted factors of family history and lifestyle

	Hypertensive n= 176 (41.5)	Non Hypertensive n=248 (58.5)	Coeff	S.E.	p	AOR	95% C.I.fo Lower	Upper
Local Diet			-1.164	.439	.008	.312	.132	.739
Fruit and Vegetables			-.239	.308	.438	.788	.431	1.440
Combined diet			.414	.401	.301	1.513	.690	3.319
Family History								
No (Ref)	115 (35.1)	213 (64.9)						
Yes	61 (63.5)	35 (36.5)	1.422	.262	.000	4.146	2.483	6.924
Smoking								
No (Ref)	103 (34.2)	198 (65.8)						
Yes	73 (59.3)	50 (40.7)	0.546	.318	.086	1.726	.925	3.222
Alcohol No (Ref)	96 (33.8)	188 (66.2)						
Yes	80 (57.1)	60 (42.9)	0.718	.296	.015	2.050	1.147	3.664

4.6 DISCUSSION

This study identified three major dietary patterns from food consumed in Ehime Mbano Local Government Area. The first dietary pattern (Local food) is a combination of fruit with sea foods and iron content foods. The second dietary pattern (fruit and vegetable) contained foods related to fruits and vegetables. The third pattern (combined pattern) comprised of snacks, beverages, meat, as well as food items contained dominated by starchy contents. These dietary patterns explained the 45% of variations for different food items consumed in the study area.

The first dietary pattern (local diet) showed significant tendency towards reducing hypertension. Possible reason is that some of the local diet foods such as plantain, beans sea foods and honey are mostly natural foods that are recommended for healthy life due to low sodium, low calories, low cholesterol and enriched vitamin contents in them (Nielsen *et al.,* 2020; Rybicka *et al.,* 2022). Similar to this finding, it has been reported that "traditional" dietary pattern showed negative association with hypertension on Brazilian foods (Previdelli *et al.,* 2016). Also, in a Pakistan study, it was found that inverse relationship exists between hypertension and seafood among Pakistani urban adults (Safdar, *et al.,* 2014). A study in Ouagadougou found association between "modern foods" and weight increase that could lead to hypertension (Becquey *et al.,* 2010

The next identified pattern in the study comprised of fruits and vegetable intakes. This result is as expected has been highly recommended against hypertension (Wang *et al.,* 2016), Dietary patterns involving greater intake of fruit, vegetables, as well as other combinations such as grains, legumes, seeds, nuts is found significant in blood pressure reduction among adults (Ndanuko, Tapsell, Charlton, Neale, & Batterham, 2016).

In what appeared to be a surprise finding, no significant association was found between food combinations of snacks, beverages, meat and starch with hypertension in this study. Likely reason

for this is that other factors may have interfered in-between. For instance, it is possible that those that reported to be consuming such food combinations with other foods or engaging in exercises that are capable of lowering calories or cholesterol contents in their body. Lifestyle adjustment such as physical exercise, is capable of lowering blood pressure in adults (James *et al.,* 2014). Also, while the participants reported consuming meat, it is possible that such consumption are low and non-constant. However, this finding is contrary to results in some other studies (Schulze Hoffmann, Kroke & Boeing, 2003). On the other hand, similar to this finding, snacks related dietary pattern was not significant associated with hypertension (Becquey *et al.,* 2010; Safdar, *et al.,* 2014).

Other aspect covered in this study is the prevailing rate of hypertension among the adults studied, which was found to be relatively high. The hypertension rate found in this study is quite high. It is higher than 23.3% found in Banigbe *et al.,* (2020) and 25.5% in Adeloye *et al.,* (2015). On the other hand, it is lower than 51.3% in Ebirim et al., (2018) and 52.8% in Odili, et al. (2020) found among adults in South-East, Nigeria. While it may be argued that the high rate in hypertension could be as a result of factors ranging from poor diets to availability of functional health facilities, the major diet pattern found in the area (local diet) rather showed inverse relationship with hypertension, it implies that other factors such as socio-economics and environmental factors could be likely influencing factors. The association between factors of socio-economics and hypertension has been documented (Ambrosin *et al.,* 2009; Cutler *et al.,* 2011; Previdelli, *et al.,* 2016).

In this study, the odds for having hypertension are significantly higher among the high-income group compared to the low-income group. Possible reason for this result is that the low-income group are more likely to be feeding mostly on local diet patterns and may not being in the position

to afford other foods at costlier prices. It has been shown that higher job position associated significantly with weight increase (Amirhamidi *et al.,* 2019),

Another factor is age. This study concentrated on older adults hence is not a surprise that age could have contributed to high blood pressure as age was found as a significant factor of hypertension in this study as well as family history of hypertension, both of which are established associating factors of hypertension (Previdelli *et al*., 2016; Okubadejo *et al.,* 2019).

Food consumption with drinks involving intake of alcohol was not suggested as healthy diet by the findings of this study, as it was found to be directly associated with hypertension. Obviously this is not a surprise finding considering that alcohol intake especially at high consumption is an established factor of hypertension among adults (Ndanuko *et al.*, .2016; Okubadejo *et al.,* 2019). In otherwards failing to control alcohol intake gives negative effects on diet with high probability of developing hypertension.

CHAPTER FIVE

CONCLUSION AND RECOMENDATIONS

5.2 Conclusions

Dietary patterns for local consumed foods in Ehime Mbano, a rural Nigerian society is inversely associated with blood pressure, yet the level of blood pressure is quite high among adults residing in the area. It therefore implies that individual food choices and nutrient intakes that align with beneficial dietary patterns may also assist in reducing blood pressure. This obviously could have significant translational meanings for dietary advice on blood pressure management. Further study to this relationship could consolidate these findings.

5.3. Recommendations

- There is need to encourage the consumption of some of the local foods from rural communities, this could help to achieve quality life.
- Proper education and awareness on healthy food diets should be constantly advised and encouraged on food consumers.
- There is a need to explain to the adults in the rural communities on the quantities of which foods can be consumed or combined with other foods to attain to balanced and healthy diet that is not detrimental to health
- There should be training and retraining programmes for health care providers to improve the content and quality of care and advice especially on diets relating to hypertension and other related diseases.
- The government should create, a center for which adults can be screened of hypertension, and also get advise on foods they consume.

5.4. Contribution to Knowledge

- This study is expected to expose the risk of hypertension among adult males in relation to the food the consume on daily basis
- The study will contribute to the existing body of knowledge on hypertension and dietary pattern of which may be beneficial to the in nutritional planning and in boasting of public health

5.5. Limitations of the Study

This study was limited to the fact that most of the information were directly obtained from the respondents through the food frequency questionnaire (FFQ) which could possibly be affected be recall bias, the questionnaire was properly validated before being utilized in the study.

Another limitation in this study was the some of the foods consumed locally were difficult to quantify but the research sought advice of experts in constructing the study tool which enabled that aspect to be taken care of.

5.6 Suggestions for Further Studies

This study has revealed that some dietary patterns in the rural communities could reduce blood pressure. Future research should focus on some of these food items on individual basis so as to establish which individual food item consumed locally could lead to reduction in rising blood pressure and improve health and wellbeing.

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APPANDICES

Samples at different wards

WARD	SAMPLE	PERCENT (%)
Umunumo	74	17.5
Umuezeala	81	19.1
Ikpe Nsu	65	15.3
Agbaja	66	15.6
Umunakanu	71	16.7
Umueze 11	67	15.8
Total	424	100

Table DS6: Distribution of Population by Five Year Age Groups and Sex			
Age Groups	Total	Sex	
		Males	Females
EHIME-MBANO			
TOTAL	130,676	65,237	65,338
0 - 4	15,710	8,045	7,665
5 - 9	16,668	8,695	7,973
10 - 14	16,307	8,449	7,858
15 - 19	15,951	7,912	8,039
20 - 24	12,681	6,075	6,606
25 - 29	10,674	4,698	5,976
30 - 34	8,349	3,665	4,684
35 - 39	7,174	3,178	3,996
40 - 44	6,477	3,275	3,202
45 - 49	5,305	2,769	2,536
50 - 54	4,771	2,672	2,099
55 - 59	2,429	1,282	1,147
60 - 64	2,894	1,499	1,395
65 - 69	1,608	818	790
70 - 74	1,693	1,047	646
75 - 79	731	413	318
80 - 84	590	396	194
85+	563	349	214

563

590

Total =82901

Male =40049

Female = 42852

QUESTIONNAIRE

Consent for Voluntary Participation

My name is …….. I am a Masters student in the department of Public Health Federal University of Technology Owerri. I am carrying out a study on **Dietary patterns and risk of hypertension Among Adults in Ehime Mbano L.G.A**, for my Masters in public health thesis.

I seek your voluntary participation and honest response in providing information that will aid the success of this study. All data collected will be treated with utmost confidentiality. Results gotten from these study will aid the researcher in developing a prevention program to promote the health of Adults in in Ehime Mbano L.G.A.

Thank you for your honest response!

……..

Duru Loveday Onyewuchi

08037303010

QUESTIONNAIRE

Dietary pattern and risk of hypertension Among Adults in Ehime Mbano L.G.A

Identification/verification

Date of data collection „/……./……./

Ward/Street name ……

House hold number ……..

Pleases tick √ were applicable

Demographic Characteristics of the respondent

AGE (YEARS)

- Age (years)?
  a) 18-29
  b) 30-39
  c) 40-49
  d) 50-59
  e) 60-65

2) Gender
   a) Male
   b) Female

3) Marital Status
   a) Single
   b) Married

c) Divorced

d) Widow

e) Widower

4) EDUCATION

- Highest education attained
- No formal education
- Primary education
- Secondary education
- Tertiary education
- Others (Please specify) ……..

5) OCCUPATION

a) None

b) Public servant

c) Business

d) Lawyer

e) Doctor

f) Nurse

g) Hair dresser

h) Seamstress

i) Others (please specify) …….

6) INCOME PER MONTH

j) less than ₦30,000

k) ₦ 30,000 – ₦ 39,900

l) ₦ 40,000 - ₦ 49,900

m) ₦ 50,000 – ₦ 59,900

n) ₦ 60,000 - ₦ 69,900

o) ₦ 70,000 - ₦ 79,000

p) greater than ₦ 80,000

7) RESIDENTIAL APARTMENT

q) One bedroom apartment

r) Two bedroom apartment

s) Three bedroom apartment

t) Four bedroom apartment

u) Communal apartment (public yard)

v) Duplex

w) Others (please specify) …….

Section C: Health Status of the Respondents

5) Anthropometry

Name	Body Weight (Kg)		Body Height (M)

6) Blood Pressure range for the past 4months :Systolic / Diastolic

7) Do you have a family history of hypertension? Yes No

8) Do you smoke ? Yes No

9) Do you drink Alcohol regularly? Yes No

Section D: Dietary Pattern profile assessment using Food Frequency Question

Please indicate how many times a day u consume these food items in their group

S/N	Food group (no. of food items)	Food items	No of Times these foods are consumed in a day	Total
10	**Cereals and grins**			
		Bread,		
		Macaroni		
		Corn Flex,		
		Popcorn,		
		Homs,		
		Falafel,		
		Biscuits		
11	**Fish, poultry and meat**	snail		
		Eggs,		
		Sausage,		
		Fried Fish		
		Roast Beef,		
		Chicken Soup,		
		Tuna With Oil, , ,		
		Fried Chicken		

		Kofta Kebab Meat		
		Poached Chicken,		
		Grilled Chicken,		
		Boiled Lamb		
12	**Beverages**			
		Concentrated Orange Syrup, ,		
		Grape Juice		
		Instant Coffee,		
		Milk (Cappuccino),		
		Coca Powder With Whole		
		Apple Juice		
		Aerated Cola Drink		
		Minutes Milk		
		Fresh Orange Juice		
		Canned,Unsweetened Juice,		
13	**Sweets and baked goods**			
		Pastries (Fatayer),		
		Honey,		
		Mxid Sweets,		
		Sugar,		
		Basbousa,		
		Croissant Fatayer,		
		Biscuit With Dates,		
		Baklava,		
		Doughnuts Jam,		
		Cake,		
		Cream Desserts Konafa Cream		
		Sweet Dumpling		
14	**Dairy products**			
		Cream Cheese,		
		Full-Fat Yogurt,		
		Full-Fat Cow's Milk,		
		Low-Fat Cow's Milk,		
		Ice Cream Pillow,		
		Milk Chake		
15	**Fruits and vegetables**			

		Fresh Tomatoes,		
		Grape Leaves,		
		Orange,		
		Watermelon,		
		Apricot,		
		Coconut,		
		Vegetable Soup,		
		Dates,		
		Vegetables		
		Cooked,		
		Fava Beans,		
		Nuts Variety		
		Potato Chips,		
		Thyme,		
		Black Olive,		
		Green Salad Mixed,		
		Boiled Potatoes		
	Others	**Fufu/Garri**		
		Ukwa (bread fruit)		
		Moi moi		
		Rice		
		Beans		
		Yam		
		Coco yam		
		Plaintain		

Comment:……
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Thank you for your response