FISHING AND FISH CONSUMPTION CONTRIBUTING TO THE NUTRIENT PROFILE, DIETARY DIVERSITY AND FOOD SECURITY OF ADULT CAREGIVERS IN A COASTAL COMMUNITY IN RIVERS STATE, SOUTHERN NIGERIA.

Dissertation submitted in fulfilment of the requirements of the degree of Masters of Applied Science in Food and Nutrition in the Department of Food and Nutrition: Consumer Science, Faculty of Applied Sciences at the Durban University of Technology

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ii

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ABSTRACT

Introduction: The contribution of fishing practices and fish consumption to food and nutrition security cannot be over emphasized, particularly where large numbers of people are poor. Nutrition research has identified fish and fishery products as key components of human nutrition as well as one of the essential foods to incorporate into daily dietary food consumption based on its potential health benefits. These benefits have promoted the consumption of fish in recent times. Fish contains proteins, vitamins and fats (Omega 3 Polyunsaturated Fatty Acids) (PUFAs) among other nutrients (Domingo 2016: 979). Recently, there has been a notable increase in the harvesting of wild stocks of fish and shellfish. Oceans are currently at their maximum sustainable yields to cope with the world's growing population and the demand for fish and shellfish. Overexploitation and the use of harmful chemicals used in harvesting fish and oil exploitation are some of the core reasons for the global decline of fish. These factors pose a threat to the ecological health of marine resources (Bennette and Dearden 2014: 107) and the economy of low-income countries whose livelihood largely depends on fishing for household and national food security sources (Sowman and Cardoso 2010: 1164). In the research community of Buguma, the decline of the fish population is attributed to the corrosion of pipelines, sabotage and mishandling of oil production operations. The petroleum and gas/oil products from this mismanagement find access directly into the rivers and creeks. The residue from these substances settles on the ocean floor, endangering the ecosystem by killing marine life such as fish and seafood. To this end, food and nutrition insecurity have become evident in the community as livelihoods are dependent on fishing and fish is a primary source of protein. Food insecurity is further aggravated by the high rate of unemployment and low educational attainment. The households are left to apply certain strategies to cope with household food shortfalls. Having to employ certain strategies to cope with food insecurity, negatively affects nutrient adequacy. Thus, inadequate nutrient intake and imbalances have resulted in poor health outcomes and malnutrition.

Aim: The study aim was to determine the fishing practices and fish consumption contributing to the nutrient profile, dietary diversity and food security of adult caregivers in a coastal community.

Methodology: Two hundred and forty-seven respondents were selected using a multi-stage sampling method. The sample size was calculated using a power calculation indicating that

250 respondents represents a reliable sample out of which 247 respondents completed the research instruments. Sampling procedures were multistage (cluster and random) sampling. The study was descriptive and quantitative in nature. Research tools used to collect data were a sociodemographic questionnaire, a fishing practices questionnaire, a coping strategies questionnaire, a food frequency questionnaire, 3x24-hour dietary recall questionnaires and an anthropometric measurement questionnaire. Food frequency and food security coping strategies questionnaires were compiled through focus group discussions to establish the relevant foods consumed and the respondents were interviewed for the socio-demographic, food frequency, food security coping strategies and fishing practices data. All the respondents were also weighed and measured in order to determine Body Mass Index (BMI), Waist Circumference (WC), Waist to Height Ratio (WHtR) and Blood Pressure (BP) classified in terms of World Health Organization (WHO) reference cut-off points. Socio-demographics, fishing practices, coping strategies and food frequency data were captured on Excel spread sheets and analyzed for descriptive statistics using the Statistical Package for Social Science (SPSS) version 24.0. Data from the 24-hour recall was captured and analyzed for nutrient analysis using the MRC Food Finder® version 3.0 software and comparisons were made to the recommended nutrient standards by the World Health Organization.

Results: The mean age group was 31-50 years old. Sixty-one-point one percent (n=151) of the respondents were females and males made up 38.9% (n=96). Most of the fish caught by the respondents was used for consumption (64.0%; n=126) and the rest was used for income generation (36.0%; n=71). The community had on average a secondary school education (55.5%; n=137) and recorded high rates of unemployment (80.2%; n=198) with 62.3% (n=76) actively looking for employment. The respondents indicated that between one person (47.8%; n=118) and two people (46.2%; n=114) contributed to household income. Thirty-three-point two percent (n=82) had an average income of #21,000 to #30,000 (Rand value: R3100-R4000), while 25.5% had a monthly income of #31,000 to #40,000 (Rand value: R4100-R5000), accommodating six persons (42.1%; n=104) and four persons (22.3%; n=55) in the household. Thirty-seven-point seven percent (n=93) and 25.5% (n=63) respectively complained that the household “sometimes” and “always” had insufficient funds to buy food. This had led households to adopt certain coping strategies to combat food shortages. The most frequently used strategies per mean were: “relying on less expensive or preferred foods” (11.47 ±7.949), “limiting portion size” (9.73 ±2.593) and “restricting consumption by adults in order for children to eat” (8.70 ±6.628). The negative effect of applying these coping strategies adversely compromised nutrient adequacy. The 20 top consumed foods showed consumption of more

energy dense foods and less fruits and vegetables. The Food Variety Score (FVS) indicated that 51 different individual food items with mean ±SD of 20.83. (±6.546) from all food groups were consumed.

Vitamin K, Biotin, pantothenate, calcium, riboflavin and thiamine were below DRIs recommendation cutting across all age groups and genders. Inappropriate imbalances in food intake reflected in BMI, WC and WHtR. The mean BMI for men (25.07kg/m^2) and women (27.66kg/m^2) fells into the overweight category with a mean average of 26.36kg/m^2 for both genders and age groups while only women (95.46cm) were majorly found to be at risk for an elevated WC/ central obesity per mean average. The WHtR at risk factor affected the female gender (88.70%; n=133, 19-50 years and 88.90%; n=18, 51+ years old) compared to their male (44.4%; n=78, 19-50 years and 61.1%; n=18, 51+years) counterparts. Mean high BP for systolic (146.9mmHg) and diastolic (92.2mmHg) BP occurred in women 51+ years old. **Conclusion:** This research revealed inappropriate eating patterns and increased risk of developing NCDs. The 20 top foods consumed showed consumption of mostly macronutrients and limited consumption of fruits and vegetables across both genders and all age groups. Overweight, at risk for WC and WHtR and High Blood Pressure (HBP) were an indication of the presence of NCDs**.** Food insecurity resulting from a jeopardized fishing livelihood, high levels of unemployment and low educational attainment were the main causes of a compromised nutritional status in the research community. The introduction of nutrition education and an alternative means of livelihood will assist in addressing the current food and nutrition insecurity.

TABLE OF CONTENTS

AMDR – Acceptable macronutrient distribution
ATP – Adenosine triphosphate
AI – Adequate intake
BP – Blood pressure
BMI – Body mass index
CVD – Cardiovascular disease
CHD – Coronary heart disease
CHO – Carbohydrate
CSI – Coping strategy index
DHA – Docosahaxaenoic acid
DBP – Diastolic blood pressure
DRI – Dietary reference intake
DNA – Deoxyribonucleic acid
DUT – Durban University of Technology

DDS	–	Dietary diversity score
DFRRIFSN	–	Directorate of foods, roads and rural infrastructure food security in Nigeria
EER	–	Estimated energy requirement
EPA	–	Eicosapentaenoic acid
EAR	–	Estimated Average Requirement
EAs	-	Enumerated Areas
FGDS	–	Food group diversity score
FVS	–	Food variety score
FSTG	–	Food security thematic group
FBDGs	–	Food based dietary guidelines
FFQ	–	Food frequency questionnaire
FAO	–	Food and Agricultural Organization
GDP	–	Gross domestic product
GHI	–	Global hunger index
GR	–	Green revolution
IREC	–	Institution Research Ethics Committee
LRBDA	–	Lower Rivers Basin Development Authority
MDGs	–	Millennium Development Goals
MUFA	–	Monounsaturated fatty acid
NAR	–	Nutrient adequacy ratio
NALDA	–	National Agricultural and Land Development Authority
NGOs	–	Non-governmental organizations
NFCRP	–	National food crisis response program
NSPFS	–	National special program of food security
NADE	–	National Agricultural Development Fund
NMBFBS	–	National Manpower Board and Federal Bureau of Statistics
NNPC	–	Nigeria National Population Commission
NCDs	–	Non communicable diseases
OFN	–	Operation Feed the Nation
PAL	–	Physical activity level
PEM	–	Protein energy malnutrition
PCBs	–	Polychlorinated biphenyls
PUFA	–	Polyunsaturated fatty acid

RNA	–	Ribonucleic acid
RDA	–	Recommended dietary allowance
RAE	–	Retinol activity equivalent
SDGs	–	Sustainable Development Goals
SD	–	Standard deviation
SPSS	–	Statistical package for social sciences
SAFBDGs	–	South African Food Based Dietary Guidelines
SBP	–	Systolic blood pressure
UN	–	United Nations
UNICEF	–	United Nations International Children's Emergency Fund
USFDA	–	United Nations Food and Drug Association
UL	–	Tolerable upper intake level
WHO	–	World Health Organization
WC	–	Waist circumference
WFS	–	World Food Summit

LIST OF SYMBOLS

%	-	Percent
>	-	Greater than
≥	-	Greater than or Equal to
<	-	Less than
≤	-	Less than or Equal to
Mg	-	Microgram
$	-	US Dollar
#	-	Naira
MmHg	–	Millimeters of mercury
cm	-	Centimetres
n	-	Sample size number
g	-	Grams
kg	-	Kilograms
kJ	-	Kilojoule
m	-	metre/s
mg	-	milligram
CI	-	Confidence Interval

P	-	Percentage
R	-	Rand
SD	-	Standard Deviation
Z	-	Z value

LIST OF TABLES

LIST OF FIGURES

LIST OF ANNEXURES

CHAPTER 1
THE PROBLEM AND ITS SETTING

1.1 INTRODUCTION

The contribution of fishing practices and fish consumption to food and nutrition security and livelihood cannot be over emphasized, particularly where large numbers of people are poor. Livelihood is defined as any work done by an individual that provides income, a means of sustenance and maintenance for an individual to survive. Fishing is the main source of livelihood for the coastal dwellers in many countries and serves as a source of the right to food (economic access and dietary diversification) and other necessities of life. In other words, fishing is the purchasing power and fish consumption is the direct source of nutrient intake (Martin, Lorenzen and Bunefeld 2013: 738; Belton and Thilsted 2014: 59; Albert and Igbokwe 2014: 103).

However, there is a notable decline in the marketable harvest of wild stocks of fish and shellfish. Oceans are currently at their maximum sustainable yields to cope with the world growing population's demand for fish and shellfish. Since the late 1980s, maintaining a global commercial harvest of ocean fish at approximately 100 million metric tons (mmt) has remained a huge concern (Odebiyi and Olaoye 2012: 1). The decline in fish and shellfish has been aggravated by overexploitation, pollution and illegal human activities. These factors posed threats to the ecological health of the marine resources (Bennette and Dearden 2014: 107) and low-income countries whose livelihood hugely depended on fishing for household and national food security (Sowman and Cardoso 2010: 1164). The concept of fish decline occurred globally as two-thirds of the world's fish stocks were at their limit or over fished. The United Nations (UN) Food and Agriculture Organization (FAO) estimated that seventy percentage of the fish population was entirely used, overused or in a disaster phase (Ele *et al*. 2013: 524).

Research has explored vulnerabilities in resource dependent economies and societies and exposed the links between natural resource depletion over time and economic decline within communities. Lack and diversification of sustainable livelihoods could tend towards poverty and food insecurity and possibly nutrition insecurity (Cullen-Unsworth, Nordlund and Paddock 2014: 387). Poverty is the incapability or lack of resources to improve one's life economically, socially, politically or otherwise. One of the major causes of poverty is low or no education

attainment. Poverty perpetually affects food availability, giving birth to food insecurity (Akwara *et al*. 2013: 1). Food insecurity indicates a constant limitation to access food due to a lack of money and other resources. The state of food insecurity in the world was estimated to have affected more than 217 million undernourished people (Chinnakali *et al*. 2014: 227). Food insecure households experienced a reduction in energy intake (quantity), diet quality and diversification and thereby nutrition insecurity and malnutrition became evident (Ghattas, 2014).

Godfray and Garnett (2014) further affirmed that the food of one billion individuals was lacking in energy, and the same number of people suffered from energy excess disease, and two billion suffered from the "hidden hunger" of micronutrient deficiency. Thus, an ample percentage of the world's seven billion people were described as being malnourished.

Malnourishment is a direct consequence of malnutrition while malnutrition is one of the serious consequences of food insecurity involving health challenges and has huge economic implications. (Chinnakali *et al*. 2014: 227). The undesirable consequences of food insecurity across life progression include physical deficiencies and deprivation and emotional instability among others and represent severe, yet preventable, public health problems (Robaina and Martin 2013: 159; Laraia 2013: 204). Robaina, Martin and Laraia further reiterated that stress and depression, irregular food availability, food shortages and dependence on high energydense foods are all associated with food insecurity. Malnutrition reflects the deficiencies, excesses and imbalances of a person's intake of energy and nutrients. Malnutrition covers two broad groups of conditions: undernutrition (stunting and wasting) and over nutrition (overweight, obesity and diet-related non-communicable diseases) (World Health Organisation

(WHO) 2018). The United Nations International Children's Emergency Fund's (UNICEF) conceptual framework has proven to be relevant in describing various forms of malnutrition as well as the intergenerational effects of poverty and poor nutrition. The double burden of malnutrition was reported to exist not only within communities but also within households and individuals (Ghattas 2014). Furthermore, households that comprise of both underweight and overweight persons have also been identified in low and middle income countries with possible underlying causes related to rapid changes in food supply, age specific risks, or reduction of energy requirements, infectious diseases, behavioral or nutritional lifestyle factors, or genetic

and environmental risk factors (Steyn and Mchiza 2014: 89-90). Malnutrition could further be worsened, if caregivers in the households has little or no knowledge of food nutrients. The term "caregiver" or "family caregiver" applies here to a person who cares for relatives and loved ones. The care recipient could be a member of the caregiver's family of origin such as special friend, neighbor, support group member or life partner. In other words, it could be one who prepares food, performs chores and provides for the household (Flewell, Levine and Freedman 2005: 5).

1.2 BACKGROUND TO THE PROBLEM: GLOBAL PERSPECTIVE

Coastal regions around the world remained a major source of economic activity and income generation (Senapatia and Guptab 2017: 90). Food producing livelihoods are regularly presumed to enhance household food and nutrition security among individuals who are involved in it. Reiterating that, fish shared a pivotal part in feeding the world's populace and contributing meaningfully to dietary protein consumption of hundreds of millions of the population universally (Belton and Thilsted 2014: 59).

However, in spite of the accolades, the vast population of the world's fifty million anglers remain food insecure. Considering why those involved in food production are often food insecure is a somewhat complex matter relatively termed "livelihood of last resort" and "fishing nets to dinner plates". The dynamics of the production system are hindered by such features as fish stock reduction, human illegal activities, pollution of all kinds, collapse of the ecosystem, price fluctuations, climate change and the world's fish crisis due to a five-fold increase in fish consumption in an ever-growing population and changes in dietary preferences (Ele *et al*. 2013: 524; Martin, Lorenzen and Bunefeld 2013: 737; Fiorella *et al*. 2014: 851; Barner *et al*. 2015:

252).

These factors (overexploitation) have caused the world's catch to experience stagnation and a decline in fish availability, accessibility and utilization since the late 1980s (Kolawole, Williams and Awujola 2010: 668). Kenya had one such experience, where current documentation suggested a depletion in fish catches, notwithstanding the efforts made towards fishing sustainability (Fiorella *et al*. 2014: 852). Barner *et al.* (2015: 252) further affirmed that exploitation was projected to grow dramatically in the coming decades. In southeast Asia, the

amount of overexploited marine life is steadily on the increase. Estimated economic loss caused by a global fish stock decline had amounted to two trillion US dollars for the past three decades and an approximate 15% potential decline of fish stock was expected to occur in the near future (Ferrol-Schulte *et al.* 2015: 163).

The current fish overexploitation, pollution of marine resources and other illegal human activities globally, threatened food provision and in many cases jeopardizes communities that rely on fisheries for food and livelihoods (Barner *et al.* 2015: 252). This affects food security, as fish contribute to food security directly as a primary source of dietary protein and indirectly as a source of income to buy food in fish-dependent communities (Belton and Thilsted 2014: 59; Fiorella *et al*. 2014: 851-852). Affected livelihood invariably affects food availability, accessibility and utilization in conjunction with the recent global increase in food prices, increasing hunger in a good number of poor households who rely on food purchases to obtain calories and energy (Carletto, Zezza and Banerjee 2013: 30; Carletto *et al*. 2015: 945; Godfray and Garnett 2014: 1).

Perpetual elevation in the world's population and the deteriorating state of the environment creates a burden on food and nutrition security This huge challenge calls for reorganization and new ways of tackling setbacks in the food system (Golden *et al.* 2016: 1). The structuring of the food system is ineffective, as affluent individuals consume food in excess and suffer some health consequences while others go hungry and suffer micronutrient deficiency (hidden hunger). The issues of unsustainability and nutritional imbalance in the ever-growing population remain huge environmental concerns, along with the inability of policy makers to develop viable food provisioning systems that ensure access to enough of the right kind of food to meet the nutritional needs of all (Proceedings of the Nutrition Society Scottish 2013: 29; Godfray and Garnett 2017: 1).

To further aggravate the issues of insufficiencies and deficiencies in the global food system, fish depletion was another contributory factor, as Golden *et al.* (2016: 317) calculated that 1.39 billion individuals globally (nineteen percent of the world's populace) were susceptible to food shortages because fish added up to about twenty percent of their food consumption. Further estimation revealed that 845 million individuals (11% of the current world population) were

expected to be lacking in one of the aforementioned micronutrients if present trends in fish decline persisted (Youn *et al*. 2014: 142; Belton and Thilsted 2014: 59; Golden *et al*. 2016: 318).

1.3 BACKGROUND TO THE PROBLEM: AFRICAN PERSPECTIVE

Fishing livelihoods in Africa are of precise concern as ninety percent of the fish workers operate on a small scale (Fiorella *et al*. 2014: 851). Martin, Lorenzen and Bunefeld (2013: 737) further argued that fishery businesses in the developing world majorly processed and traded (processing and marketing) on small scales. On estimate, 93,0000 to 97,0000 individuals were directly involved in small-scale fishing, out of which fifty-one million were operating in inland fisheries. Fish contains micronutrients of high biological value (calcium, iron, vitamins and minerals) and low cholesterol content (fat) necessary to improve and enhance human nutrition (Kolawole Williams and Awujola 2010: 669). Most of the nations that relied greatly on fish for nutrition were in the emerging countries. Adding to that, an estimated twenty percent of the people's animal-based food from these countries by bulk was seafood (Golden *et al*. 2016: 318).

Furthermore, in low- and middle-income countries, fish and fisheries products made an irreplaceable contribution to food and nutrition security, where a good number of the population relied heavily on aquatic resources as a means of survival (Ferrol-Schulte *et al*. 2015: 163). This was particularly seen in countries such as Bangladesh, Cambodia, Ghana, Nigeria and the Pacific islands, where the majority of the populations were impoverished and susceptible to acute food scarcity. Fish was the most commonly consumed animal food source which became a dilemma as fish populations were declining (Belton and Thilsted 2014: 59). The success of fishery resources to meet minimal nutritional requirements rests on fluctuations between availability, accessibility and utilization (Fiorella *et al*. 2014).

Deprived persons have fewer replacements to make up for these impending deficits in accessing micronutrients. Most of the good sources of nutrients (meat, eggs, vitamin supplements and imported fish) can be excessively costly. Communities or households are left with no choice other than to depend on what their income can afford, which in most cases are less-healthy processed foods. The three pillars of food security: availability, accessibility and utilization are inevitably affected (Golden *et al*. 2016: 318; Ajani 2010: 161). Furthermore, consumption of less-healthy food over an extended period could lower the efficiency of the immune system, thereby resulting in diseases and sicknesses. Individuals with compromised

health lack the strength to participate actively in livelihood activities (such as accessing fish and other seafood). Household income, food production and nutrition security will be adversely affected and ultimately, food insecurity will be the result (Fiorella *et al.* 2014: 852).

Food security is directly proportional to dietary diversity. Dietary diversity ensures adequate nutrient intakes among food groups. Food-based dietary guidelines recommend eating a variety of foods across and within major food groups. The resultant effect is associated with improved or favorable nutritional status. Additionally, there is an inverse relationship between dietary diversity and diseases such as heart disease, cancer, type 2 diabetes, obesity and overweight (Non-Communicable Diseases (NCDs). Currently, NCDs affect more individuals in developing nations, accounting for 80% of all NCDs-related deaths. NCDs have been on the increase in recent times due to nutrition transition and modification in dietary eating patterns with economic development and urbanization of developing societies leading to adverse health consequences. Specific foods and nutrients or overall dietary patterns can influence human health either positively or negatively. Consumption of highly processed food and reduced intake of fruits and vegetable can result in NCDs such as cancers, cardiovascular diseases and type 2 diabetes due to excessive weight gain. In other words, there is an association between dietary intake and the epidemiological state or well-being of an individual (Ezzati and Raboli 2013: 958; Vorster, Badham and Venter 2013: 5; Shetty 2013: 21).

1.4 BACKGROUND TO THE PROBLEM: NIGERIAN PERSPECTIVE

Nigeria is endowed with a human population of over 160 million people in addition to rich vegetation and rich water resources of approximately two hundred and fourteen billion m^3 of surface water and 87 km^3 of ground water, both of which are proficient in sustaining a huge population of livestock and providing more than adequate crop irrigation. The large bodies of water also yield sufficient fish and fish products not only for local intake but also for export. Fishing communities in Nigeria are mostly situated on the Atlantic coastal region of the southern part of the country. Most occupants of these communities are mainly subsistence fishers whose daily meals depend on it. Fish consumption plays a substantial role in Nigerian meals, providing about 75% of the protein intake of the total animal protein, particularly in coastal domains. It further creates a means of livelihood for the unemployed, illiterate and poor populace. Fishing is expected to address household food insecurity for individuals whose livelihood depends on it, in which every member in the household has direct (subsistence fisheries) and indirect (revenue generation) access to safe, nutritious and sufficient food

(Kolawole, Williams and Awujola 2010; Nigerian National Population Commission (NNPC) 2011; Oladimeji *et al*. 2014: 13).

Conversely, Nigeria, just like any other country in the world, is also experiencing a decline in fish stocks as marine resources are adversely affected by pollution from petroleum production activities, particularly, the Niger Delta region where data from this study was collected (Amao, Oluwatayo and Osuntope 2006: 25; Pinstrup-Andersen 2009; Gomma and Rana 2007: 145; Kolawole, Williams and Awujola 2010: 669; Olaji *et al*. 2014: 109).

Amao, Oluwatayo and Osuntope (2006: 25) delineated that oil exploitation and exploration in Nigeria had truncated, or decreased, the availability of sources of income for coastal dwellers whose livelihood depends on fishing. The daily catch was drastically reduced due to oil spills and damage to the ecosystem. About one thousand oil wells and about 47,000 km of oil and gas flowlines are situated in the Niger Delta rivers and creeks (Zabbey 2013: 391). Ikechukwu (2012: 103) attributed the causes of damaged livelihood to the corrosion of pipelines and tanks, sabotage, accidents and mishandling of oil production operations. The petroleum and gas/oil products from this mismanagement find direct access into rivers and creeks. The residue from these substances settles on the ocean floor, endangering the ecosystem by killing marine life such as periwinkle (*Tympanotonue fuscatus*), oysters (*Crassostrea gasar*), swimming crab (*Ikoli*) (*Callinectes spp*), cockles (*Anadara, senilie*), whelk (*Thais coronata*), clams (*Tagelus adansornia*) and other marine produce, thereby decreasing the yields of edible shellfish and fish. Oil spills put at risk fish hatcheries in coastal waters, lessening the number of caught fish (Nwilo and Badejo 2005: 568; Albert and Igbokwe 2014: 104). Oil spills in water also contaminate the fleshiness of consumable and commercially valuable fish with an alteration in taste (Aghauno and Eyinla 2009: 179).

Oil spillage, exploitation and exploration have caused untold hardship and poverty, as the principal source of income has been either damaged or destroyed. This is further worsened as the coastal communities have no alternative source of income. Nigeria is faced with vast developmental issues particularly on employment creation (Albert and Igbokwe 2014: 104). Salami (2013: 18) reaffirmed the high rate of unemployment in Nigeria and estimated growth rates of 16% per annum, with the vast population of the youth being affected. Ajufo (2013: 308) also commented on the statistics from the National Manpower Board and Federal Bureau of Statistics (NMBFBS), which described the statistics of the unemployed and under-employed population of Nigerian youth. Records from NMBFBS stated that sixty-four million youths

were unemployed and 1600,000 are under-employed out of the total youth population of eighty million, forming sixty percent of the entire Nigerian population.

To this end, food insecurity is evident, forcing households to employ strategies to cope with it. The commonly adopted coping strategies for North Central Nigeria, as studied by Agada and Igbokwe (2014: 31), indicated that, "less preferred food (95.8%)" and "limiting portion size (83.5%)" strategies were commonly used. Another study conducted by Akerele *et al*. (2013: 407) in south-western Nigeria (Ado-Ekiti, Ekiti) also confirmed the strategy of eating less preferred foods, reducing portion size and buying less expensive food were all ways of combating short-term food shortages.

Food insecurity is defined as the limited or uncertain availability of nutritionally adequate and safe foods. Food insecurity may affect body weight in two contrasting ways: weight gain or weight loss. Weight gain results from inappropriate eating patterns predominately found in mildly food insecure households while severe food insecurity can promote weight loss due to insufficient food intake (Mohammadi *et al.* 2013: 380; Robaina and Martin 2013: 159). Golden *et al.* (2016: 317) further added that both overweight and underweight (malnutrition) predispose an individual to health risks.

Food insecurity remains a worrisome impediment to any nation as long as it is unresolved (Akwara *et al.* 2013: 1). Alleviating such an impediment can be achieved through empowerment strategies and policy development programmes that seek to improve household food security and encourage year-round eating of nutritionally acceptable meals through community-based programmes. These activities are required to happen within the structure of supporting maintainable livelihoods (Akwara *et al.* 2013: 1) such as introducing small-scale fishers to aquaculture (fish farming) and empowering them to undertake this activity. Fish farming can be multi-dimensional if properly handled and managed as it could boost food security and nutrition security. This is further relevant as overexploited stocks and ecosystems get rebuilt through decreasing fishing demand (Oluwemimo and Damilola 2013: 1). Secondly, adopting the Food and Agriculture Organization (FAO) Code of Conduct for Responsible Fisheries could assist in the reduction of the demand for wild stock. The code, established in 1995, sets out a comprehensive agreement for the maintainable, accountable and rightful use of fishery resources (Coll *et al*. 2013: 157). Thirdly, oil-producing companies should mitigate and possibly eradicate processes that kill wild stock and jeopardize livelihoods (Ikechukwu.

2012: 103).
In other words, a sustainable generation that produces viable food systems should be encouraged. Practices that enhance, or increase, malnutrition, including challenges of chronic diseases and seasonal food scarcities, lack of food variety, insufficient family care and feeding practices and deprived living standards should be abolished (Ferrol-Schulte *et al*. 2013: 253). Therefore, this study seeks to assess fishing practices and fish consumption contributing to the nutrient profile, dietary diversity and food security of adult caregivers in the Buguma community.

1.5 RATIONALE AND MOTIVATION

Food, as a biological necessity, cultural symbol and economic resource, remains literally at the centre of the household's wellbeing for rural communities around the globe. The pathway of inaccessibility, unavailability and non-utilization becomes a great cause for concern (Fiorella *et al*. 2014: 856).

Extensive research has reviewed the vulnerability of coastal occupants due to illegal human activities (pollution of various kinds and overexploitation) carried out on the marine resources (Barner *et al.* 2015: 252; Zabbey 2013: 391). The marine resources turn out to be the single livelihood (purchasing power) and nutrient intake of protein of high biological value (fish consumption). In developing countries, the majority of the population is poor and solely depends on fishing for survival and fish consumption as the major source of protein (FerrolSchulte *et al.* 2015: 163; Belton and Thilsted 2014: 59). An affected livelihood handicaps household, increasing household food insecurity and nutrition insecurity. Household food insecurity deprives households of the availability, accessibility and utilization of food sources, which is directly associated with nutrition insecurity. Nutrition insecurity is evident from a lack of or reduced intake of different food groups (dietary diversification) and probably, diet-related diseases may be the result if the practice continues for an extended time (Golden *et al*. 2016:

318; Ajani 2010: 161).

Diet-related diseases have been the leading cause of death in recent times. Consumption of less preferred foods which mostly consist of highly processed or refined carbohydrate has been attributed to certain non-communicable diseases such as cancer, type 2 diabetes and hypertension (Ezzati and Raboli 2013: 958).

1.6 NIGERIAN STUDIES CONDUCTED

Previous research studies have contributed to the body of knowledge regarding fishing and fish consumption and food security in the country and globally. Table 1.1 highlights relevant studies conducted in the past ten years in relation to fishing and fish consumption and household food security.

Table 1.1: Previous research conducted in the past ten years on fishing and fish consumption and food security in Nigeria

Title of study	Author	Measuring tools/population	Summary of results
Demand for quantity versus quality in beef, chicken and fish consumption in Nigeria	Ogundari 2012	Pre-tested structured questionnaire was used. The study randomly recruited 134 households in Ondo State.	Implication of this was that the demand for quality protein sources decreased with more money in the household. This could be a better facilitator in the hands of policy makers to improve food policy to enhance the welfare of the consumer in Nigeria.
Quantitative analysis of fish consumption in Rivers State, Nigeria	Anyanwu 2014	Structured questionnaire was used in eliciting information from the respondents. Cross-sectional data were randomly collected from 210 respondents from the three senatorial zones.	The study summarised compulsory secondary education of the citizens, viewing this as an avenue to increase the level of nutritional enlightenment which was expected to boost their levels of protein intake.
Food insecurity in Nigeria: A thematic exposition	Eme *et al*. 2014.		Ignoring the causes and consequences of food insecurity will further aggravate the challenges. Measures for addressing and resolving the issues must be dialogued and implemented among policy makers in Nigeria.
Food insecurity and coping strategies in South-West Nigeria	Akerele 2013	Data were collected from 80 households, consisting of 321 members, with the aid of a well-structured questionnaire.	Policy makers should focus on promoting gender specific programme intervention, amplified income earning for the household and accessible education for all. Home garden farms should be promoted as well.
Food insecurity in Nigeria: The Way Forward	Otaha 2013		The study concluded that sustainability and adequacy in quantity, quality and supply of food needed to be ensured for equitable economic development and human survival.

Food insecurity status of rural households during the post-planting season in Nigeria	Adepoju and Adejare 2013	3306 households constituted the sample size. 2-stage sampling was used (stratified and systematic random sampling). Questionnaire was employed as a measuring tool.	Food availability remained below the required levels for large parts of the rural populace during the planting period; recognized food insecure households should be directed to the welfare department.
Prevalence of food insecurity in Egor local government area of Edo State, Nigeria	Omuemu, Otasowie and Onyiriuka 2013	Multi-stage sampling method. A total of 416 households were studied. Pre-tested, structured, interviewer-administered questionnaire was used.	Study summarized suggestions for stakeholders to employ strategies for improvement of the current trends of food insecurity in the urban household.
Small and Medium Scale Aquaculture Enterprises (SMES) Development in Ogun State, Nigeria: The Role of Microfinance Banks	Odebiyi and Olaoye 2012	One hundred and twenty aquaculturists were studied through well-structured, validated and pre-tested sets of interview schedules, administered through personal interviews and observations.	This study drew conclusions on the relevance of microfinance bank loans for small- and mediumscale businesses in aquaculture development. It further recommended improved farmers' income earning, creating multiple strings of employment opportunities and the reduction of rural-urban migration.
Double-Hurdle Model of Fresh Fish Consumption among urban households in South-West Nigeria	Akinbode and Dipeolu 2012	Data collected from 218 households in Abeokuta, South-west Nigeria were used for the study.	The study summarised that public enlightenment on the importance, or significance, of fresh fish consumption was necessary.
The role of Tilapia in the food security of fishing villages in Niger state, Nigeria	Gomna 2011	Five local government areas in Niger State were used. About 100 households in the fishing village were randomly selected.	High preference for fresh fish was noted as indicated in the study.
Determinants of Food Security among households in Nsukka Metropolis of Enugu State, Nigeria	Arene and Anyeaji 2010	Purposive sampling techniques were used involving sixty respondents. Primary and secondary data sources were used to collect information from respondents and the ministry of Agriculture respectively.	Policies that can create a good business environment for the metropolitan poor were recommended, among others.
Analysis of the profitability of fish farming in Ogun State, Nigeria	Adewuyi *et al*. 2010	Structured questionnaire was used for data collection.	The study was undertaken in Ogun state, Nigeria and concluded that fishing was a profitable venture that was rewarding. The study further appraised that fishing has been able to create jobs, emphasizing that fishing can enhance income and improve the standard of living of individuals.
Analysis of fish demand in Sokoto Metropolis, Sokoto, Nigeria	Dalhatu and Ala 2010	180 fish consumers participated. Structured	Low income, insufficient number of fish markets and reduced

		questionnaires were used as a research tool.	number of fish farmers were viewed as the major challenges.
Indigenous fish processing and preservation practices amongst women in South-western Nigeria	Kolawole, Williams and Awujola 2010	120 women engaged in fish processing and preservation were interviewed using validated and pre-tested, structured and unstructured interview schedules.	The conclusion of this study highlighted major challenges faced by the respondents in fish processing and preservation. These challenges were listed as follows: insufficient capital for the business, low sales output, no storage facilities, logistics issues and pollution from smoke which could endanger their health.
Determinants of food insecurity among arable farmers in Edo State, Nigeria	Ojogho 2010	Primary and secondary data was used. A structured questionnaire was used to obtain primary data and stratified sampling techniques were given to select respondents.	Efforts to improve household income earning capacity, education and reduction in family size was seen as necessary for a way forward.

Previous research conducted on fishing and fish consumption and food security in Nigeria presented above sees fishing as a profitable venture, as it is able to create jobs, enhance income and improve the standard of living. However, mismanagement of the fisheries and environments had resulted in low income generation. Food availability remained below required levels for the large part of the rural populations. Therefore, sustainability and adequacy in quantity, quality and supply of food are needed to ensure equitable economic development and human survival. This also includes; the demand for quality protein and promoting gender specific intervention programme that increases income earning for all households. Education was also seen as a way of improving family earning as well as enhancing nutritional knowledge (Ogundari 2012; Anyanwu 2014: 118; Ojogho 2010: 151; Otaha 2013:

26 and Adewuyi *et al*. 2010: 179).

1.7 RESEARCH AIM AND OBJECTIVES

The main aim of the study was to assess fishing practices and fish consumption, and the contribution to the nutrient profile, dietary diversity and food security of adult caregivers in the Buguma community. Buguma is a coastal community in Rivers State, Southern Nigeria whose means of survival solely depends on marine resources (fishing and sea business).

1.7.1 Specific Objectives of the study

- To determine the socio-demographic profile of the target households including their fishing practices.
- To assess the food consumption pattern of the community using 3 x 24-hour food recall questionnaires.
- To determine the dietary diversity of the community through the use of Food Frequency Questionnaires (FFQ).
- To assess food insecurity at the household level using the Coping Strategy Index.
- To assess the cardiovascular health of the respondents through measurement of their blood pressure.
- To assess the nutrition status of respondents by determining Body Mass Index (BMI) and Waist to Height Ratio (WHtR).
- To determine relationships (correlations) between variables.

1.7.2 Conceptual framework of the study

The conceptual framework of the research study is represented in figure 1.1.

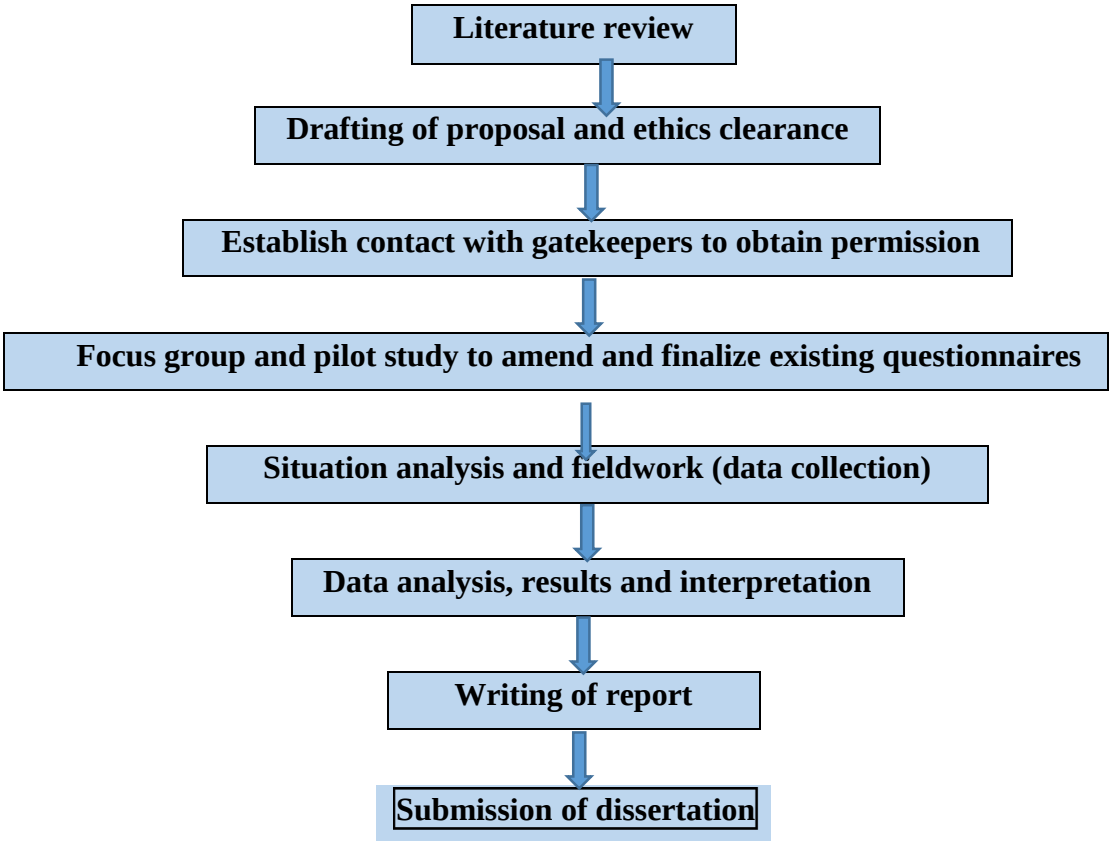

Figure 1.1: Conceptual framework of the study

1.8 STRUCTURE OF THE DISSERTATION

An overview of the dissertation is presented in figure 1.2, summarizing each chapter of the research study.

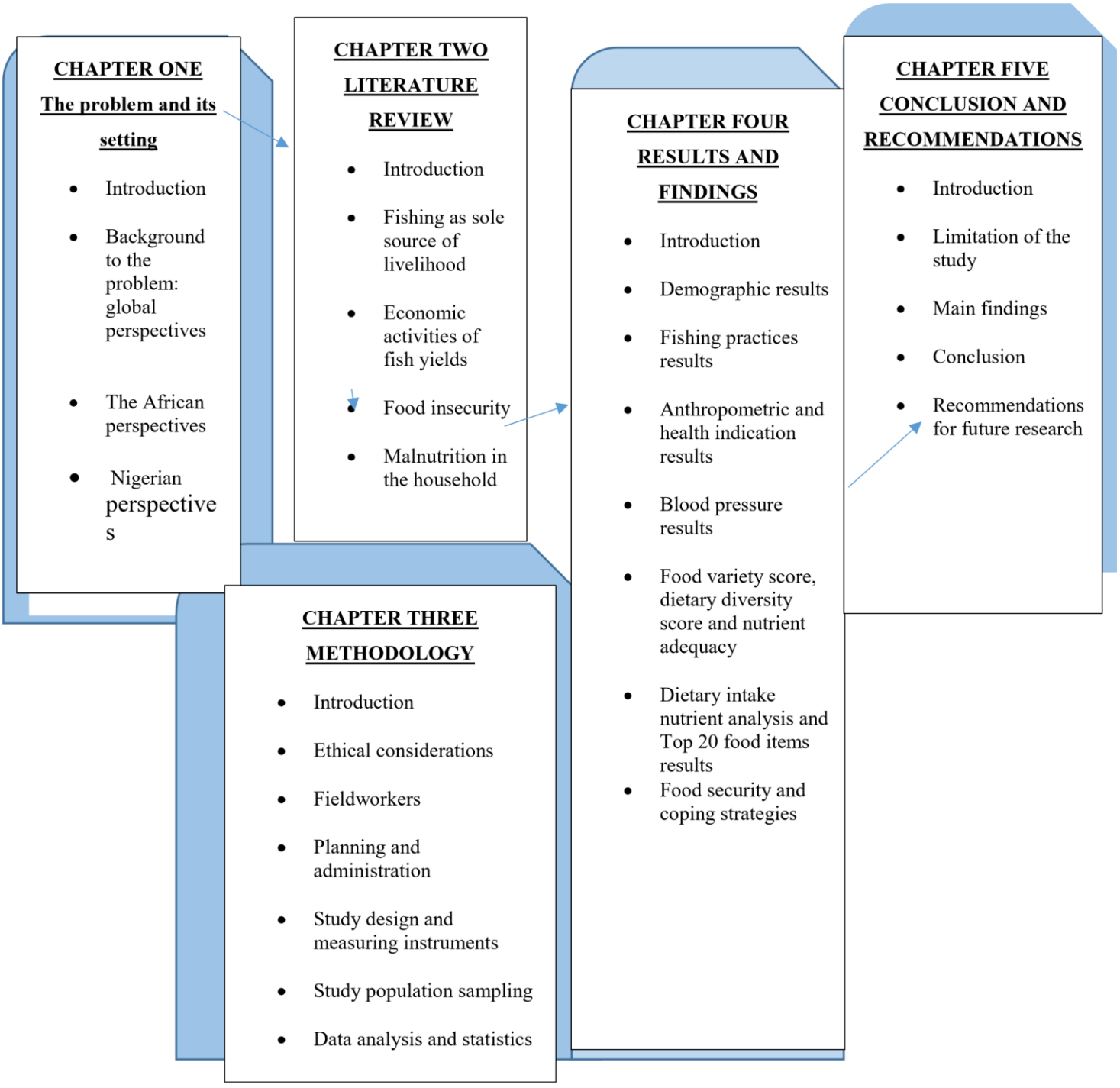

Figure 1.2: An overview of the dissertation

1.9. CONCLUSION

Declining fish populations resulting from overexploitation, pollution and other illegal human activities poses a great concern. As such, the Food and Agriculture Organization (FAO) of the

United Nations implemented and adopted the Code of Conduct for Responsible Fisheries to address the fish decline. However, the code still lacked full application globally (Coll *et al* 2013: 157). The original concept of this code was to stop dilapidation processes and safeguard the sustainability of fisheries. Studies conducted locally and internationally vividly stated the importance of livelihood sustainability in addressing food insecurity and nutrition insecurity (FAO 2015).

The research is a situational analysis and descriptive study. The dissertation contains five chapters and is structured as follows:

- Chapter one – The problem and its setting
- Chapter two – Literature review
- Chapter three – Methodology
- Chapter four – Results and findings
- Chapter five – Conclusion and Recommendations.

CHAPTER 2
LITERATURE REVIEW

2.1 INTRODUCTION

Food, one of the rudimentary necessities for the sustenance of life, needs to be adequate in quality and quantity for a healthy and productive life (Omuemu, Otasowie and Onyiriuka 2013: 139). Foods containing essential nutrients aid proper functioning of the body. The nutrient requirements are greatly influenced by age and activity levels, among other factors. Macronutrients (carbohydrate, protein and fat) and micronutrients, the two major nutrient groups, are necessary in daily meal consumption, to help optimize nutrient requirements (Awosan *et al*. 2014).

Fish contains a handful of these nutrients, and nutrition research has identified fish and fishery products as key components of human nutrition as well as being one of the essential foods to incorporate into daily dietary food consumption based on their potential health benefits. These health benefits have promoted the consumption of fish in recent times. Fish contains proteins, vitamins and fats (omega 3 polyunsaturated fat acids) (PUFAs)) among other nutrients (Domingo 2016: 979). Fish species containing these properties are sardines, mackerel, herrings, lake trout, salmon, anchovy, tilapia, catfish, prawns, periwinkles, clams, mangrove oysters, catfish, mackerel, shrimps and bluefish. Consumption of fresh fish is preferable as it is easily digested and can be directly utilized by the human body, which makes it appropriate for complementing the high carbohydrate foods in low-income countries. Consumption of 250 mg per day is encouraged (Kolawole Williams and Awujola1 2010: 669; Mafimisebi 2012: 2; Raatz *et al*. 2013: 108).

Furthermore, fishing enhances the development of local economies, particularly subsistence fishing (Mahanty *et al*. 2014: 39). Estimates indicated that ninety percent of the thirty-eight million fishers and fish-farmers globally were operating on a small scale and approximately one hundred and thirty-five million were working directly or indirectly in small-scale fisheries and aquaculture in Africa. This could have resulted in food security for two hundred million individuals and the wages of about ten million (Anene, Ezeh and Oputa 2010: 98; Sowman and Cardoso 2010; Béné, Barange and Subasingh 2015: 261).

Similarly, Asia and Latin America's dependence on subsistence fishing for quality protein and income source is still relatively high. Global marine resources provide about 170 million jobs and it is estimated that one billion people depend on fish as their basic source of animal protein, accounting for not less than ten percent of fish supplies for total animal protein eaten in Europe and North America, seventeen percent in developing countries and twenty-six percent and twenty-two percent in Asia and China respectively (Ferrol-Schulte *et al*. 2013: 253-255; FerrolSchulte *et al*. 2015: 163).

Concomitantly, food security is certain from the benefit and profits derived from fishing business and fish consumption as explicitly enumerated by the previous authors. Food security, as stated by Huet *et al*. (2012) and Porter *et al*. (2014: 489), exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life. This definition was accepted globally during the World Food Summit (WFS) in 1996 and emphasized four key words, namely: food availability, food access, food utilization and food stability. The definition clearly states that food must be available before an individual can access it and it also bring into play the issue of food quality and cultural preferences (Carletto, Zezza and Banerjee 2013: 31). Food security is required to sustain an ideal nutritional status although it is not a prerequisite for nutrition security but rather a condition for eating healthy foods, which denotes not only adequate amounts of food (in terms of calories) but also adequate value (relating to diversity and micronutrient make-up) (Ghattas 2014). Food security is multidimensional, taking into account different measures to combat food insecurity.

However, a sustainable livelihood, or source of income is pivotal, among others, for a household to be food secure. Food-producing livelihoods are faced with challenges just like any other income sources (Cullen-Unsworth, Nordlund and Paddock 2014: 387). In the fisheries sector, the issues of unavailability due to over-exploitation and pollution, and inaccessibility as a result of inadequate policy formation and lack of proper utilization in terms of quantity and quality continue to be a concern. The resultant effect has heightened food insecurity locally and internationally as the number of malnourished individuals remains highly prevalent. A Food and Agriculture Organization (FAO) documentary showed that seven hundred and ninety-five million individuals were malnourished globally (FAO 2015). The study by Golden *et al*. (2016: 1) also reaffirmed a high prevalence of undernutrition and postulated that eight hundred and forty-five million individuals (eleven percent of the world's

then populace) were likely to have deficiency in either zinc, iron or vitamin-A if the decline in fish catches prevailed. Although micronutrients are needed by the body only in minute quantities for proper growth and development, deficiencies can increase the risk of perinatal and maternal mortality, growth impairment, cognitive impairment and lowered immune activities (Hakim and Kamruzzaman 2015: 332).

This chapter summarizes previous studies on fish consumption and fishing practices, the nutrient composition of fish, food security, malnutrition and remedies. Its further reviews previous literature on adult macronutrient and micronutrient requirements including nutrition assessment tools and other health parameters.

2.2 FISH CONSUMPTION AND NUTRIENT COMPOSITION

Fish is a rich source of protein of high biological value and containing a variety of micronutrients (calcium, selenium and zinc) (Mahanty 2014: 39). Fish is important, especially for its omega 3 fatty acid complex profile, which is essential for healthy brain and heart function. Other benefits include reducing inflammation and the risk of heart disease and it is also beneficial in promoting pre- and post-natal development. The American Heart Association has endorsed the consumption of fatty fish such as salmon, lake trout, sardines and albacore tuna because of their richness in omega-3 fatty acid and has further recommended consumption of fatty fish at least two times in a week to provide an average of 250 mg per day of long-chain omega-3 fatty acids for healthy individuals and those with cardiovascular disease (CVD). Furthermore, fish, being a healthy protein source, plays a significant role in the prevention of diseases linked to malnutrition (Beveridge *et al*. 2013: 1069; Howarth 2014: 691; Papanikolaou *et al*. 2014: 2).

However, the United States Food and Drug Association (USFDA) advises that pregnant women should consume eight to 12 ounces of fatty fish per week while children are to eat two to three servings of an appropriate portion of a variety of fish and sea foods that are low in mercury. The Association also suggested that individuals in the aforementioned stages of life be cognizant of the minor risks associated with eating fish such as shark, swordfish, mackerel and tilefish because of the possible contaminants from waste, such as mercury and polychlorinated biphenyls (PCBs). However, for other individuals, the benefits derived from

fish intake outweigh the risks (United States Food and Drug Administration 2014; Bodin *et al.* 2014: 70; Basu *et al*. 2014: 66-67; Domingo 2016: 980).

The total fish supply and consumption has increased at a rate of 3.6 percent each year since 1961, while the global populace has been increasing at 1.8 percent each year. The proteins derived from fish, (particularly crustaceans and molluscs) range between 13.8 percent and 16.5 percent. The obvious per capita intake increased from approximately 9kgs per year in the early 1960s to 16kgs in 1997. In other words, the per capita intake obtainable from fish and fishery produce has approximately doubled. The motivating factors that influence consumer behaviour and lead to a rise in demand for different types of fish and other food commodities are urbanization, lifestyle and dietary habits. The motivating influences differ from one region to another. The prime motivating or influencing factors for Africans are likely to be limited protein sources and obtainability while in the western world, increased demand may be due to improved consumer consciousness of the health and nutritional benefits of fish (Belton and Thilsted 2014: 59; Béné, Barange and Subasingh 2015: 261; Golden *et al*. 2016: 318).

Table 2.1. gives a rundown of some micronutrients and omega 3 polyunsaturated fatty acid content of some fish species. The usual and scientific name are also enumerated.

Table 2.1: Micronutrient and Omega 3 polyunsaturated fatty acid content of some fish species (Modified Source: Belton and Thilsted 2014)

Usual name	Scientific name	Vitamin A (RAE)a	Calcium (g)	Iron (mg)	Zinc (mg)	EPA (mg)	DHA (mg)
Channel catfish	*Ictalurus punctatus*	0.3	0.8	0.2	0.5	17	57
Common carp	*Cyprinus carpio*	9	0.4	1.2	1.5	283	114
Tilapia	*Oreochromis spp*	0	0.1	0.6	0.3	5	86
Atlantic herring	*Clupea harengus harengus*	28	0.6	1.1	1.0	709	862
Atlantic mackerel	*Scomber scombrus*	50	0.1	1.6	0.6	898	1401
European anchovy	*Engraulis encrasicholus*	15	1.5	3.3	1.7	538	991
Pacific herring	*Clupea harengus pallasi*	32	0.8	1.1	0.5	969	689’

Eicosapentaenoic acid (EPA), Docosahexaenoic acid (DHA) and Retinol Activity Equivalent (RAE),

2.3 SOCIO-DEMOGRAPHICS AND LIVELIHOOD

Fish plays an important role in food and nutrition security and several African countries have become leading exporters of this commodity. Substantial quantities of the fish were eaten by subsistence fishers and their families, substituting it as a main source of protein in their diet, and Nigeria seemed to be one of the largest consumers of fish in Africa (Olale and Henson 2012: 235; Mahanty2014: 39; Ozigbo *et al*. 2014: 1138; Béné, Barange and Subasingh 2015: 261). Fishing communities consisted of self-employed groups of people and were mainly small-scale fishers (Nayak, Oliveira and Berkes 2014: 1). Capture fisheries supported food security through resources provision and consumption, and it was estimated that 54.8 million persons were involved in the major segment of capture fisheries and aquaculture, out of which 38.2 million (seventy percent) were involved in wild stock fisheries (Belton and Thilsted 2014: 61). Global commercial and subsistence fishers in the year 2002 numbered about thirty-eight million, triplicating the number estimated in 1970. From this total number, twenty percent were aquaculturists and seventy-four percent were wild stock fishers. Adding to that, most of the progress occurred in Asian nations, where four-fifths of global fishers resided (Abdul Hakim and Kamruzzaman 2015: 333). Furthermore, the Kenyan fisheries industry had a landed value of about one million US dollars in 2008, which made up approximately 0.5 percent of the entire GDP, whereas total Kenyan fish exports were valued at an estimated fifty million dollars, and this industry served over three hundred thousand individuals (Olale and Henson 2012: 235). In Nigeria, artisanal fishers reported catches of 418,069 tons in 2000, 433,537 tons in 2001, 450.965 tons in 2002, 446,203 tons in 2003, 434,830 tons in 2004, 513,332 tons in 2005, 55,332 tons in 2006 and 504,227 tons in 2007) (Martin, Lorenzen and Bunnefeld 2013: 745). Furthermore, Martin et al. attributed the fundamental development of the local economies to fishing and further described households who fish purposefully as symbols of wealth in society.

Table 2.2 shows capture fisheries in some countries including production and consumption.

Table 2.2: Production and consumption of capture fisheries in selected countries (data adapted from Belton and Thilsted 2014)

Country	Total capture fisheries' production (million tons)	Global rank in total capture fisheries production (million tons)	Annual capture fisheries growth rate,1990–2011 (%)	Fish intake per capita (kg/year)	Fish intake as % age of total animal-source of food consumption	Fish as a percentage of animal protein
Bangladesh	1.6	15	4.4	18.7	41.8	56.5
China	15.5	1	4.2	31.6	27.4	22.3
Egypt	0.4	40	1.9	16.5	20.2	39.5

India	4.3	5	2.1	5.4	6.6	16.8
Indonesia	5.7	3	4.0	25.2	46.1	53.7
Myanmar	3.3	8	7.5	50.4	42.7	45.4
Nigeria	0.6	26	3.5	13.9	39.7	41.1
Philippines	2.4	11	1.2	35.8	39.4	42.6
Thailand	1.8	13	1.4	24.5	29.3	32.0
Vietnam	2.8	10	5.7	32.2	31.5	35.3

2.4 FISH EXPLOITATION AND DECLINE

A number of researchers have repeatedly warned against the progressive rate of fish overexploitation and the resultant decline in fish stocks. Over-exploitation of fish for human consumption was the prominent driver of global biodiversity decline and local elimination of species. Over-exploiting reduces rate and density of fish species, affects food nets and natural developments widely (Wittemyer *et al.* 2014: 13117). The total level of capture fisheries reported internationally in the 1980s was estimated at eighty percent and five hundred and twenty-three global fish stocks were overexploited and have declined (Howarth *et al*. 2014: 691; Golden *et al*. 2016: 318; Thilsted *et al*. 2016: 126).

Among West African countries, overexploited and declined fisheries and products are predominantly high, as a result of various forms of illegal human activities. For instance, in Benin Republic, the increasing number of declined fishes are the result of the wide use of chemicals. Reports have stated that the chemicals (endosulfan, heptachlor) have an endocrine action, which has the ability to damage the reproduction of wildlife populations. The anglers drop this pollutant directly into the water to catch fish at low water phases, which possibly alters fish reproduction and growth processes. Both mature and premature fish are hugely affected as harvested fisheries rates are massive through this mode compared to the conventional trawler methods of harvesting fish (Agbohessi *et al*. 2015: 569).

In the same manner, the study of Belhabib, Greer and Pauly (2018: 1) from Senegal attributed fish decline to the use of certain fishing gear that also has harmful effects on the ecosystem. Catching of non-targeted species and habitat alteration by trawlers thus eventually adds to the progressive decline of fish stocks. In Nigeria, oil spillage and exploitation is the prime cause of fish and seafood decline. The residue from the oil spillage settles on the ocean floor, killing edible seafood and fish. Sabotage, oil bunkering, lack of maintenance of engineering equipment and tanker's accidents are the recognized causes of oil spills. Although oil

production and sales in Nigeria contributes to more than 40 percent of GDP, 80 percent of the nation's income and above 95 percent of exports and moderate production of approximately two million barrels each day, the impact on the oil generating areas (Niger-Delta) is grievously harmful and immeasurable. These consequences are particularly seen in regions whose occupation is agriculturally based (farming and others). Oil production has caused environmental catastrophes in these areas (Ite *et al.* 2013: 78; Ajide and Isaac 2013: 236; Ebegbulem, Ekpe and Adejumo 2013: 280-281; Elum, Mopipi and Henri-Ukoha 2016: 12882).

Consequently, fishing businesses are adversely affected to varying degrees in Nigeria. Lowincome generation is evident resulting from negatively affected agricultural livelihoods caused by oil exploitation. In other words, fishers and farmers in polluted communities recorded lower income generation compared to the non-polluted communities (Ebegbulem, Ekpe and Adejumo 2013: 280-281; Elum, Mopipi and Henri-Ukoha 2016: 12881). Action for maintenance and sustainability of livelihoods needs to be initiated to reduce the suffering of these communities. In resolving issues, the populace in question should not be spectators. If the fishing communities (people) develop a consciousness that continuous fisheries rely on targeted stock maintenance and an unaffected ecosystem for stock yields, then applied working measures for protecting the livelihood could be adhered to and sustained (Charles *et al.* 2016: 165). In other words, livelihood users (anglers) and the whole community should be part of the decision-making. By participating, substantial advances in poverty reduction and intervention programmes targeted at rural livelihoods sustainability are actualized (Guatam and Andersen 2016: 239).

Furthermore, poor households mostly relied on a single source of livelihood. Lack of livelihood diversification and sustainability constantly left the household food insecure whenever there was a shortage and damage from the one source (Rakodi 2014: 26). Livelihood diversification was a dynamic community strategy to secure and enhance the living standards of the people through the consistent adapting and safeguarding of an extremely varied collection of income generation activities over time (AloboLoison 2015: 1125). Livelihood diversification was also viewed from the perspective of commonly applied approaches for managing financial and environmental stocks and was instrumental in poverty reduction. More interestingly, livelihood diversification could be much more meaningful when income and preferences are shared between household members. The application was seen as crucial as the occupants of the

affected livelihoods operated on subsistence scales and the possibility of food security was likely to be attained (Guatam and Andersen 2016: 239).

2.4.1 Fishing Practice and Vulnerability

Vulnerability could be any situations that depict threat, insult, hazard or harm to the individuals in question or even what they relied on for survival from either within or outside the natural environment (Thompson, Johnson and Hanes 2016: 165). Sometimes, due to fish decline adverse effects were seen in communities whose livelihood generation was solely dependent on fishing (Belton and Thilsted 2014: 59; Hakim and Kamruzzaman 2015: 333). Apart from fish decline, a series of activities and policies also interferes with viable fishing practices. In South Africa, full access to fishing resources is still denied to the poor coastal communities, with the authorities blaming overexploitation of resources, loss of variety, damage to the habitat, and ultimately, the collapse of the resource (Sowman *et al*. 2014: 31). The Magnusson Stevens Act (federal fisheries legislation) in the United States Institute explained the need for fisheries managers to reconsider the consequences of the fishing regulations on socio-economic dependent communities and to mitigate the impact when possible. However, the unstructured description of fishing communities and the increasing influences of the communities hindered full implementation (Thompson, Johnson and Hanes 2016: 165). Gentrification was another principal vulnerability element in fishing dependent communities as it hindered potential anglers' access to the waterfront. To this end, most authors had described fisheries as being synonymous with poverty due to the extensive vulnerability, discrimination and overexploitation of the products, and indicating that fisheries stocks were experiencing a major structural change (Nayak, Oliveira and Berkes 2014: 1).

2.4.2 Fishing Community and Income Deficits

Fishing is termed a lucrative business. In developing countries, more than ten million individuals were dependent on fisheries as a crucial profitable venture. Approximately 2.5 million fishers produced additional business prospects. Conversely, empirical proof illustrated elevated and consistent poverty levels faced by fishing communities in emerging countries (Olale and Henson 2012: 235). The fishing communities experienced narrowed income sources and most times the total income was spent on buying the necessary goods, such as food items and cloths. Only a small portion of the income accommodated health care and education (Ali *et al*. 2014: 193).

The study conducted by Olale and Henson emphasized the issue of diversification of income from a similar viewpoint as mentioned in 2.4 by Rakodi (2014: 26). Therefore, reducing the poverty rate would amount to investing in multiple assets to increase income and lessen the pressure mounted on fish resources. The study by Kasperskia and Holland (2012: 2076) supported the idea of income diversification but pointed out that a minimal amount of income diversification would not make a meaning contribution to reducing income risk. However, a substantial amount could definitely play a part in reducing the vulnerability of income from fishing**.**

2.4.3 Fishing Community: Education and Infrastructure

Education is an important arsenal for empowering people, being the tool or concept required to break the cycle of poverty in families and communities (Samir and Lutz 2017: 183). Knowledge drives optimism in children to acquire or pursue a full education and thereafter becomes progressive from one generation to another. Education from any perspective has the needed element to improve the life of its beneficiary as well as mitigating the cycle of poverty. Furthermore, it has elevating consequences not just on the individual but also likewise on society (Muttarak and Lutz 2014: 2). Educated parents create attributes for their children to emulate and create a substantial difference in their living standards, particularly in application to day-to-day life, including nutrition, healthcare and gender equity (Chevalier *et al*. 2013: 8).

However, poverty, income and food insecurity and low education standards continue to persist in both rural and coastal areas. Low education standards are more prevalent in rural communities than urban areas in low income countries. Permanent struggles and poverty become the resultant effects, particularly when young people do not acquire the basic education needed. People living in poverty cannot conclude their education and so illiteracy levels are high and career advancement is denied or hindered. Poverty (low income) leaves people with fewer options and most times, job seeking is prioritized over schooling (Omoniyi 2013: 177; Ebegbulem, Ekpe and Adejumo 2013: 280-281; Anyanwu 2014: 118).

Compounding the challenges, most rural schools in developing nations have inadequate resources and poor equipment, poor quality infrastructure characterized by dilapidated buildings, overcrowded classrooms, unqualified and or under-qualified teachers and a lack of basic necessities like electricity (where learners still do their homework by candle light and oil

lamps), decent sanitation and running potable water. Moreover, the schools tend to be scarce in rural areas like fishing communities, which often means walking long distances to school. Opportunities for secondary education are often scarce and school attendance is usually poor.

Nigeria also shared this predicament. Good numbers of Nigerian's population live in the rural/ coastal areas. However, the government concerned with developmental issues such as education and service delivery continually neglect this section of the population. In addition, the wealth (crude oil) of the nation comes from the coastal areas (Niger Delta) but remains unrecognized and neglected by the government. Under-development in Nigeria is also linked to neglect and a lack of useful strategies to develop the rural/coastal areas (Härmä 2013: 550; Matthew 2013: 3; Ebisine 2013: 5; Ebegbulem, Ekpe and Adejumo 2013: 280-281).

Certain measures, if put in place, could encourage children to become educated. Some of these measures include: funding in all schools, no-fee schooling policy, school feeding programmes, a suitable learning environment and the recruitment and retention of qualified teachers. Evidence has shown that education addresses the issue of long-term health benefits and increases gender equality, which is a faster way of diminishing poverty. Education stirs up knowledge irrespective of the field and significant differences are likely to be attained. For instance, proper knowledge of agriculture assists the producer gain or use techniques necessary to grow and maintain healthy crops, which provide natural and healthy foods as well as an additional income source. Viable knowledge in food planning for each developmental stage promotes healthy living particularly for growing children and pregnant women in the family (Samir and Lutz 2017: 183; Chevalier *et al*. 2013: 8; Asiyai 2013: 160; Lawal 2013: 28).

2.5 CONCEPT OF FOOD SECURITY

Food security inter-dimensional concepts include "local or domestic food availability, household food security and individual food security". Household and individual food security takes into account "economic and physical food availability" (Chinnakali *et al*. 2014: 227). As stated earlier, the globally acceptable definition of food security formulated during the World Food Summit (WFS) in 1996 contained key words such as food availability, food access, food utilization and food stability. A nation was expected to experience all the four concepts stated below to be food secured as reported by Carletto, Zezza and Banerjee (2013: 31) and Malta (2008: 5)

- Food availability – refers to adequate amounts of suitable, essential food types either from the small-scale producer or market importer that ensures constant availability within reach.
- Food access – refers to an individual having sufficient income to buy or acquire suitable food required to attain an adequate intake of diet or to achieve an acceptable level of nutrition.
- Food utilization – the proper application and use of food in terms of correct knowledge of nutrition, storage processes and cooking /processing procedures. This is also applicable to safe health and cleanliness services.
- Food stability – this addresses the issue of food being always in stock. It is an all-yearround stability irrespective of unforeseen circumstances such as economic crises and unfavorable climate conditions. With food stability, accessing suitable food at all times remains constant whether it is seasonal food or before harvest time, usually described as the hunger season.

The world's food production is sufficient to feed its occupants, yet food insecurity remains a menace in both developed and developing nations. Poverty and hunger are on a perpetual increase. Physical, social and economic unavailability of food denotes food insecurity (Berkowitz, Seligman and Choudhry 2014: 304). Sustainable Development Goal (SDG) 1 targeted the complete eradication of poverty which is the main cause of food insecurity by 2030. Addressing poverty eradication, especially among vulnerable individuals, has been one of the core issues on the mind of the international community. Vulnerable individuals are poor people affected by a lack of essential resources to meet their daily needs. People are poor in one form or another in all nations; therefore, it is a global phenomenon. Global approximation showed that one million people still lived on less than $1.25 per day, particularly the people who lived in the Southern Asian and sub-Saharan African regions (Ford 2015; Le Blanc 2015: 176; UNPP 2018).

World Bank, USDA and FAO argued that seventy-five to one hundred and sixty million individuals experienced hunger and poverty due to the international food crisis that took place in 2007/2008 with special reference to emerging countries (Verpoorten *et al*. 2013: 51). The food insecurity rate remained constant globally. Food insecurity is defined as the limited or uncertain availability of nutritionally adequate and safe foods, or the limited, uncertain ability to acquire acceptable foods in socially acceptable ways. (Hannum, Liu and Frongillo 2014: 90;

Patton-Lopez *et al*. 2014: 209). Food insecurity also thrives in the face of conflict and war as this causes people to leave their residence, including sources of livelihood and valuable assets and this could further increase the level of poverty. Countries that had such experiences were referred to as "home of half of the global poor" (Hendrix and Brinkman 2013: 3).

Sub-Saharan Africa was perpetually faced with poor nutrition, the result of which caused the majority of people to suffer from stunted growth and 54% were severely malnourished, which was the major cause of death (Bain *et al*. 2013: 1). Poverty is linked to hunger; as a result, the population of the world's nations were undernourished with the hungriest people living in low- and middle income nations, which had recorded one out of nine individuals being malnourished, although this was claimed to have been reduced at the end of the Millennium Development Goals (MDGs) in 2015 but it still persisted (Hickel 2016: 753). Escalating food prices were another matter of concern as they prevented people developing an income as they had to sell off their productive assets (livestock and seeds) to meet the demand for food. This further affected earning prospects and increased food insecurity (Verpoorten *et al*. 2013: 52; Singh 2014: 1). Food insecure people present vivid evidence of malnourishment because of the lower consumption of energy and nutrients requirements. This deprivation further delineates the body's incompetence or ineffective use of food due to disease or infections (Otaha 2013: 28). Diet-related (overweight and obesity) and non-diet related illness has been associated with food insecurity. Other challenges associated with food insecurity are low income, cognitive weakness and developmental slowness and generally, poor health is attributed to insufficient consumption of essential nutrients and deprived access to nutritious meals (Hannum, Liu and Frongillo 2014: 90).

Household size, gender of the family head, low level of education of the family head and dependency rate in a rural setting are the principal determinants of food insecurity in Nigeria. However, the Global Hunger Index (GHI) blamed poverty in Nigeria on the constant elevation in food prices. Consequently, food shortages and starvation persist as a sign of distress and food insecurity amongst the people. The GHI ranked Nigeria 40th among seventy-nine nations in 2012 and also short-listed the country among the 42 most food-deficit, low-income countries. Surprisingly, some useful programmes were set to mitigate and alleviate poverty and food insecurity. These programmes included: The National Agricultural Development Fund, NADF (2002), the National Special Programme on Food Security, NSPFS (2002), the National Food Crisis Response Programme (NFCRP), and the Food Security Thematic Group ([FSTG)

(2009). Food insecurity is high in Nigeria according to significant data on inadequate calorie intake, food imports, per capita income and export tariffs. Furthermore, most Nigerians still live on less than one-dollar daily, lacking access to basic amenities and infrastructure such as education, electricity, potable water, health centres and viable agricultural policies as well as sufficient food to enhance good health. Food insecurity needs urgent attention to enhance and improve the wellbeing of the citizens. Workable plans involving restructuring the economy could also improve food security (Oriola 2009: 135; Adepoju and Adejare 2013: 1; Bain *et al*. 2013: 3; Ojeleye, Saleh and Oyewole 2014: 1).

2.5.1 Factors Affecting Food Security

2.5.1.1 Food cost and inflation

Food-secure households have access at all times to enough food to ensure active, healthy living for all household members Food-insecure households, on the other hand, lack constant access to adequate food. Globally, the poor suffer each time negative changes occur in the food system. For instance, the intense elevation in food prices in 2006-2008 majorly affected people who spent most of their earnings on food, and this affected both urban and rural households. Current price instabilities have revealed the vulnerability of millions of people globally to hunger and these people are predominantly in developing nations where many households experience food insecurity. Cost implications of food affected more low-income households than high-income households with some slight variation in geographical location. High prices of food commodities rendered low-income households less able to acquire nutritious food, thereby, compromising the purchase and consumption of healthy foods (Matla 2008: 13; Godfray *et al.* 2010; Gregory and Coleman-Jensen 2013: 679; Verpoorten *et al*. 2013: 51; Godfray and Garnett 2014: 1).

2.5.1.2 Distribution obstacles

Poor distribution and supply channels in food systems aid escalation in food insecurity particularly in the developing nations. Food distribution and supply lack organization, which can be blamed on “bad weather, the unprecedented nature of the biological processes, the seasonality of the products, the market cycle, and the geographical separation of production and end users”. Besides the aforementioned obstacles to food supply, other key challenges include inequalities and inconsistencies in the food supply system. The global food delivery system still lacks a supply of diverse and high-quality meals. Healthy foods remain unavailable and too costly for low-income households. To resolve the distribution dilemma, the food

system needs a comprehensive approach in addressing fundamental factors that negatively affect supply. Finally, a holistic view in prioritizing policies and goal formulations for the food system to improve nutrition is achievable through food availability, price monitoring and control, marketing/vendor strategies and product properties. (Enyinda, Anana and Hamouri 2013: 2760; Ransom, Bain and Higgins 2013: 148; Bain *et al*. 2013: 3; Thow *et al*. 2018: 1-2).

2.5.1.3 Lack of successful agriculture and adequate storage facilities

Most Nigerians live in the rural areas and are involved in agricultural livelihoods (fishing, livestock and crop production). These commodities are for household use and income generation. Agricultural activities are linked to food and nutrition security thus high production improves food security. The problem of food insecurity is a long-standing one as the majority of the households experience adequate harvest but lack storage or processing technology to preserve the food for future use. In Nigeria, several agricultural programmes and policies that were implemented failed or contributed poorly to the productivity of the economy. These programmes included: "Operation Feed the Nation, Green Revolution, Lower River Basin Development Authorities as well as agencies like National Agricultural and Land Development Authority (NALDA) and the Directorate of Foods, Roads and Rural Infrastructure Food

Security in Nigeria". The unsustainability of these programmes was blamed on insufficient funding, improper management and various forms of pollution (Oriola 2009: 134; Adepoju and Adejare 2013: 18; Otaha 2013: 32).

2.5.1.4 Policy inconsistency and corruption

Food availability and accessibility (food security) is possible through well-established programmes and policies implemented by the incumbent government and each new government that takes over is expected to implement programmes to alleviate the suffering of the citizens. New governments often allow programmes established by the previous government to continue with some improvements so as to avoid unnecessary expenditure on new programmes. However, new governments often discontinue or truncate programmes that are successfully enhancing food security. Consequently, setbacks in food production and supply are often evident due to poor performance from units in charge of implementing the agricultural policies. This creates opportunities for graft, which causes more havoc in the system, increasing food insecurity (Otaha 2013: 32; Stecyk 2018: 7).

2.5.2 Household Food Security

A nation being food secure does not guarantee household or individual food security (Labadarios *et al.* 2011: 8). The absence of concern about hunger and starvation in the household indicates a food secure household. Furthermore, "food security for a household means access by all members at all times to enough food for an active, healthy life." Food security encompasses the availability of healthy, acceptable and safe foods. It is also seen through a steady and satisfactory supply of food that is within acceptable reach (Otaha 2013: 28).

Forms of food security at household level are further classified as individual food security and nutrition security. Individual food security is the individual's capability to access food in a household while nutrition security brings into play the diet that is adequate not just in terms of quantity and overall energy (kilojoules) intake, but also adequate in terms of the quality and diversity (protein, vitamin and mineral requirements). Nutrition security further considers good sanitation (hygiene), clean water and adequate health care (Beveridge *et al*. 2013: 1069; Meenakshi 2016: 115).

Actualizing nutrition security has been a huge problem globally and further estimation indicates a more deleterious situation by 2050 as global population growth is projected to increase up to nine billion. Over-population in the face of limited access to food may affect the quantity, quality and variety of food consumption with particular reference to the latter, as food and nutrition considers various food types and diet quality and not just food availability. Foods eaten from diversified food groups produce a favorable outcome nutritionally, thus good nutrition results in better cognitive development, enhanced productivity and physical potential (Beveridge *et al.* 2013: 1069; Horton and Steckel 2013: 247; Meenakshi 2016: 115).

Achieving nutrition security involves sufficiency and adequacy of food supply at all levels and impartial distribution of food among the populace in line with their physiological needs. Although the latter looks difficult to attain, it could be achievable through government policies designed to reduce starvation and remedy nutritional deficiencies. This type of policy remains one of the most extensively accepted policies in the world, taking diverse forms, from subsidized prices of common foodstuffs to cash allocations. However, its success depends on the actuality of a sensitivity to food demand related to income disparity and its magnitude (Ransom, Bain and Higgins 2013: 148; Carletto *et al.* 2013: 31-33; Beveridge *et al.* 2013:

1069; Blattman and Niehaus 2014: 117-118; Awosan *et al*. 2014: 9; Banerjee 2016: 3; Thi, Simioni and Agnan 2018: 2).

Furthermore, increased agricultural productivity could improve household food security through viable and workable programs that create opportunity for empowerment (Otaha 2013: 32). One such program is fish farming. The fishing community could particularly thrive in managing fish farming as it relates to their occupation (fishing). This could further enhance livelihood sustainability as the wild stock gains resilience after overexploitation and decline, while improving the food security of the populace through an alternative mechanism; making a reality the dream of food security (Oluwemimo and Damilola 2013: 3).

2.6 MALNUTRITION

Malnutrition denotes either inadequate or excessive intake of nutrients (Awosan *et al*. 2014: 9). Malnutrition can manifest in triple burden forms (under-nutrition, over-nutrition and specific micronutrient deficiency). Under-nutrition is a pathological state resulting from intake of an inadequate amount of food over a prolonged period. Over-nutrition is a state resulting from excessive intake or imbalance of essential nutrients with or without the absolute deficiency of any one nutrient as determined by the requirements of a balanced diet. Specific micronutrient deficiency is the pathological state resulting from a virtual or complete lack of an individual specific nutrient. In other words, malnutrition is a concept of disproportion or nutrient imbalance that gives rise to health challenges (Kaliamoorthi 2013: 67; Meenakshi 2016: 115; Ayaz *et al*. 2018: 454).

Malnutrition affects all age categories (Alison *et al.* 2015:1335). In 2010 to 2012, 870 million individuals globally suffered from malnourishment while 852 million lived in hunger in developing countries (FAO 2012). Micronutrient malnutrition is still prevalent globally as one or more out of seven individuals are unable to access good protein sources and energy from their meals (Charles *et al*. 2010: 8120).

Malnutrition increases illness complications and ultimately results in death. Unfortunately, the deleterious consequences of malnutrition are sometimes under-diagnosed and mistaken for other sicknesses with similar symptoms. The infectious cycle of malnutrition begins with insufficient dietary intake leading to inadequate or absolute depletion of the body's

mechanisms to repair damaged cells. This inadequacy does not allow room for the body to create new cells to replenish the damaged ones due to malabsorption. Nutrient malabsorption affects the production of new cells, which is a direct effect of malnutrition (Barthelemy *et al*. 2014: 1531; Ayaz *et al*. 2018: 454).

Improper and imbalanced proportion of food nutrients could result in many harmful effects on the human body. These varying effects could originate from weight loss (under-nutrition) or weight gain (over-nutrition), developing into symptoms and manifestations described as NonCommunicable Diseases (NCDs) (Ayaz *et al*. 2018: 455).

2.6.1 Under-Nutrition

Malnutrition and hunger remain an unresolved issue globally. The prevalence of undernutrition still exists in Africa and Asia notwithstanding the improvement and advancement in the concept of food and nutrition security (Sibhatu, Krishna and Qaim 2015: 10,657). Undernutrition results in stunted growth (stunting), wasting and deficiencies of essential vitamins and minerals (collectively referred to as micronutrients) (UNICEF 2017; Ayaz *et al*. 2018: 455). Several factors such as inadequate intake of essential nutrients, malabsorption of nutrition and infection or disease could be associated with under-nutrition (Duggan *et al*. 2014: 348). The prevalence of under-nutrition and infectious diseases is high in low- and middle-income countries. Under-nutrition can occur as a consequence of the following conditions:

2.6.1.1 Inadequate Dietary Intake

Inadequate dietary intake has a multifaceted etiology that varies. Mostly, lack of access to food in adequate quantity and of adequate quality primarily hinders adequate intake of food. Unavailability of adequate quantity and quality of food is the result of a high level of poverty, affecting livelihood and the high cost of food. Other consequences include micronutrient deficiency, socio-political deprivation and poor dietary practices. Poor quality diet and sanitation (unhygienic environment) increases susceptibility to infectious diseases. Overpopulation also results in food insufficiency leading to inadequate intake and reduced diet quality which commonly prevails in emerging countries (Bain *et al*. 2013: 3; Alison *et al*. 2015: 26).

2.6.1.2 Poverty and food prices

The poverty rate remained very high in Africa as millions of individuals still suffer from hunger in spite of recent global economic development (Bain *et al*. 2013: 6)**.** This condition is further aggravated by the high cost of food, making malnutrition due to insufficient and inadequate food access evident. Poor quality of life, low human resource development and nutrition insecurity are the other resultant effects (Kaliamoorthi 2013: 67). Poor individuals have insufficient income for their primary needs and live below the poverty level. Poor households also lack all forms of support and infrastructural development, particularly in respect of people who live in isolated areas. Sometimes the female-headed households have compromised nutritional needs and are unemployed, retrenched individuals and deprivation in all forms are signs and elements of poverty and malnutrition (Omoniyi 2013: 177; Anyanwu 2014: 118).

Countries lacking technology that enhances productivity experience food shortages, which is a situation that contributes to malnutrition. Malnutrition is common among individuals with low socioeconomic status as accessing nutritious foods such as fruits and vegetables and quality proteins (milk, meat and poultry) is financially not within reach (Ayaz *et al*. 2018:454). Irrefutable evidence from literature suggests the possibility of food costs influencing diet quality, as lower-income groups consume low-cost, low-quality diets and endure more serious health consequences than their rich counterparts. Chronic poverty is an indicator of malnutrition. Poverty is also directly proportional to malnutrition as poverty and obesity are the direct consequences of the consumption of energy-dense foods from a low-cost perspective and are further reinforced by the high palatability of sugar and fat (Darmon and Drewnowski 2015: 643).

2.6.1.3 Poor dietary practices and knowledge

Poor dietary practices lead to malnutrition while lack of knowledge on nutrition security results in consumption of monotonous diets. Starch-based diets, for example, maize, bread, and processed foods high in sugar and rich in fats, and minimal consumption of fruits and vegetables has been found to be closely associated with food insecurity. Furthermore, a sedentary lifestyle clearly contributes to a worsening quality of life and susceptibility to diseases (Labadarios *et al*. 2011: 1; Domingo 2016: 979). Improving the nutritional knowledge of parents, especially of mothers, will logically reduce malnutrition related mortality and morbidity (Bain *et al*. 2013: 3). Finally, most rural/fishing communities still depend on subsistence produce and may not have access to a variety of foods (Matla 2008).

2.6.1.4 Socio- political causes

Malnutrition from the socio-political perspective could be due to negligence on the part of government and policy makers regarding lack of employment and food price controls and subsidies. Government with no legal system to influence resource management and maintenance heightens malnutrition among the populace. Consequently, the rate of vulnerability to malnutrition becomes higher due to difference in land access, income and education levels. Government subsidizing some assets may reduce the suffering of the people and enhance the quality of life (Matla 2008; Ayaz *et al*. 2018: 454).

2.6.1.5 Protein Energy Malnutrition (PEM)

PEM is a deadly condition occurring when protein and energy are inadequate to provide the body's nutritional requirements. This is commonly seen in developing countries and is responsible for children's regular hospital visits. PEM could manifest as marasmus, kwashiorkor and intermediate states of marasmus-kwashiorkor. Marasmus is inadequate energy consumption in all forms and kwashiorkor is protein deficiency with inadequate energy intake. PEM is common in individuals who are unable to absorb nutrients and convert them for further use. PEM increases vulnerability to infections and unstable health and is associated with a high morbidity and mortality rate. Symptoms of PEM include vomiting, diarrhea, loss of appetite, weight loss, decreased productivity and anemia (Bain *et al*. 2013: 2; Sheetal *et al.* 2013: 178; Bhutia 2014: 63).

2.6.2 Micronutrient Deficiency

Globally, above half of the populace suffers from micronutrient malnutrition with more in the emerging nations. Micronutrient deficiency is the absence of essential vitamins and minerals required in small quantities by the body for appropriate growth and development. Lack of micronutrients such as zinc, iron, iodine, folate and vitamin A constitutes a major health challenge or concern. Vitamin B12 and other B-vitamins deficiency occurs regularly (Muthayya *et al*. 2013: 2; Gupta, Gangoliya and Singh 2015: 676; Kumssa *et al*. 2015: 1; Ayaz *et al*. 2018: 454).

However, a lack of micronutrients in the diet causes a specific deficiency which sometimes results in chronic health conditions. The deficiencies differ in respect of symptoms and

presentation with overly adverse consequences to the health of its victims. Lack of iron causes impairment of cognitive development, resistance to infection, reduced work capacity and productivity. Zinc deficiency causes immune dysfunction and stunted growth while its depletion manifests in symptoms of reduced respiration (Gupta, Gangoliya and Singh 2015: 676; Ayaz *et al*. 2018: 454). Lack of calcium causes faulty bones and teeth, tetany and rickets and loss of muscle. Phosphorus deficiency is rare, while sodium deficiency could generate loss of sodium in urine and dehydration, nervous depression and improper muscle contraction. Deficiency of potassium results in poor muscle control leading to paralysis and nervous disorder. Deficiency in magnesium causes loss of muscle coordination, dilated blood vessels and heart and vascular irregularities. Lack of iron results in anemia and skin problems while lack of iodine results in goiter, Cretinism and myxoedema. Reproductive failure and menstrual irregularities are signs of manganese depletion. Lack of copper will manifest as anemia and lack of fluorine causes dental caries. Chromium deficiency presents as catabolism irregularity and adenosine triphosphate (ATP) deficiency and chlorine depletion presents as vomiting and hypochloremia alkalosis (Bhandari and Banjara 2015: 1; Ayaz *et al*. 2018: 452).

2.6.3 Over-nutrition (overweight and obesity)

The outcome of over-nutrition majorly manifests in the form of overweight and obesity and prevails mostly in the western world. Overweight and obesity may cause impairment to a person's wellbeing due to abnormal distribution of excessive fat in the body. Overweight subsequently develops into obesity if corrective measures are not applied. Energy intake exceeding energy expenditure is a major process of fat accumulation in the body from unused calories. In Northern America and Europe obesity is more common as 28% of the adult populace are obese, while 11% and 7% were reported in Africa and Asia respectively. Globally, 600 million adults were reported to be obese between 1980 and 2014. One-quarter of the adults in Latin America and the Caribbean were also reported to be obese. Overweight and obesity are expensive to manage and therefore pose huge financial stress on the health care system, causing 3.4 million global mortalities (Ng *et al*. 2013: 767; Markwald *et al.* 2013: 5695; Xia and Grant 2013: 178; Alison *et al*. 2015: 26; Ayaz *et al*. 2018: 455).

Obesity and overweight are international problems that record 2.8 million deaths per annum. Overweight and obesity are increasing, particularly in the western world and even in Africa, which previously recorded reduced prevalence, resulting in increased cases of NCDs (Xia and

Grant 2013: 178; Steyn and Mchiza 2014: 88). Factors influencing overweight and obesity are as follows:

2.6.3.1 Increased energy intake

Most readily available foods are energy dense and consumption is frequent due to availability, palatability and low cost. Consuming these foods in excessive quantities produces a positive energy balance (energy exceeding usage), coupled with limited physical activity. The concentrated calories in such foods have a cumulative effect and are capable of causing weight gain resulting in obesity, although it is not the only factor responsible for weight gain (Sharma and Fulton 2013: 382; Markwald *et al*. 2013: 5695).

2.6.3.2 Genetic factors

Genetic factors may also be responsible for obesity, although the correlation between both (genetics and obesity) is somehow complex. Studies have shown that environmental and behavioral factors are responsible for obesity and people living together are likely to be obese due to similar food intake and lack of physical activities. Some families are known to be habitual consumers of large portions of food. However, the connectivity of genetic factors and obesity has mixed evidence. Environmental factors may be of greater significance than genetic concepts, although it is believed that some persons are genetically more vulnerable to the effects of an obesogenic environment (Xia and Grant 2013: 179; Siddiqui and Donato 2017; Ayaz *et al*. 2018: 455).

2.6.4 Diseases of lifestyle

Adults and the elderly population suffer mostly from malnutrition related diseases as a result of poor eating habits and life style over an extended period of time (Freijer *et al*. 2013: 136). Unhealthy foods such as cheap fatty, sugary (energy dense) foods, little or no intake of fruits and vegetables and animal food products in developed countries and the world at large are associated with overweight and obesity (Monteiro *et al*. 2013: 22). Many authors have clearly stated that one of the predisposing factors to malnutrition-related diseases, or NCDs, is overweight and obesity. There is a strong correlation between diet and NCDs. Thirty-six million deaths out of the 57 million deaths that occurred in 2008 were due to NCDs, which are becoming the overt cause of death each year. The most common NCDs are cardiovascular diseases, cancers, diabetes mellitus and chronic lung diseases (WHO, 2011a). Endocrine

disorders such as hypothyroidism, congenital leptin, Prader-Willi syndrome, and Cushing's syndrome deficiency are likewise predisposing factors to obesity in a small number of persons. However, how endocrine disorders can cause obesity is still unclear due to limited evidence (Ayaz *et al*. 2018:455).

2.6.4.1 Diabetes

Diabetes further increases the risk of malnutrition and affects a huge number of people globally. Diabetes is caused by the body's inability to produce (type 1 diabetes) or use (type 2 diabetes) insulin. Insulin is a blood sugar regulatory hormone. Type 1 diabetes is more deadly and insulin-dependent while type 2 diabetes is common, occurring in both developed and developing countries, usually as a result of uncontrolled weight and low physical activity. The

World Health Organization warns that 439 million adults will suffer from diabetes by 2030 while 346 million individuals are already living with or affected by diabetes. Diabetes is costly due to its long-term treatment, placing huge costs on the health care system and compromising the quality of life of its sufferers. Its complications result in a series of morbidities and mortalities. Long-term effects of uncontrolled diabetes can cause malfunctioning of the blood vessels, nerves, heart, eyes and kidneys. Prevention of diabetes, particularly type 2, can be achieved by maintaining a healthy body weight, avoiding a sedentary lifestyle (being physically and steadily inactive), and engaging in moderate or intensive physical activities for at least 30 minutes daily or at least on a regular basis. The cessation of tobacco smoking is also encouraged to minimize or avoid complications of diabetes, along with the application of treatment to lower blood sugar levels (Chapple, Genco and Workshop 2013: 107; Sanz *et al*. 2013: 573; Grams and Garvey 2015; Ayaz *et al*. 2018: 454).

2.6.4.2 Cardiovascular diseases (CVD)

Cardiovascular disease is one of the principal causes of death globally, with obesity as one of the major predisposing factors. Obese individuals have a fifty to seventy-five percent chance of developing CVD compared with ideal weight individuals. A projection from the International Burden of Diseases argued that CVD was responsible for twenty-nine-point six percent of global mortalities in 2010 and is still the root cause of 4 million deaths yearly. All deaths recorded for CVD were reasonably higher in women (fifty-one percent) than in men (forty-two percent). Coronary heart disease, when measured separately, accounts for almost 1.8 million causalities, or twenty percent of all deaths in Europe yearly. Apart from elevated BMI (obesity) resulting in the development of CVD, other related threat factors include diet low in fruits and vegetables, high intake of sodium and saturated fats (for example, artificial trans fats), tobacco smoking and second-hand smoke exposure, alcohol use, high blood pressure and physical inactivity. Healthy behavioral support through community-based

establishments will deliver and promote effective management of chronic conditions, thereby producing a healthier population (Markwald *et al*. 2013: 5695; Bauer *et al*. 2014: 45; Nichols *et al.* 2014: 2950; DeBoer *et al*. 2015: 756).

2.6.4.3 Cancer

Cancer is one of the diseases assumed to be caused by obesity, with a twenty percent approximation on excessive weight, particularly obesity, in women's postmenopausal stage. The American Cancer Society postulated that liver and pancreatic cancer deaths are commonly associated with overweight and obesity. Other cancers linked to obesity are prostrate and bowel cancer in men and breast cancer in women. The occurrence of malnutrition in cancer patients ranges from thirty to eighty percent. Unhealthy nutritional status resulting from previous challenges may be a factor causing cancer. Cancer has been another prominent cause of death in recent times. Timely detection of malnutrition is necessary through adequate nutritional examination. This is essential as diet has a role to play in the etiology of cancer (De Pergola and Silvestris 2013: 2; Barthelemy *et al.* 2014: 1531; Nichols *et al*. 2014: 2950).

2.7 TOOLS FOR ADDRESSING MALNUTRITION

2.7.1 Healthy food consumption pattern

Multispectral processes are necessary to combat NCDs. Food approaches to achieve good health entail food security, consumption of safe quality foods and adequate quantities from different sources. An adequately varied diet reflects nutrient adequacy. In other words, no one food type can contain all the nutrients required by the body (Goetzke, Nitzko and Spiller 2014: 95; Johnston, Fanzo and Cogill 2014: 420; Liu 2013: 384; Labadarios *et al*. 2011: 11).

An adequate food consumption pattern may include a diet that contains nutrients needed for the body to optimize its functions for a healthy life. This could take into account cooking methods, consumption of less fatty foods, complex carbohydrates, fruits and vegetables and portion sizes that are proportionate to the body's needs. Furthermore, the more food groups consumed, the more likely the possibility of achieving optimum nutritional status and alleviating malnutrition (Olayiwola 2013: 2; Tuso *et al*. 2013: 61; Awosan *et al* 2014: 9; Qi *et al.* 2014: 2; Johnston, Fanzo and Cogill 2014: 418).

2.7.2 Supplementation

Vulnerability to a lack of vitamins and minerals is prevalent in emerging nations resulting from poor intake or lack of essential nutrients in the diet to attain or meet nutritional requirements**.** The World Health Organization (WHO) estimates that there are two million or more persons lacking vitamins or minerals in one form or another. Supplementation is targeted to improve intake of a specific vitamin or mineral product by the addition of nutrients, in capsule, syrup or tablet form, to address a known deficiency in a particular population. Most common disease burdens occur as a result of iron, vitamin A and zinc, among other micronutrients deficiencies. Iron deficiency is the most identified and preventable micronutrient deficiency and supplementation has widely received success in the prevention of iron-deficiency anemia in pregnant women. This has become necessary as pregnant women need more iron than nonpregnant women owing to the physiological changes or demands in pregnancy (De-Regil *et al*.

2013: 119; Das *et al*. 2013: 1; Ayaz *et al*. 2018: 456).

2.7.3 Fortification

Growth and metabolism thrive when essential nutrients are adequately consumed in the diet and the reverse is evident in the absence of it. The absence or small amount of particular nutrients in food products is increased or enhanced through fortification. Fortification is the result of nutrient deficiency becoming more frequent and common. One-third and 50% of the global population is suffering from anemia and iron deficiency respectively. Children, pregnant women and lactating mothers are significantly vulnerable to micronutrients (vitamin A, Zinc and iron) deficiency. Globally, fortification has substantially contributed to public health intervention in reducing nutritional deficiencies. For example, fortification has mitigated the occurrences of diseases such as goiter, rickets, beriberi and pellagra. Evidence shows that fortification of commonly consumed staple food products is preferred for cost-effectiveness and sustainability in achieving the set result on the target population (Gupta, Gangoliya and Singh 2015: 676; Muthayya *et al*. 2013: 2; Mannar and Sankar 2004: 997; Das *et al*. 2013: 1). Fortification is achievable through the following ways:

- Restoring the nutrients lost during food processing to their natural level (for example, restoring B-vitamins which are lost during milling).
- Increasing the level of a nutrient above its normal occurring amount in the food (for example, adding extra iron to wheat flour or extra calcium to milk).

- Adding nutrients that are not normally present in a food item is considered a good vehicle for delivering micronutrients to the consumer (for example, adding vitamin A into sugar, or iodine into salt' (Ayaz *et al.* 2018: 456).

However, considering the economic feasibility of fortification and the situation in emerging countries that cultivate their foods locally, calcium and zinc fortification becomes a challenge. In such instances, agronomic intervention may assist to increase the composition of zinc in food crops through fertilizer application to the soil. Increasing bioavailability of zinc is also possible through fermentation, soaking and germination. Public education and awareness is important to enhance knowledge in combating the deficiencies (Kumssa *et al*. 2015: 1; Gupta, Gangoliya and Singh 2015: 676).

2.7.4 Food Based Dietary Guidelines (FBDGS)

Food-based dietary guidelines (FBDGs) are short, simple, clear and positive messages structured as directives about food grouping for the consumer to follow by selecting food and beverages that meet their nutritional requirements. Expectations on adapting diet to include the foods and instructions described in the FBDGs are about improving the consumers' health and lessening the prevalence of NCDs among the populace. Food recommended in the FBDGs is locally available food products with proof of correlation between food consumption and health. Although the FBDGs are country specific (taking into account public health challenges and patterns of eating) they are centered on improving nutritional status and producing a healthy society by assisting consumers to make healthy and informed choices (van Dooren *et al*. 2014: 36; Vorster 2013: 3).

WHO and FAO jointly conceptualized and structured the FBDGs during a conference held in Nicosia, Cyprus in 1995 in a bid to respond to the resolution instituted during the 1992 International Conference on Nutrition held in Rome. The World Declaration and Plan of Action on Nutrition reached during the aforementioned conference was to mitigate and, if feasible, eliminate all nutrition-related issues such as famine, starvation and specific deficiencies and reduce the incidence of NCDs. In other words, adequate meals that address nutritional needs, mitigate or avert deficiencies and reduce NCDs underpin the formulation and implementation of the FBDGs. However, in achieving this, consumer's awareness and knowledge about the

necessity and applicability of FBDGs is paramount (Vorster, Badham and Venter 2013: 5; Van Dooren *et al*. 2014: 37). Specific characteristics benchmarked the formulation of the FBDGs:

- 'The guidelines (individually) should be written in an easily understandable format that cut across different cultures and backgrounds.
- Language usage should be friendly, not discouraging.
- Formulation style should be positive throughout. Words with a negative connotation such as reduce, avoid, limit, cut down are not encouraged.
- The guidelines should be user friendly in terms of diverse cultures and their eating patterns.
- They should take into consideration foods that are inexpensive, readily available and commonly consumed.
- They should be long lasting.
- They should encourage the consumption of naturally grown food.
- They should advocate food choices that can be eaten together.
- They should address malnutrition.
- They should recommend nutritious meals that are affordable.
- They should highlight the pleasure of eating.
- Well-communicated information to the population is necessary via available skills based on awareness, perceptions, attitudes and behaviors of the target population (Vorster Love and Browne 2001:3-4).

The FBDGs from the South African perspective (SAFBDGs) contain the following short, simple and clear messages:

- Enjoy a variety of foods.
- Be active!
- Make starchy foods part of most meals.
- Eat plenty of vegetables and fruit every day.
- Eat dry beans, split peas, lentils and soya regularly.
- Have milk, *maas* or yoghurt every day.
- Fish, chicken, lean meat or eggs can be eaten daily.
- Drink lots of clean, safe water.
- Use fats sparingly. Choose vegetable oils rather than hard fats.

- Use sugar and foods and drinks high in sugar sparingly.
- Use salt and foods high in salt sparingly' (Vorster, Badham and Venter 2013: 5).

2.7.5 Sustainable Development Goals (SDGs)

The Sustainable Development Goals **(**SDGs) make up a framework for the development and enhancing of living standards. There are 17 goals with 169 targets that expand on the Millennium Development Goals (MDGs) (Ford 2015). The SDGs are global in scope, and seek to mitigate hunger and poverty, and advocate human rights for all and gender equality to empower women and female children (Hawkes and Popkin 2015: 2).

The SDGs are committed to building on the unfinished work of the Millennium Development Goals (MDGs) and recognize the various concepts for enhancement of global wellbeing. Some of these goals are: the eradication of poverty and disparity, and the promotion of global health, economic development and planet preservation including climate change and its impacts. The goals are connected and constitute a mutual and dynamic correlation (WHO 2015). Hawkes and Popkin also posted that, since the SDGs prioritize an end to malnutrition in all its forms, they are also therefore targeting nutrition and related issues (NCDs). Moving forward to achieve these set goals will reduce and possibly eradicate nutrition challenges and related issues.

The SDGs are:

- End poverty in all its forms everywhere.
- End hunger, achieve food security and improved nutrition and promote sustainable agriculture.
- Ensure healthy lives and promote well-being for all at all ages.
- Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.
- Achieve gender equality and empower all women and girls.
- Ensure availability and sustainable management of water and sanitation for all.
- Ensure access to affordable, reliable, sustainable and modern energy for all.
- Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.

- Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation.
- Reduce inequality within and among countries.
- Make cities and human settlements inclusive, safe, resilient and sustainable.
- Ensure sustainable consumption and production patterns.
- Take urgent action to combat climate change and its impacts.
- Conserve and sustainably use the oceans, seas and marine resources for sustainable development.
- Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.
- Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels.
- Strengthen the means of implementation and revitalize the global partnership for sustainable development' (WHO 2015; Ford 2015).

2.7.6 Nutrition Education

Nutrition education is a novel idea used in promoting general well-being. Knowledge enhancement in the field of food and nutrition maximizes resources and reduces the incidence of NCDs among people. Nutrition education is conveyed through numerous channels and comprises of activities at various levels (individual, community and policy levels). Creating awareness through nutrition education has produced convincing evidence, as knowledgeable individuals who practice healthy lifestyles have reduced health challenges, thereby increasing life expectancy (Kris-Etherton *et al.* 2014).

Several tools are used for disseminating nutrition knowledge to the individual or populace. These tools include a food guide pyramid or a food plate, FBDGs and nutrition education. A food pyramid or food plate introduces and initiates new ideas in understanding dietary standards and guidelines in a simplified manner classified as nutrition education. It is helpful in disseminating information to the entire public. FBDGs refer to locally available nutritious foods. The content of the FBDGs comprises short, simple and clear messages that are easily

understood and capable of assisting the entire population in planning a prudent and balanced diet (Vorster, Badham and Venter 2013: 5; Legbara and Selepe 2017: 4).

Nutrition education is relevant in establishments, such as schools and colleges, government agencies, cooperative extensions, public relations and communication firms, the food industry and Non-Governmental Organizations (NGOs). Nutrition education teaches and creates awareness on nutrition and related issues such as healthy eating habits and healthy lifestyles (Kris-Etherton, *et al.* 2014). Legbara and Selepe also reinforced that nutrition education provides information on culinary understanding and proficiency, meal compilation and improvement of dietary quality. Furthermore, nutrition education combines educational approaches, which simplify and encourage the voluntary adoption of food choices and other food- and nutrition-related actions favorable to good health and well-being.

2.7.7 Dietary Diversification

Dietary diversity is the number of individual foods or the sum of the food groups eaten over a given period. Nutritionists have long acknowledged dietary diversity as the crucial component of a high-quality diet. Increasing the variety of foods across and within food groups is endorsed by most dietary guidelines both locally and globally. Agriculture-based livelihoods are the main sources of food in local communities, where about three-quarters of poor individuals live. This is particularly prevalent in low-income nations. Diet diversification may thrive locally, based on the availability of agricultural produce or assets and is influenced by subsistence agriculture (farming, fishing and production of livestock) and other agricultural assets used for income generation. However, combating malnutrition and micronutrients deficiency requires good quality food, food diversification, food availability and access to better and improved nutrition. (Matla 2008; Jones, Shrinivas and Bezner-Kerr 2014: 1; Sibhatu, Krishna and Qaim 2015: 106).

2.7.8 Home Gardens and Aquaculture

Feasible agricultural programmes and activities are capable of supporting the food supply and reserves needed for the welfare of the household. Home garden and aquaculture are among such programmes. Home gardens can be defined as a diversified cropping system that includes vegetables, fruits, plantation crops, spices and herbs, ornamental and medicinal plants as well as livestock that can serve as a supplementary food source. Aquaculture refers to fish farming

which includes nurturing fish commercially in containers or enclosures such as fish ponds, typically for food and income. Home gardening and fish farming assists food activities that are naturally based in the home and creates a positive effect towards addressing food insecurity and malnutrition. They could also provide added aids such as income and livelihood opportunities (employment) for resource-poor families and furthermore become vital supplemental sources in addressing diet-related diseases as they provide a means of living and providing nutritious foods to the community (Galhena, Freed and Maredia 2013: 2; Eme *et al*. 2014; Ozigbo *et al*. 2014: 1138; Patalagsa *et al.* 2015: 2).

2.8 MACRONUTRIENT AND MICRONUTRIENT REQUIREMENTS OF ADULTS

A complete diet or overall eating pattern consumed in moderation with appropriate portion sizes and regular physical activities is recommended for healthy living. The Academy of Nutrition and Dietetics emphasized balanced food and beverages within energy needs, rather than any one food or meal. Energy needs differ from one individual to the other as well and change according to stages of life. Irrespective of culture, background, norms and food availability, most importantly, healthy eating practices should be the hallmark of existence (Kerr *et al*. 2013: 290; Freeland-Graves and Nitzke 2013: 307).

Food consumption from different food groups containing macronutrients and micronutrients is essential to combat diseases and promote a healthy and active lifestyle (Mithril *et al*. 2013: 777). The use of nutritional tools that enhance or give precise and practical steps and messages on nutrient requirements and actual intake of food are encouraged at all stages of life and development; the Dietary Reference Intake (DRI) is such a tool that can be used.

2.8.1 DRI

The Dietary Reference Intake (DRI) addresses nutrient requirements at every stage (age) of life, providing guidelines to reduce nutrient deficiency and improve good health (NICUS 2003). Nutrient-based references for DRI are made up of four types, where each type constitutes the average daily nutrient intake, taking into account the uncertainty of deviations that may arise around the average value over the number of days. The nutritional reference value from the average mean intake over time, therefore, becomes crucial and necessary (Murphy and Poos 2002).

TABLE 2.3: BREAKDOWN OF THE FOUR DRIs

Dietary Reference Intake (DRI)	
Estimated Average Requirement (EARs)	Nutrient intake that meets the estimated needs of 50% of individuals of a specified gender at a particular life-stage. The EAR is a dietary intake value and it includes modification for an assumed bioavailability of the particular nutrient. The EAR is used as an origin in setting the RDA, and if insufficient scientific evidence arises to determine the EAR, no RDA is set.
Recommended Dietary Allowance (RDAs)	RDA is estimated to meet the nutrient needs of almost all (97-98%) healthy individuals of a given gender and specified life-stage. It is necessary to recognize that the RDA applies to individuals and not groups, and is the goal for dietary intake by the individual.
Adequate Intake (AIs)	Adequate Intake is used as a goal when no RDA or EAR is in place. It is an estimation of average nutrient intake that seems to sustain an anticipated indicator of health.
Tolerable Upper Intake Level (UL)	This is the maximum nutrient intake by an individual, which is unlikely to pose risks or adverse health effects to almost all individuals in a specified group.'

(Murphy and Poos 2002; NICUS 2003).

2.8.2 Macronutrients

Macronutrients refer to carbohydrates (CHO), proteins and fats, and are defined as classes of chemical compounds which individuals eat in large amounts, providing bulk energy. These macronutrients can augment each other to meet the energy required by the body. However, excessive or low intake of these macronutrients may pose a chronic disease outcome. Based on this, Acceptable Macronutrient Distribution Ranges (AMDRs) were established. AMDRs estimate ranges of intake for a specific energy source that is allied to reduced risk of metabolic diseases while needed nutrients are provided. The amount of AMDR provided by each macronutrient varies considerably. An adult AMDR for CHO is 45 to 65%, fat is 25 to 35% and protein is 10 to 35%. Fibre is sometimes listed among macronutrients but is not captured in AMDRs. Furthermore, it is very important to adhere strictly to AMDRs with increased physical activity to reduce the risk of obesity linked with CHD, cancer, diabetes and bone health (NICUS 2003; Mehta, Groetch and Wang 2013: 2; Okreglicka 2015: 77).

2.8.2.1 Energy

The body needs energy to carry out its biochemical processes and physical exertion of activities. 'The Estimated Energy Requirement (EER) is the average dietary energy intake that is projected to maintain energy balance in a healthy adult of a given age, gender, weight, height and level of physical activity consistent with good health'. The EER for men 19-50 years is 1288KJ, and for men 51 years and above it is 12881KJ while for women 19-50 years it is 10093 kJ and for women 51 years and above it is 10093kJ (Murphy and Poos 2002; NICUS 2003).

Table 2.4: Physical activity level (PAL) categories (NICUS 2003)

Category	Physical activity level
Sedentary	PAL ≥ 1.0 - < 1.4
Low active	PAL ≥ 1.4 - < 1.6
Active	PAL ≥ 1.6 - < 1.9
Very active	PAL ≥ 1.9 - < 2.5

2.8.2.2 Protein

Sources of protein that originate from animal and plant include meat, fish, cheese, milk, legumes and nuts. However, plant sources of proteins are incomplete protein due to a lack of one or more essential amino acids. Nine amino acids make up a complete protein. A combination of two or more sources of incomplete protein can complement the missing amino acid thereby becoming a complete protein. Proteins aid in the function, development and maintenance of cells and enzymes in the body (Mehta, Groetch and Wang 2013: 2; Michaelsen and Greer 2014: 719). In other words, proteins are the building blocks of life. The RDA/IA gram per day for females is 46g, and it is 56g for males. RDA protein per body weight is 0.5g with an addition of 10g for lactating mothers and 15g for pregnant women. Protein deficiency may lead to loss of mean body mass and subsequently, other diseases may occur (NICUS 2003).

2.8.2.3 Carbohydrates

Carbohydrates are primary sources of energy provision in the body. The major sources of carbohydrate are starches and sugars. Sources of starch are grains and vegetable (bread, corn,

pasta and rice) while natural sugar is found in fruit juices. Added sugar comes from soft drinks, candy and dessert. The EAR carbohydrate recommendation is 100g per day. Adequate consumption is essential to maintain normal body weight and optimum biochemical processes, as inadequate and excessive intake has adverse health consequences (Mehta, Groetch and Wang 2013: 2; Okreglicka 2015: 77).

2.8.2.4 Fat

Fat is a vital part of the diet. It provides high energy and is essential for the absorption of fatsoluble vitamins (A, D, E and K) and also maintains basic body temperature (Jayarajan, Reddy and Mohanram 2013: 53). Vitamins A, D, E and K cannot function without adequate consumption of fats. These vitamins have antioxidant properties and are essential parts of our daily meals with important roles in promoting and keeping the body healthy. Vitamin A enhances good vision, vitamin D is essential for bone health, vitamin E protects the cells by neutralizing free radicals and vitamin K is essential for blood clotting (Roodenburg *et al*. 2000: 1187; Jayarajan, Reddy and Mohanram 2013: 53; Rizvi *et al*. 2014: 158-159; Dawson-Hughes *et al.* 2015: 225).

Beside these functions, fat is a complementary source of energy in the absence of carbohydrates. Fat is energy dense, containing nine calories per gram, twice the energy content of carbohydrates and proteins and as such, consumption of fat is limited to 25-35% of total energy intake. For instance, 40 to 70 gram of fat daily is recommended to be consumed based on an 1,800-calorie diet (Mehta, Groetch and Wang 2013: 2).

Monounsaturated Fatty Acid (MUFA) and Polyunsaturated Fatty Acid (PUFA) are healthy fats derived from sources such as vegetable oils, nuts, avocados and cold-water fish (salmon and tuna). Consumption of food sources from MUFA and PUFA are encouraged as they promote heart health. Saturated fats, or trans-fats, are referred to as bad fats and increase the risk of Cardiovascular Disease (CVD). Sources of saturated or trans-fats can be obtained from meat, seafood, dairy and processed junk foods (Okreglicka 2015: 77; De Souza *et al*. 2015: 2).

2.8.2.5 Fibre

Dietary fibre obtained from whole fruits, grains, cereals and vegetables is usually referred to as non-digestive complex carbohydrates and generally referred to as roughage. Dietary fibre

remains indigestible as it passes through the human digestive tract (Dahl and Stewart 2015: 1816). The main role of fibre is to keep the digestive system healthy due to its laxative nature as well as reducing the risk of CHD. Fibre also assists in maintaining normal glucose and cholesterol levels in the body and could be either soluble or insoluble. In its solubility state, it lowers bad cholesterol levels. This type (soluble fibre) is majorly found in plants cells, consisting of mucilage, gum and pectin. The insoluble fibres function by adding bulk to the faeces, thereby preventing constipation-associated problems such as hemorrhoids. Insoluble fibres consist of lignin, cellulose and hemicelluloses. Nations whose traditional diets are highfibre-based, develop less prevalence for ailments such as bowel cancer, diabetes and coronary heart disease compared to western countries. The recommended dietary intake of fibre for men 19-50 years old is 38g, followed by 25g for women of the same age group. Men and women

51years and above are expected to consume 30g and 21g of fibre respectively (Ananthakrishnan *et al*. 2013: 970; Mudgil and Barak 2013: 2; de MoraesCrizel *et al*. 2013: 9).

2.8.3 Micronutrients

Micronutrients are vitamins and minerals needed in small quantities to function properly in the human body. A deficiency of micronutrients could result in malfunctioning of the body and sometimes pose a life-threatening situation (Mehta, Groetch and Wang 2013: 3). In other words, the essential development and uptake of biochemical processes including bone density, metabolism regulation, heartbeat and cellular PH in the human body are the result of vitamin and mineral availability and utilization. Diseases such as scurvy (deficiency of vitamin c), rickets (deficiency of vitamin D), osteoporosis and fractures due to calcium deficit and stunted growth are associated with micronutrient deficiencies (Bhandari and Banjara 2015: 1; Ayaz *et al*. 2018: 452).

2.8.3.1 Vitamins

Vitamins could be fat-soluble or water-soluble. Fat-soluble vitamins are soluble (dissolve) in fat and unused ones can be stored in the body while water-soluble vitamins are soluble in water and are unable be stored in the body, therefore a daily supply from food is needed by the body. Fat-soluble vitamins are less vulnerable to heat compared to water-soluble vitamins, particularly the B-vitamins. These vitamins are needed in minute quantities to carry out

biochemical processes such as metabolism, growth and physical well-being (Mehta, Groetch and Wang 2013: 3; Jayarajan, Reddy and Mohanram 2013: 53; Said 2013: 601; Hosseini *et al.* 2013: 87).

Table 2.5: Water-soluble vitamins

Nutrient	Sources and functions of nutrient	DRI men and women 19-50 years	DRI men and women 51 + years
Thiamin (vitamin B1) (mg/day)	Sources of thiamin are whole grains, beans, beef, rice, orange juice, tomato juice, poultry, seeds and milk. Vitamin B1 functions as a coenzyme during coenzyme oxidation-reduction, particularly in the metabolism of glucose. This is essential for appropriate functioning of the heart and nerves as well as energy production (Hosseini *et al*. 2013: 87; Koh *et al*. 2015: 215).	♂1.0 EAR ♀0.9 EAR	♂1.0 EAR ♀0.9 EAR
Riboflavin (vitamin B2) (mg/day)	Riboflavin, also known as vitamin B2, like other B-vitamins is essentially used for replication and repair of DNA and gene expression. In other words, vitamin B2 contains antioxidants which are useful for keeping blood cells healthy, facilitating metabolism, contributing to growth, fighting against free radicals, protecting the skin and including eye health. Sources of vitamin B2 include meat and organ meat, dairy products (cheese and egg), vegetables (green and leafy), beans, legumes and certain nuts and seeds. (Bassett *et al*. 2013: 660).	♂1.0 EAR ♀0.9 EAR	♂1.0 EAR ♀0.9 EAR
Niacin (vitamin B3) (mg/day)	Vitamin B3 is an essential nutrient, the main function of which is to help produce energy from food especially the breakdown of glucose, fat and alcohol. Sources of vitamin B3 include whole grains, peanuts, potato, mushrooms, chicken, turkey, pork, beef and yeast. (Hosseini *et al*. 2013: 87; EFSA Panel on Dietetic Products and Allergies. 2014: 7).	♂12 EAR ♀11EAR	♂12 EAR ♀11 EAR
Vitamin B6 (pyridoxine)	Vitamin B6, also called pyridoxine, can be obtained from the following sources: fortified ready-to-eat cereals, sweet potatoes, yam, taro, grains, prunes, bananas, avocado, jackfruit, legumes, spinach, red meat, poultry, liver and fish. Vitamin B6 is responsible for the synthesis of glucose from glycogen (glycogenolysis) and from amino acids (gluconeogenesis) (Bassett *et al*. 2013: 660).	♂1.1 EAR ♀1.1EAR	♂1.4 EAR ♀1.3 EAR
Folate (vitamin B9)(µg/day)	Folate or vitamin B9 is necessary for the production of red blood cells during DNA and RNA synthesis and amino acids. Folate further prevents malformation of the brain and spinal cord during fetus development. In addition, it lowers blood homocysteine levels by converting homocysteine to methionine. Sources are cereals, cornmeal, rice, wheat, liver, mollusks and baker's yeast. (Bassett *et al*. 2013: 660).	♂320 EAR ♀320 EAR	♂320 EAR ♀320 EAR

Vitamin B12) (µg/day)	Vitamin B12 is an important B vitamin. It is required for brain function, production of red blood cells and healthy nerve tissue. Cobalamin is another name for vitamin B12. Sources are beef, pork and ham, poultry, fish and milk (Bassett *et al*. 2013: 660; Moll and Davis 2017: 198).	♂2.0 EAR ♀2.0 EAR	♂2.0 EAR ♀2.0 EAR
Pantothenate (vitamin B5) (µg/day)	Vitamin B5 is essential for proper brain functioning. It is responsible for the conversion of food into available and usable energy through the process of macronutrient transformation into glucose. It is also required for other biochemical processes such as neurotransmitters, production of red blood cells and steroids, as a stress regulator, maintenance of healthy digestive system and optimizes the use of vitamin B12. Sources are organ meats, beef, yeast, whole grains, milk and milk products, vegetables such as broccoli, avocados, tomatoes, sweet potatoes and kale, peanuts, soya beans, wheat germ, legumes, cereals, split peas, sunflower seeds, lentils, egg yolk, salmon, chicken, duck, lobster and turkey (Chauhan *et al*. 2013: 2).	♂5.0 AI ♀5.0 AI	♂5.0 AI ♀5.0 AI
Biotin (vitamin B7) (µg/day)	Sources of biotin include strawberries, broccoli, fish (salmon), liver, egg (yolks), pork, almonds, peanuts, walnuts, sweet potato and carrots. Vitamin B7 is essential in various metabolic functions such as metabolism of glucose (gluconeogenesis), fatty acids and amino acids (Chauhan *et al*. 2013: 2).	♂30 AI ♀30 AI	♂30 AI ♀30AI
Vitamin c (Ascorbic acid) (µg/day)	Sources of vitamin C are watermelon, pineapple, papaya, cabbage, tomatoes, kiwi fruits, spinach and sweet potato. Vitamin C reduces skin pigmentation through increasing the capacity and number of fibroblasts. Vitamin C is likewise required for good health and normal growth as well as activating collagen formation, thereby accelerating the process of wound healing. Vitamin C further fights against free radicals, preventing oxidative stress due to its antioxidant content (Liu 2013: 387).	♂ 75 EAR ♀ 60 EAR	♂75 EAR ♀60 EAR

Table 2.

6: Fat-soluble vitamins

Nutrients	Sources and functions of nutrients	DRI men and women 19-50 years	DRI men and women 51 + years
Vitamin A (µg/day)	Vitamin A is responsible for good and healthy vision, skin, bones and other tissue in the body. Basic sources are obtained from leafy vegetables as well as other foods such as carrots, dark green leafy vegetables, winter squash, pink grapefruit, broccoli, sweet potato and cantaloupe. Majorly, these foods contain antioxidants and are essential in fighting cell damage. Eating food sources rich in vitamin A aids normal heart, kidney and lungs maintenance. (Jayarajan, Reddy and Mohanram 2013: 53; Hosseini *et al*. 2013: 87; Chauhan *et al*. 2013: 2; EFSA Panel on Dietetic Products, Nutrition, and Allergies 2015).	♂ 625 EAR ♀ 625 EAR	♂625 EAR ♀625 EAR
Vitamin D (µg/day)	Vitamin D also helps to maintain good health like other vitamins and is essential in sustaining normal levels of calcium, phosphate and healthy bones and teeth formation. Vitamin D further prevents thin and brittles bones by normalizing calcium levels through the aid of parathyroid hormones, thereby building stronger and healthier bone. Sources are sun exposure and diet (egg yolk, cereals, cheese, cod oil, liver and sardine) (Hosseini *et al*. 2013: 87; Chauhan *et al* 2013: 2).	♂5.0 AI ♀5.0 AI	♂ 10 AI ♀ 10 AI
Vitamin E (µg/day)	Vitamin E, also called Tocopherol, has antioxidant properties. It protects the cell membrane from free radical attacks and damage, thereby improving the effectiveness of the immune system. Important sources are oil and fats which include oily fish, shrimps, wheat germ, almonds, hazelnuts, peanuts, vegetable oils, mango, kiwifruit, egg yolk, butter and avocado (Chauhan *et al*. 2013: 2; Rizvi *et al*. 2014: 158-159).	♂12 EAR ♀12 EAR	♂12 EAR ♀12 EAR
Vitamin K (µg/day)	One of the basic functions of vitamin K is that it promotes blood clotting. Other functions include; protein synthesis found in plasma, bone formation and promoting kidney health. Sources are obtained from carrots, tomatoes, okra, spinach, cabbage, cauliflower, wheat bran, some fruits, dairy products, meats and organ meats. (Chauhan *et al* 2013: 2).	♂ 120 AI ♀ 90 AI	♂ 120 AI ♀ 90 AI

2.8.3.2 Minerals

Minerals are essential in the body to optimize its biochemical processes such as tissue repair, metabolism, growth and maintaining the body's physiological functions. Minerals consist of macro-minerals and micro-minerals. Macro-minerals are required in larger quantities than micro-minerals (trace elements). Each mineral has a specific function, contributing to the body's maintenance (Kim and Choi 2013: 69).

Table 2.

7: Macro-minerals

Nutrients	Sources and functions of nutrients	DRI men and women 19-50 years	DRI men and women 51 + years
Calcium (mg/day)	Calcium is responsible for healthy teeth and bone formation, and assists in clotting of blood and the conduction of nerve impulses. Sources include calcium-fortified foods, spinach, milk, yoghurt, oranges, broccoli and fish (salmon) (Ayaz *et al*. 2018: 453).	♂ 1000 AI ♀ 1000 AI	♂ 1200 AI ♀ 1200 AI
Phosphorus (mg/day)	Sources of phosphorus include food additives, meat and milk. Phosphorus is responsible for the formation of healthy bones and teeth, acid-base balance in the body and energy molecules and coenzymes (Ayaz *et al*. 2018: 453).	♂ 580 EAR ♀ 580 EAR	♂ 580 EAR ♀ 580 EAR
Sodium (g/day)	The most common source of sodium is sodium chloride, known as table salt and it occurs naturally in foods. Sodium acts by maintaining a balance of water and ions. Sodium also conducts nerve impulses and muscle contractions (Ayaz *et al*. 2018: 453).	♂ 1.5 AI ♀ 1.5 AI	♂ 1.3AI ♀ 1.3 AI
Potassium (g/day)	Functions of potassium include balancing fluid and PH levels (alkaline or acidic normalization), controlling blood pressure and regulating heartbeats. It is further involved in the contraction and relaxation of muscles. Good sources of potassium are yoghurt, sweet potato, watermelon, mushrooms, lentils, broccoli, banana, prunes, dates, avocados, cantaloupe, carrots, apricots, winter squash, oranges, peanuts, beans, meat and milk. (Ayaz *et al*. 2018: 453).	♂ 4.7 AI ♀ 4.7 AI	♂ 4.7AI ♀ 4.7 AI
Magnesium (mg/day)	Magnesium acts as a cofactor for enzymes like other minerals and is responsible for activation of mood-regulating transmitters. It further supports a healthy immune system and regular heartbeat, and promotes strong bones, normal nerve maintenance and proper muscle functioning. It also functions in regulating blood sugar levels, energy production and protein utilization. Magnesium is found in nuts and seeds, dark green vegetables, whole grains and legumes (Volpe 2013: 3795; Miki *et al*. 2015: 686).	♂ *340 EAR ♀ *260 EAR	♂ 350 EAR ♀ 265 EAR

Table 2.

8: Micro-minerals (Trace elements)

Nutrients	Sources and functions of nutrients	**DRI men and women 19-50 years**	**DRI men and women 51 + years**
Iron (mg/day)	Rich sources of iron include organ meat and beef, broccoli, dried fruits, fish, apples, kale, cereals, pulses, molasses and dandelion greens. Iron carries out its function through the compounds in which it is present, and it is therefore responsible for the formation of Hemoglobin (HB), assisting oxygen and carbon dioxide transport and is also essential for effective immune-competence in the body (Ayaz *et al*. 2018:453; Wu, Lesperance and Bernstein 2016: 172).	♂ 6.1 EAR ♀ 8.1 EAR	♂ 6.0 EAR ♀ 5.0 EAR
Iodine (µg/day)	Iodine is responsible for normal functioning of the thyroid gland and thyroid hormone production. A common food fortified with iodine is table salt (Ayaz *et al.* 2018: 453).	♂ 95 EAR ♀ 95 EAR	♂ 95 EAR ♀ 95 EAR
Zinc (mg/day)	Zinc intake is vital for growth, gene expression and cell division, reproduction and immune function. Zinc is present in all body cells and is responsible for senses of smell and taste. Zinc has a defence mechanism in its action. Sources are acquired from beef, seafood, cheese, yoghurt, eggs, almonds and peanuts (Pereira and Vicente 2013: 590).	♂ 9. 4 EAR ♀ 6.8 EAR	♂ 9. 4 EAR ♀ 6.8 EAR
Chromium (µg/day)	Chromium is involved in catabolic metabolism and controlling blood sugar (glucose) levels. Sources include unprocessed foods, especially liver, cheese, nuts, brewer's yeast and whole grains. (Ayaz *et al*. 2018: 453)	♂ 35 AI ♀ 25 AI	♂ 30 AI ♀ 20 AI
Selenium (µg/day)	The body only needs small amounts of selenium. It helps the body to fight cell damage and possesses antioxidant properties for cardiovascular disease and cancer prevention. Selenium is obtained from meat and seafood, which has a high content (Pereira and Vicente 2013: 590)	♂ 45 EAR ♀ 45 EAR	♂ 45 EAR ♀ 45 EAR

2.9. NUTRITIONAL ASSESSMENT.

Nutritional assessment is an in-depth investigation of an individual's medical and nutritional history by means of laboratory testing and physical examination.

Table 2.

2.9.1 Anthropometric measurement

Anthropometric measurement involves physical evaluation or measurement of specified body parts in assessing an ideal weight and general well-being of an individual (Madden and Smith 2016: 7; Gibson 2005). The following measurements make up anthropometric measurement.

2.9.1.1 Body Mass Index (BMI)

BMI involves measurement of an adult's weight and height for classification as underweight, normal weight, overweight and obesity. BMI is determined by dividing the person's weight by the height in meters squared (kg/m^2) and it is a commonly and widely used method for classifying adult obesity (Ayaz *et al*. 2018: 454). BMI is less expensive, easy to perform and an important prognostic predictor for CVD (Goh *et al*. 2014: 2; Bhaskaran *et al*. 2014: 755). However, a study by Brambilla *et al*. (2013: 943) and Hou *et al.* (2013: 2) lamented that BMI

is not an accurate indicator for predicting an individual's risk for CVD as the total body adiposity distribution cannot be accounted for in the measurement, only the reflex fat mass and lean mass. Furthermore, BMI values differ across ethnic groups and races. Asians and Blacks are typical examples as they generally have more body fat than Europeans (Freedman, Horlick, and Berenson 2013: 1417).

BMI is assessed by means of a measuring scale and stadiometer. The scale is placed on a level floor surface and set at zero before the respondent stands on it. Respondents are required to remove excess clothing and any extra weight items while mounting the scale and assume an upright position with bare feet apart while readings are taken. For accuracy, measurements are taken twice and the scale reset at zero after each measurement (Gibson 2005: 235; Bener *et al*. 2013: 2). BMI readings/ measurements are categorized as underweight, normal weight, preobesity (overweight) and obesity. The cut-off categories for BMI values were given in 1997 in a documentary made by the World Health Organization Consultation and the same values were adopted by the National Heart, Lung, and Blood Institute in 1998 (Flegal *et al*. 2013: 71) as shown on the table below.

TABLE 2.9: BODY MASS INDEX (BMI) CLASSIFICATION

		BMI (kg/m2)
Under weight		≤ 18.5
Normal weight		18.5 - 24.99
Overweight		25.00 – 29.99
Obesity	Class obesity 1	30.00 – 34.99
	Class obesity 11	35.00 – 39.99
	Class obesity 111	≥ 40’

(Ayaz *et al*. 2018)

2.9.1.2 Waist circumference

Many researchers have voted the Waist Circumference (WC) indices to be a better indicator for assessing risk factors of metabolic disease (Hou *et al*. 2013: 2). WC is a simple anthropometric measurement of the overall and intra-abdominal body fat (Ford, Maynard and Li 2014: 1151). WC is credited for use in determining central obesity as it predicts accurately people at risk of cardio-metabolic diseases (Jayawardana *et al*. 2013: 293). A non-stretchable measuring tape is used for the measurement of WC. The tape is passed round the waist without placing too much pressure on the soft tissue at the midway level between the lower rib side and iliac top and the

measurement is taken in centimeters. WC measurement is taken in a standing position with feet together, arms at the side, body weight evenly distributed and wearing light clothing. WC cut-off point for men is >102 cm and >88 cm for women (Bener *et al.* 2013: 2).

2.9.1.3 Waist-hip ratio

Waist-hip ratio is one of the methods used in identifying undernutrition and overnutrition in epidemiological research and hospital practice. Waist and hip circumference are two different measurements and the hallmark of measurement in assessing the risk of metabolic diseases. However, it has been said that the two measurements operate in diverging directions in assessing metabolic syndrome although it still shows a strong indication for cardiovascular diseases, diabetes (type 2) and mortality. Waist-hip ratio is a more accurate method of classifying metabolic disease than BMI (Cameron, Magliano and Söderberg 2013: 86). Each measurement represents different body composition in a gender and culture (Hou *et al*. 2013: 2). The hip circumference is measured at the broadest, or widest, part of the buttocks, using a non-stretchable tape held parallel to the floor while the waist is also measured with the same tape around the waistline. To calculate waist-hip circumference, the waist circumference is divided by the hip circumference (Bener *et al.* 2013: 2).

2.9.1.4 Waist-to-height ratio

Waist-to-height ratio (WHtR) is another index for assessing body fat (obesity). WHtR is useful for assessing central and abdominal obesity. WHtR is sensitive in the early detection of health challenges. Measurement is simple and easy to calculate compared to BMI (Jayawardana *et al*. 2013: 293). WHtR also shows a higher percentage of predicting metabolic diseases than the other anthropometric parameters. Waist circumference that measures over half of the weight of an individual is an indicator of obesity. To calculate WHtR, waist circumference (cm) is divided by height (cm) (Bener *et al*. 2013: 2).

2.9.1.5 Skinfold thickness

Skinfold thickness measurement provides a more direct and precise approximation of subcutaneous fat deposit, which is the fat under the skin. By assessing the thickness of this area, researchers are able to achieve an approximation of entire body fat. A precision thickness caliper is the tool used for this measurement and the pointer should be at zero before commencement of measurement (Freedman, Horlick and Berenson 2013: 1417-1421). To commence measurement, the participant must stand upright, with arms and shoulders relaxed freely at the side and the measurement is obtained from the right side. The skin is rolled from side to side

between the finger and the thumb on the subcutaneous fat to remove any muscle, then the subcutaneous fat is gently pinched using the precision caliper. Skinfold sites for measurement are the triceps, biceps, subscapular, suprailiac and midaxillary. The caliper is placed onto the marked skinfold and two measurements are taken and averaged for accuracy (Kannieappan *et al*. 2013: 2).

Skinfold thickness is a quick and noninvasive method to analyze the entire body fat. However, in calculating the skin thickness and percentage of body fat, the formula varies according to gender and the number of skinfold sites (Boeke *et al*. 2013: 7).

2.9.2 Laboratory assessment

Table 2.10: Laboratory tests (Gibson 2005)

Static biochemical tests and usage	Functional tests and usage
Nutrients in biological fluids or tissue	Functional biochemical test
Urinary excretion rate of nutrients or its metabolites	Functional physiological or behavioral test
Usable for the second and third stages for identification of nutrient deficiency.	Increased use in the later stages of the detection of nutrient deficiency. For example, when a decline occurs in certain nutrient-dependent enzymes.
	Reduction in the risk of chronic disease to achieve optimal health is associated with measuring nutrient level. For example, papillary and visual threshold for vitamin A and acuity for zinc.

Laboratory testing for the assessment of various nutrients serves as a pointer of nutritional status, as it gives a prognostic reaction to a particular dietary component. The tests are used to measure the level of nutrients in biological fluids or assessing certain biochemical functions. Laboratory or biochemical tests for nutrient assessment are employed to assess the presence of various nutrients such as iron, folacin, vitamin B12 and vitamin B6 which constitute bloodforming nutrients. Others are serum protein, water soluble-vitamins, fat soluble-vitamins, cholesterol and triglyceride levels. However, the interpretation of laboratory data is often challenging and caution needs to be exercised as the validity of the data depends on numerous factors, which may influence test results. Possibly, laboratory results may be affected by disease state, medications and other metabolic processes (Shim, Oh, and Kim 2014: 1; Ladero *et al*. 2015: 200; Wu, Lesperance and Bernstein 2016: 172; Moll and Davis 2017: 198).

2.9.3 Blood Pressure (BP) measurement

High blood pressure (BP) is one of the leading causes of death or disability globally, affecting about 40% of the adult's populace with a 13.2% control rate (Dasgupta *et al*. 2014: 487). Due to the high prevalence of this disorder, adults are advised to do a regular check of their BP as complications such as coronary heart disease, stroke and eventually renal diseases among others may develop from undiagnosed high blood pressure (Rehman and Nelson 2018). BP measurement measures the rate at which the heart pumps the blood forcefully through the wall of the arteries in the body. A stethoscope and a sphygmomanometer are essential tools for measuring blood pressure. Systolic BP and diastolic BP are the two numbers for reading blood pressure measurements. Measurement of the pressure in the blood vessels when the heart beats is referred to as systolic (upper number) BP while diastolic (lower number) BP measures the pressure in the blood vessel when the heart rests between beats. Systolic and diastolic measurements for normal blood pressure is expected to be less than 120mmHg and 80mmHg respectively. Blood pressure measurement is necessary and entails accuracy to eradicate blood pressure associated risk and to offer a management guide (Weber *et al.* 2014: 15; Vidal-Petiot *et al*. 2016).

However, caution needs to be exercised when taking BP measurements. Faulty tools and measurements could lead to wrong diagnosis. Knowledgeable and trained individuals are to handle BP measurement for accurate and reliable results with repeated measurements (Siu 2015: 781). Classification for adult BP is shown in the table below:

Table 2.11: Blood Pressure classification

Classification	Systolic (mm Hg)	Diastolic (mm Hg)
Normal	<120	<80
Prehypertension	120-139	80-89
Stage 1 hypertension	140=159	90-99
Stage 2 hypertension	≥160	≥100

Adapted from (WHO 2013).

2.9.4 Nutrition survey

A nutrition survey is a process of collecting information on the nutritional status of a population or a subgroup. Such information is gathered by asking nutrition related questions in a dialogue to a representative sample of the population (Johnston, Dohrmann, Burt and Mohadjer 2014:

1). The information obtained provides clear information on dietary intake and nutritional status. However, this nutrition information must be considered along with other health information as malnutrition could occur from different factors. Primarily, the purpose of a nutrition survey is to identify the prevalence and causes of malnutrition, and assess the extent of coverage of an existing nutrition programme. Basically, the survey collects data on socio-demographics, food and nutrient consumption (household) and other health indicators (Curtin *et al*. 2013: 1-2).

2.9.5 Health surveys

Health surveys gather and disseminate accurate information on the health and nutrition assessment of the population. This involves gathering information on the health status and mortality rate of the population and approximating the level of individual consumption of health care and precautionary procedures. It also assesses public security, medical and surgical history, tobacco and alcohol abuse, disability problems and dietary habits and preventive measures. (Curtin *et al*. 2013: 1-2; Johnson *et al*. 2014: 1).

2.10 DIETARY ASSESSMENT TOOLS

Dietary assessment tools are various instruments used in collecting information on food supply and production, food purchase and food consumption. The collection strategy could run on any of these levels such as national, household or individual levels depending on the level of concern. Most importantly, the researcher must be experienced and knowledgeable in collecting information with the research tools and the respondent needs to be trained or orientated on the detailed information required. This information could be the correct description of foods consumed, methods used in food preparation, recipes/ingredients used and portion, or size, of food consumed (Thompson and Subar 2013: 5; Shim, Oh, and Kim 2014:1).

2.10.1 Food Frequency Questionnaire (FFQ)

FFQ is a questionnaire used to obtain information on frequency and in some cases, portion size of food and beverages consumed during a quantified period of time (Thompson and Subar 2013: 5). FFQ is a common dietary assessment tool used in large epidemiologic studies of diet and health surveys. It assesses consumption from various food groups (diversity of consumption), intake of vitamins and other nutrients. The questionnaire comprises a list of foods particular to the specific population and is useful in determining dietary intake of the populace in question. FFQ is cost effective and simple to administer, requiring only 30 to 60 minutes' interview per section. However, FFQ is intended for individual rather than household use and is only suitable for group assessment alongside other dietary assessment tools (Shim, Oh, and Kim 2014: 1-4).

2.10.2 24-hour dietary recall

The 24-hour dietary recall is one of the dietary assessment tools applied in research through a quantitative interview method. This method takes into consideration the recall of food consumed, preparation methods, recipes and portion sizes. Usually the recall is expected to entail precise foods and beverages consumed twenty-four hours before the interview commences and it may be self-administered or administered by a trained professional. Twenty to thirty minutes may be required to complete a single interview with each respondent (Shim, Oh, and Kim 2014: 1-4).

Food models and visual aids (props) are used to help respondents in quantifying portion sizes and identifying food items; however, props should be culturally-specific (Thompson and Subar 2013: 5). Standardized weight/quantity needs to be attached to props for accurate results**.** The 24-hour dietary recall is effective and accurate when done in triplicate and together with other nutrition research methods. It involves daily records of consumption and is effective when administered more than once for each respondent**.** This type of assessment gathers nutritional information from individuals as well as trends of food consumption of individuals in a specified community. (Shim, Oh, and Kim 2014: 1-4; Salvador *et al*. 2015: 47).

2.10.3 Nutrition knowledge

Nutrition knowledge refers to the knowledge of nutrients and nutrition**.** Dissemination of nutritional knowledge is an appreciated and widely recognized preventive degree of lessening the prevalence of diseases in the populace. Different means are employed for nutrition knowledge enhancement, some of which include: food-based dietary guidelines, nutritionist educator, food pyramids and various manuals and books on nutrition. Nutrition knowledge takes into consideration knowledge of sound dietary intake and is applicable to both groups and individuals. It could further enhance the knowledge of the populace in making healthy choices as well as understanding the association between diets and diseases (Spronk *et al*. 2014:

1713; Legbara and Selepe 2017: 3).

2.10.4 Food records

A food record is a self-reported intake of all foods and beverages consumed by respondents in one day or longer. Food records are open-ended forms. Respondents may be guided in filling the food record forms or coached regarding the product brand name, food preparation methods, place of food consumption and portion size consumed. This can be further simplified with the

aid of food pictures, food models, measuring utensils and other visual aids. A trained interviewer/ researcher needs to review the concluding section of the records with the respondents to ensure accuracy of information reported (Thompson and Subar 2013: 5; Shim, Oh, and Kim 2014: 1-4).

2.11 Conclusion

This chapter extensively discussed the processes and importance of fishing and fish consumption, assessing livelihood possibilities, profitability and challenges. The challenges faced as a result of jeopardized livelihood sources and lack of diversification of income sources further initiated and increased household food insecurity. Malnutrition became a direct consequence of food insecurity, rendering households handicapped and infected with various forms of NCDs and health related problems. The literature further gave a breakdown on the mitigation and possible elimination of malnutrition challenges and outlined macronutrients and micronutrients requirements for adults to achieve a healthy and disease-free life.

CHAPTER 3

METHODOLOGY

3.1 INTRODUCTION

This chapter outlines the methodology used in the study to determine the fishing practices and fish consumption contribution to the nutrient profile, dietary diversity and food security of adult caregivers in the Buguma community in Rivers State in Southern Nigeria. The research tools of the study included a socio-demographic questionnaire, fishing practices questionnaire, 3 x 24-hour dietary recall questionnaires, Household Coping Strategies Index (CSI) questionnaire, a blood pressure and anthropometric measurement (height, weight and waist circumference) questionnaire and a Food Frequency Questionnaire (FFQ). The main objective of this chapter is to explain the planning and administration phase, research design, data collection, data analysis and statistics used in the study.

The aim of the study was to determine the fishing practices and fish consumption, contribution to the nutrient profile, dietary diversity and food security of adult caregivers in Buguma community, Rivers State, Southern Nigeria in order to plan interventions to address food insecurities caused through a disintegrated source of livelihood and improve the nutrition status of the community.

3.2 ETHICAL CONSIDERATIONS

The research proposal was submitted and approved in 2017 by the Durban University of Technology (DUT) Institutional Research Ethics Committee (IREC) prior to the commencement of the study. Ethical clearance number IREC 73/17 was issued for the study (Annexure A-1).

Permission to conduct the study was requested and approved by the Buguma municipality headquarters secretary and the council of chiefs of the Buguma community (Annexure A-2). Multistage, cluster and randomly selected households or respondents were approached at their homes, the study was explained and an information letter presented outlining the study in detail. Once the respondent understood the content of the information letter, a consent form was given requesting participation and those who agreed to participate voluntarily signed the consent form. The information letter assured the confidentiality of all information collected, and while no respondent's name was required, a participant number for each respondent was assigned to the questionnaires. Respondents were also informed that they had the right to withdraw from the study at any time without the imposition of a penalty. None of the respondents were compensated for participating in the study and none incurred any costs by participating in the study (Annexure C). Only the researcher and the supervisor had access to the information that was to be locked away in the Department of Food and Nutrition, Durban University of Technology for a period of five years, after which it will be destroyed by shredding; electronic data was password protected.

3.3 PLANNING AND ADMINISTRATION

After the researcher obtained ethical clearance from DUT IREC, she approached the Buguma municipality headquarters secretary through a written letter followed up by a meeting. The letter was approved and the researcher was further given consent to approach the council of chiefs by the municipality secretary. The researcher sent a written letter to the council of chiefs to obtain permission to conduct research in the community. The letter was considered during one of their sectional meetings and the researcher was invited to come and give further clarification. The council of chiefs thereafter issued approval for the researcher to conduct the study.

A focus group discussion consisting of nine members of the community was held immediately after permission was granted. The aim of the focus group discussion was to establish the relevant food items to be included in the food frequency questionnaire (Annexure J), the coping strategies (food security tool) (Annexure K) to be employed during food insecurity, as well as

the severity weight of the strategies. The discussion/meeting took place three times. Recommendations from the focus group discussion were cross-checked with the existing questionnaires and modifications made where necessary. The focus group discussion took place prior to the commencement of data collection. A pilot study was also conducted by the researcher with 15 persons in order to verify the validity of the modified questionnaires.

In the next phase, the respondents were randomly selected from the clusters of Enumeration Areas (EAs) mapped out by the Nigerian National Population Commission (NNPC). The selected respondents were approached in their homes, the study was explained and an information letter presented outlining the study in detail. Once the respondents understood the content of the information letter, a consent form was given to them requesting participation and those who agreed to participate, voluntarily signed the consent form.

Data were immediately taken from all respondents who had signed the consent form and were ready to give the necessary information required, while visits were scheduled for respondents who wished to sign later. The respondents were adults (19-70 years) in the household that had fishing knowledge and could give the precise information required. In most households, both male and female members had been or were currently involved in one form of fishing or another. Data collection took 40-60 minutes per respondent while data collection lasted for a period of eight weeks.

3.4 STUDY DESIGN

Nigeria is the most populated country in Africa with an estimated 169.7 million people (Tartiyus, Dauda and Peter 2015: 115). Nigeria has 36 states plus the capital state of Abuja, eight of which are situated along the coastline. Rivers State is one of the eight provinces on the coastline (Anele 2015: 2).

Rivers State is located in the southern part of Nigeria with over 6,162,100 people as documented by the Nigerian National Population Commission (NNPC 2011). Rivers State is regarded as the sixth most populated state in the country. The state is bounded by the Atlantic Ocean and is named after the many rivers that border its territory. Rivers State has many cities, towns and communities of which Buguma is one of the biggest.

Buguma is situated at the northern part of Rivers State with over 82, 862 people (NNPC 2011). Buguma is endowed with abundant resources. People from different parts of Rivers State usually travel to Buguma in search of livelihood (fishing) due to the diversity of its marine nature. Buguma has a local language called "*Kalabari*" but the predominant language spoken is English since the population represents diverse cultures.

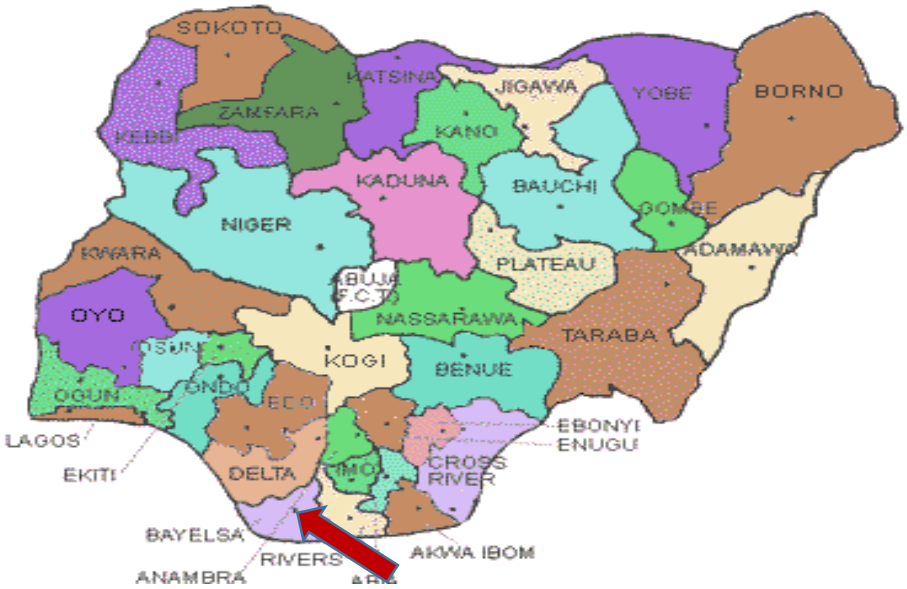

Figure 3.1: Map of Nigeria showing Rivers State: Province of research community

Figure 3.2: Rivers State map showing Buguma community

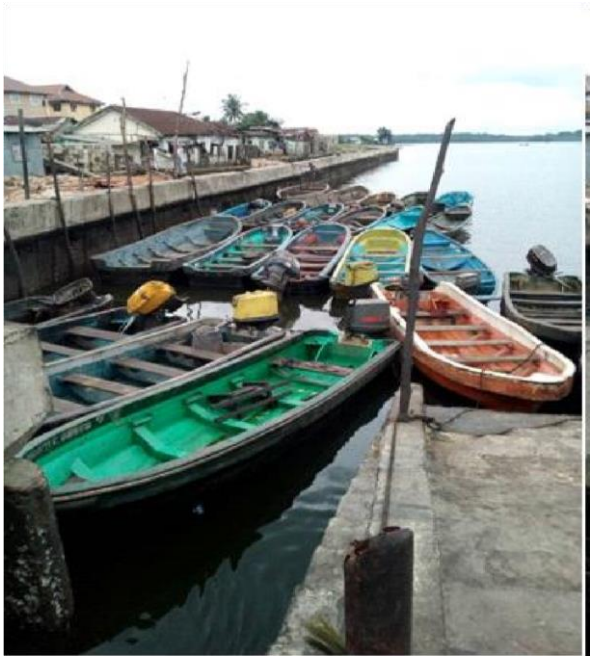

Figure 3.3: Buguma fishing site

The research is a descriptive study, designed as a survey using quantitative measures complemented by qualitative techniques. Various measuring instruments (questionnaires, weighing scale, food models, measuring tapes and sphygmomanometer) were used to collect relevant data in this study. All information collected was recorded immediately by the researcher to minimize error and with the aim of identifying and providing vital answers to the research problem during the interviews in the area. The questionnaires were administered to the respondents in an interview situation.

3.5 SAMPLING STRATEGY

The sample size of this study was 250 respondents (households). The sample size was calculated using a power calculation indicating that 250 respondents will represent a reliable sample (Cole, Nie and Chu 2006: 483-491) with a 95% confidence level. The sample was based on ten enumerated areas mapped out by the Nigerian National Population Commission (NNPC 2011). The focus was only on the households in Buguma community, Rivers State in Southern Nigeria. The sampling procedure applied was multistage (cluster and random). The population was divided into clusters or groups (30 clusters), based on the ten enumerated mapping by NNPC. Within the clusters, family compounds were drawn. Simple random sampling using ballot numbering were then used on family compounds to select targeted households. The selection continued until the targeted sample size was achieved. Data were collected from 250 respondents aged 19–70 years. Three respondents did not complete the full database and were therefore removed from the final samples, making 247 useable full datasets. Each respondent took approximately 40-60 minutes to complete the assessment and questionnaires.

Sample size calculation:

$$= \frac{Z^2 * (p) * (1-p) \quad ss}{c^2}$$

Where:

Z = Z value (e.g. 1.96 for 95% confidence level)

p = percentage picking a choice, expressed as a decimal (0.5 used for sample size needed) c = confidence interval, expressed as a decimal = 0.04 (three units on both sides of the normal).

Inclusion criteria

The following were included in the study:

- Adult caregivers in the household with knowledge of fishing practices.

- Respondents who were between 19 and 70 years old.
- Respondents who were permanent residents of the chosen coastal community.

Exclusion criteria

The following were excluded from the study:

- Visitors and people who had been residents in the community for less than six months.
- People under 19 years and above 70 years.
- Pregnant women in the household (the exact weight of respondent may not be accurate).

3.6 SELECTION OF FIELDWORKERS

Two residents from Buguma community were trained as fieldworkers by the researcher to assist in administering the questionnaires, which included socio-demographic, Food Frequency, coping strategy index, 24-hour food recall, anthropometric and fishing practices questionnaires for the study. A consent form to participate as a fieldworker was signed by all the fieldworkers (Annexure E). The significance of the study was explained and discussed. A fieldworker guide was used to train the fieldworkers (Annexure D). Training included how to approach respondents, the code of conduct to be followed and the administration of questionnaires. The fieldworkers were shown how to obtain anthropometric measurements and how to use the food models and visual aids (food pictures) to access portion sizes and help respondents identify unfamiliar foods. The trained fieldworkers accompanied the researcher to see how the research was conducted and were monitored and evaluated on the first day.

All the fieldworkers were fluent in English as the majority of the residents of Buguma community speak English fluently. All the respondents were treated with respect by the fieldworkers and made to feel as comfortable as possible. The fieldworkers were also taught the ethics of being friendly and patient with the respondents. The need for commitment and reliability was stressed as the key to effective data collection.

3.7 ADMINISTRATION OF MEASURING INSTRUMENTS

Figure 3.4: Data collection by researcher

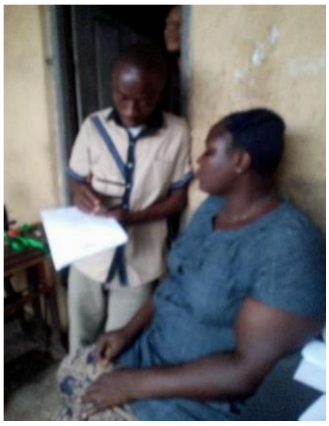

Figure 3.5: Data collection by fieldworker

3.7.1 Socio-demographic questionnaire

The socio-demographic questionnaire was developed and validated by Napier (2006) (Annexure F) and adapted for use during the pilot study. One-on-one interviews comprising open-ended and closed questions as structured in the questionnaire were administered to the respondents, who were addressed in simple English language. Socio-demographic questionnaires were completed with the following information being collected: personal demographic information, accommodation and family composition, work status and income, educational levels, languages spoken, food practices in the household and assets owned by the household. A total of 247 questionnaires were completed.

3.7.2 Anthropometric measurement

Anthropometric measurements were used to evaluate health, nutrition and social well-being (WHO 2018). The anthropometric device used consisted of portable, commonly applicable, low-cost, and non-invasive methods available to measure the proportions, size and structure of the human body. The device reflects health and nutrition and forecasts performance, and health and for these reasons, it is used on persons and populations for health and nutrition interventions, as well as to monitor health and nutrition (WHO 2011). The World Health Organization (WHO) defines Body Mass Index (BMI) as weight/height ($kg/m^{2)}$, a rudimentary guide of weight-for-height assessment of underweight, overweight and obesity (WHO 2000). The WHO recommendation for measurement of waist circumference instructs that the measurement be made at exactly the borderline between the lower margin of the last palpable

rib and the top of the iliac crest. The non-stretchable tape used is to be passed around the waist but not pulled too tightly. WHO recommends that the respondent stands with arms at the sides, feet positioned close together, and weight evenly distributed across the feet and the waist circumference should be measured at the end of a normal expiration, when the lungs are at their functional residual capacity. A relaxed posture is recommended, that is, the respondent should relax and take a few deep, natural breaths before the actual measurement is made, to minimize the inward pull of the abdominal contents during the waist measurement (WHO 2011).

The anthropometric parameters that were taken for this study included weight, height and waist circumference (Annexure G)**.** The procedures described above by WHO were adopted for this study in all the anthropometrics measures**.**

Blood Pressure (BP) was measured as an additional health assessment using the WHO recommendations and guidelines. As described by the WHO, BP is measured in millimeters of mercury. Normal adult blood pressure is defined as a systolic blood pressure of 120 mm Hg and a diastolic blood pressure of 80 mm Hg and two readings should be taken consecutively at one-minute intervals while the individual is seated (WHO 2013). Two hundred and fifty measurements were recorded for all the anthropometric measurements, with two hundred and forty-seven respondents completing the full database.

3.7.2.1 Weight

A mechanical scale (Hana-SON MPR000346) was used to measure weight in kilograms (kg). The scale was tested twice using the same weight in kg before measurements were taken. All respondents were asked to remove excess clothing and items that add extra weight, e.g. jackets, hats, cell phones, shoes etc. The scale was placed on an even surface and set at zero.

Respondents were asked to step on the scale and stand upright with both feet flat and apart while the measurement was recorded on the anthropometric sheet. Before the second measurement was taken the researcher ensured that the scale returned to zero. The weight measurements were combined and the total average weight was used. This procedure for weight measurement is recommended by WHO and was adopted for use in this study (WHO 1995).

3.7.2.2 Height

A stadiometer was used to measure the height of all respondents in metres (m). The stadiometer was placed on a flat surface against the wall. All respondents were asked to remove shoes, excessive clothing and hats. The respondents were also asked to stand in between the stadiometer bar and spine, with arms relaxed at the sides, legs straight, knees together, buttocks touching the spine of the stadiometer and heels flat and placed together against the horizontal floor of the stadiometer bar. The measurements were taken twice with the stadiometer touching the head while allowed to rest. The two measurements were recorded in metres (m) and rounded up to the nearest 0.05 metre (m). The procedure was repeated to obtain a second reading. An average of the two readings was recorded. The above height measurement procedure is in-line with WHO recommendation (WHO 1995) and was adopted for use in this research study.

3.7.2.3 Waist circumference

The WHO (2008) method was adopted for waist measurement, using a non-stretchable measuring tape. Respondents were asked to lift up their top clothing to expose the abdomen. Respondents stood up straight and pointed out the navel position using a finger. The measuring tape was held in a horizontal position, with the tape held loosely enough to allow one finger between the tape and the respondent's body and the measurement was recorded in centimeters (cm). The process was repeated and the average of the two measurements was recorded.

3.7.2.4 Blood pressure measurement

The WHO method for measurement of Blood Pressure (BP) was adopted using a digital sphygmomanometer device (Omron EN-M2 Automated Blood Pressure Monitor) and the battery was refreshed after every 50 measurements. One of the fieldworkers who is a trained nurse and was conversant with blood pressure measurement and readings took the blood pressure measurements to determine the prevalence of hypertension. Respondents in a sitting position were asked to pull up the left sleeve of their clothing to expose the upper part of the arm for direct contact from the sphygmomanometer to the pulse. The arm cuff was wrapped round the arm of the respondents and the fieldworker ensured it was tightly secured. The respondents were allowed to sit for one minute before the blood pressure measurement was taken. The start/stop button was pressed to commence the inflation of the arm cuff and it was allowed to be deflated before the final reading on the sphygmomanometer was taken. The procedure was repeated to obtain the second reading and an average of the two readings was recorded.

3.7.3 Coping Strategy Index (CSI)

The CSI is a pointer to household food security that is comparatively simple and quick to use, easy to comprehend, and relates well with the multifaceted procedures of food security (Carietto, Zezza and Banerjee 2013: 32). A sequence of questions about how households cope with a deficit in food consumption are itemized in a simple numeric score. In its simplest form, observing changes in the CSI score shows whether household food security status is decreasing or improving. The CSI is an appropriate tool for emergency use as it is quick and relatively cheap (Maxwell *et al.* 2003: 1).

A food coping strategy questionnaire developed by Maxwell *et al* (2003: 1) was adapted and modified for the Buguma community (Annexure K) during the initial focus group discussion and tested during the pilot study. The trained fieldworkers and the researcher completed 247 questionnaires in one-on-one interview situations with the respondents. The respondents were asked if there had been times in the past 30 days where there was not enough money to buy food and how often the household had to use a specific coping strategy. The relative frequency scores vary from 7: all the time, everyday; 4.5: pretty often, 3-6 x/week: 1.5; once in a while, 1-2 x/week: 0.5; hardly at all, 1 x/week and 0: never. The coping strategies were also weighed for severity during the focus group discussion as mentioned in 3.3, scoring from one to four, with one being for least severe and four being for most severe. The questionnaire results are interpreted and discussed in chapter 4.

3.7.4 24-hour dietary recall

The 24-hour dietary recall is a food intake assessment. Respondents were expected to recall all food and beverages consumed within the previous 24 hours (Kirkpatrick *et al*. 2014: 233). This study undertook three 24-hour dietary recalls and was carried out as enumerated below. A structured 24-hour recall questionnaire was used to determine actual food intake, food items and quantities consumed over a 24-hour period (Annexure H) by the caregiver reflecting on the household intake. The three 24-hour recall questionnaires were conducted in an interview situation in 247 households. Food models and visual aids (pictures of food types and portion sizes) were concurrently used to assist respondents in estimating portion sizes and identifying certain food items accurately. The 24-hour recalls comprised of a weekend day and two week days. Each recall was recorded on a separate questionnaire. The data was captured and analyzed for the nutrient adequacy of the diet. **3.7.5 Food frequency questionnaire**

Food frequency questionnaires consist of a list of foods from the various food groups that are applicable or related to the study population. This type of dietary assessment is suitable for

groups. It is commonly used in investigating or identifying food consumption from each food group and identifying varieties of consumptions (Jayawardena *et al*. 2013: 1-2). It assesses food variety score and dietary diversity where the type and variety of individual foods are measured. Food frequency assessment is capable of assessing under-consumption or overconsumption of single nutrients. The food frequency dietary assessment can be selfadministered by large numbers of individuals in a short period (Zainal Badari *et al*. 2012: 266).

This study undertook used a food frequency assessment as stated below.

The food frequency questionnaire developed by Mirmiran *et al.* (2010) was adapted and modified (Annexure I) by the researcher after the focus group discussion with the nine community members. The questionnaire was completed in a one-on-one interview with respondents. Food items that had been consumed in the last seven days prior to data collection were recorded. Two hundred and forty-seven questionnaires were completed during the data collection phase.

3.7.6 Fishing practices questionnaire

The fishing practices questionnaire made use of diverse types of information to assess the prime exploitation of fish and possible outcomes of sustainability. This related to the resource abundance, such as whether the stock was depleted or close to its extreme biomass. It also accounted for other important aspects of fish population dynamics such as the current expected levels of future recruitment, or even economically relevant features such as probable changes in catch per unit and how it affects the dealers (Fernández-Boán *et al.* 2013: 605). Fishing practices were thus assessed in this study and carried out as written below.

A fishing practices questionnaire developed by Ahmed *et al.* (2013: 88) was adapted and modified for the Buguma community (Annexure J) during the focus group discussion and tested as part of the pilot study. The questionnaire was completed in an interview situation while the respondents and responses were recorded promptly in the spaces provided. A total of 247 questionnaires were fully completed by the respondents.

3.8. DATA ANALYSIS AND STATISTICS

3.8.1 Socio demographic questionnaire

The socio demographic questionnaire was checked for completeness and accuracy by the researcher. The data were captured onto an Excel® spreadsheet. The questionnaires were analyzed using the Statistical Package for Social Sciences (SPSS) for Windows Version 24

software program. Descriptive statistics were determined. Data were presented as frequencies and percentages in tables, graphs and figures.

3.8.2 Anthropometric measurement

3.8.2.1 BMI

The weight and height (average readings) measurements of all the respondents (n=247) were captured on an Excel® spreadsheet and used to determine body mass index (BMI). The BMI was calculated by dividing weight in kilograms (kg) by height in metres squared (m^2). The results were compared to the WHO (2008) cut-off points as follows**:**

Table 3.1: BMI Classification (WHO 2008)

Parameter	Ranges
Underweight	<18.5
Normal weight	18.5 - 24.9
Overweight	25.00 - 29.9
Obesity class I	30.00 - 34.99
Obesity class II	35.00 - 39.99
Obesity class III	>40.00

The BMI was used to estimate and predict the prevalence of underweight, overweight and obesity in the community and its associated risks.

3.8.2.2 Waist Circumference (WC) and Waist to height ratio (WHtR)

The WC and WHtR are predictors of health risk. The WC measures abdominal obesity and the height measurement is a supplemented index for accurate investigation. WC and WHtR analysis reveal respondents at risk of multiple cardio-metabolic risk factors, including metabolic syndrome (MS), elevated lipid levels, inflammation and insulin resistance, as well as an amplified incidence of hypertension, diabetes and cardiovascular disease higher than the general obesity measurement. The WC and height measurement cut-off points were used to identify the aforementioned syndrome. The waist circumference indicative of increased risk for women is >88cm and for men it is >102cm. Waist to Height Ratio (WHtR) was calculated by dividing waist measurement in centimetres by height measurement in centimetres (cm). A WHtR >0.5 indicates possible risk of metabolic diseases (Park *et al*. 2014: 667-668; WHO 2011b: 2; Gibson 2005: 6).

3.8.2.3 Blood pressure (BP)

Blood pressure measurement is used for health assessment and prediction for cardiovascular disease. Respondents with high BP (140/90mmHg) are at risk of developing heart disease, stroke, kidney disease and dementia compared to their counterparts with normal BP (Kapil *et al*. 2013: 93). The BP measurements were also used to identify respondents at risk of hypertension. The categories are described below:

Table 3.2: Blood pressure categories (WHO 2013)

Blood pressure category	Systolic blood pressure (SBP)	Diastolic blood pressure (DBP)
Normal blood pressure	120	80
Prehypertension	>120-139	>80-89
High blood pressure stage 1	140-159	90-99
High blood pressure stage 2	≥160	≥100

Data were all captured on an Excel spreadsheet and SPSS window version 24 used by the researcher to determine means and standard deviation.

3.8.3 Dietary Assessments

3.8.3.1 The 24-Hour Food Recall

The dietary intake and food consumption data from the 24-hour recall questionnaires was analyzed by a Food and Nutrition specialist. The Food Finder Version 3.0 computer program was used for the nutrient's analysis (Langenhoven *et al*. 1991; Food Finder 3 2002). Traditional Nigerian meals were added to the software programme in made-up forms. Make-up meals were egusi soup, okra soup, native soup and porridge beans and yam. These meals were combinations of different ingredients to form a masterpiece. The results of the 24-hour recalls were then used to determine the actual intake with mean, standard deviation and nutrient intake calculated and compared with the Dietary Reference Intakes (DRIs). Estimated Average Requirements (EARs) were used as the reference measure and if this was not available, Adequate Intake (AI) was used as Recommended Daily Allowances (RDAs) are indicated for use in individuals and not groups of people (NICUS 2003). The top 20 food items consumed were determined and presented as total intake, mean intake and frequency. Fruit and vegetable intake were compared to the WHO guidelines of >400g/day. The Daily Recommended Intake (DRI) expresses the distribution as the Acceptable Macronutrient Distribution Range (AMDR) as per percentage of kilojoules.

Energy contribution to daily requirements of WHO cut-off points: Protein: 10-15%, Fat: 15-30% and Carbohydrates: 55-75% (WHO 2003) was calculated. The Nutrient Adequacy Ratio (NAR) was also calculated.

3.8.3.2 Food Frequency Questionnaire

The data from the FFQs over the past seven days in each household were used as a measure for the food group diversity score (FGDS) and food variety score (FVS) and were captured on a Microsoft Excel® spreadsheet and analyzed using SPSS version 24 for descriptive statistics. The captured data were then used to determine whether there was a low, medium or high food variety in the household. The FVS and FGDS of all households were then compared and the most frequently consumed food items in all households determined. The FVS and FGDS ranged from low: 0-30 food groups or < 30 individual foods, medium: 4-5 food groups or 3060 individual foods, and high: 6-9 food groups or > 60 individual foods (Matla 2008: 13). Food Variety Score (FVS) is a simple count of food items, while Dietary Diversity Score (DDS) refers to the food group count (FAO 2013).

3.8.4 Coping Strategy Questionnaire

The completed Coping Strategy Questionnaire data were sorted and checked for completeness and accuracy by the researcher and n=247 were found to be usable. The data were captured on an Excel spreadsheet by the researcher and then analyzed by utilizing the SPSS Version 24. Descriptive statistics including frequencies, mean, standard deviations and percentages were determined. Tables were drawn up with different variables included in the questionnaires. Data were presented in terms of frequencies and percentages for the various categories.

3.8.5 Fishing Practices Questionnaire

The completed fishing practices questionnaire data were sorted and checked for completeness and accuracy by the researcher and out of 250 samples, 247 were found useable. The data were captured on an Excel spreadsheet and then analyzed using SPSS Version 24.0. Descriptive statistics including frequencies, figures and percentages were obtained.

3.8.6 Correlations

Bivariate correlation was conducted using the Pearson statistical test (2-tailed): r=0 indicates no relationship while negative links are indicated by r= -1. The *p*-value is the probability of finding a test statistic at least as extreme as the one that was really observed, assuming that the null hypothesis is true. Furthermore, the null hypothesis is rejected when the *p*-value is less than

0.05 or 0.01. When rejection of null hypothesis occurs, the hypothesis is said to be statistically significant (Pernet, Wilcox and Rousselet 2013; Gelman 2013).

3. 8.6.1 Variables for correlation

- Household monthly income and household monthly spending
- Number of persons contributing to household spending and household monthly spending
- Education and employment
- BMI and WHtR
- FVS and number of persons in the household
- WHtR men and women (51+ years)
- BMI and WC
- Fishing practices and monthly income
- Fishing practices and not having enough money
- Monthly income and FVS
- Education and monthly income
- Education and Age
- WC and Carbohydrate intake (men 51+)
- Energy intake (men and women 19-50 years) and FGDS
- Energy (men 51+ years) and FVS
- BMI and systolic blood pressure
- BMI and diastolic blood pressure
- WC and systolic blood pressure
- WC and diastolic blood pressure
- WHtR and systolic blood pressure
- WHtR and diastolic blood pressure
- Energy intake (men 51+ years) and FVS
- Energy intake (women 51+ years) and FVS
- Carbohydrate intake (women 19-50 years) and BMI
- Energy intake (women 51+ years) and BMI
- Energy intake (men 51+ years) and education

3.8.7 Conclusion

In this chapter, all the instruments used to determine the fishing practices and fish consumption contribution to nutrient profile, dietary diversity and food security of adult caregivers in Buguma community were discussed. The measuring instruments used in this study were appropriate, effective and reliable in gathering the data in order to achieve the study aim. The next chapter includes a compilation of all the data collected.

CHAPTER 4
RESULTS AND FINDINGS

4.0 SOCIO-DEMOGRAPHIC RESULTS

4.1 INTRODUCTION

The purpose of this study was to determine the contribution of fishing practices and fish consumption to the nutrient profile, dietary diversity and food security of adult caregivers in a coastal community in Rivers State, Southern Nigeria. The Buguma community was used for this study and was assessed for socio-demographics, fishing practices, anthropometric measurements, household Coping Strategies Index (CSI) for measuring food insecurity, food frequency and 3×24-hour food recalls. Socio-demographic data provided essential information about the study population.

This chapter focuses on reporting the results obtained in the study. All the processed data are presented in the form of tables, statistical figures and graphs and interpreted and evaluated. The results are presented in the form of percentages (%) and numbers (n), mean and standard deviation.

4.2. STUDY RESULT OF BUGUMA COMMUNITY

The sampling techniques resulted in 250 selected respondents forming part of the sample population, with a total of 247 of the respondents completing the study. Table 4.1 shows gender distribution. The majority of the respondents were women making up 61.1% (n=151), whereas men made up 38.9% (n=96) of the sample size.

Table 4.1: Gender distribution

Gender	Number (n)	Percentage (%)
Men	96	38.9
Women	151	61.1
Total	247	100.0

Table 4.2 presents age distribution, number and percentage of respondents. Forty-eight point six percent (n=120) of the respondents fell within the age group of 31-50 years old, while 36.8% (n=91) and 14.6% (n=36) were within the age groups of 19-30 years and >51 years respectively.

Table 4.2: Age distribution

Age (years)	Number (n)	Percentage (%)
19-30	91	36.8
31-50	120	48.6
>51	36	14.6
Total	247	100.0

4.2.1 Family composition, accommodation and sanitation

The roles of respondents in the family indicates that 55.5% (n=137) were mothers, followed by fathers (35.6%; n=88). Others were relations or helpers, grandmothers and grandfathers with the following percentages 4.9% (n=12), 2.4% (n=6) and 1.6% (n=4) respectively as indicated in Figure 4.1.

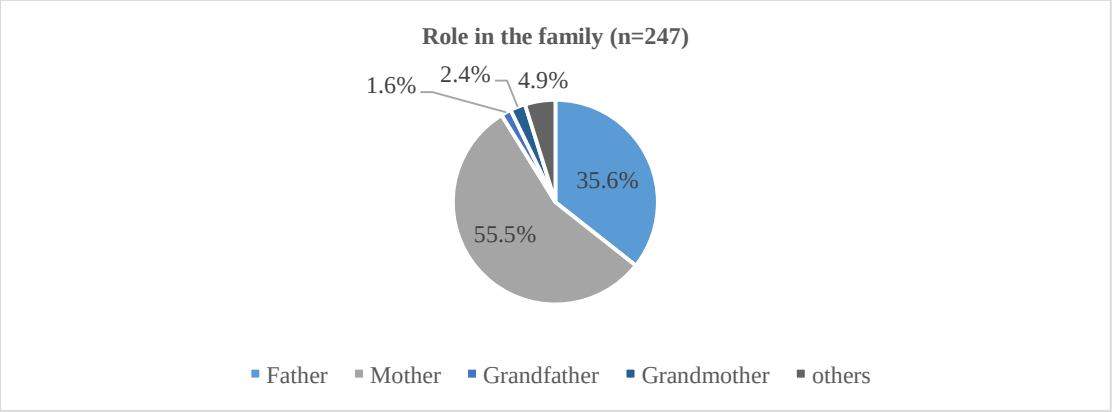

Figure 4.1: Role of respondent in the family

The accommodation of the respondents is depicted in Table 4.3. All respondents lived in the Buguma community (100.0%; n=247), stayed in brick (83.0%; n=206) and zinc (13%; n=32) houses with other people living with them (98.4%; n=243) in the households. Most respondents accommodated six persons and above (42.1%; n=104), followed by four persons (22.3%; n=55), five persons (12.1%; n=30), three persons (11.3%; n=28), two persons (7.7%; n=19) and one person (4.5%; n=11) respectively. Most of the accommodation (41.7%; n=103) was rented by the respondents, only 32.0% (n=79) owned their residences, while 21.9% (n=54) stayed in the family houses or inherited houses and 3.6% (n=9) of the respondents stayed with relatives. A good proportion of the respondents had stayed in their residence for more than five years (67.2%; n=166), followed by one to five years (22.7%; n=56) and less than one year (10.1%; n=25). Similarly, two rooms (32.8%; n=81) were mostly occupied by the respondents, followed

by more than five rooms (23.1%; n=57), one room (20.3%; n=50), three rooms (12.3%; n=31) and four rooms (11.3%; n=38). These rooms mostly had cement floors (74.9%; n=185), followed by tiles (27.1%; n=67) and carpets (19.0%; n=47). Most homes had other buildings within the yard (93.1%; n=230) and only 6.9% (n=17) did not have any building within the premises.

Table 4.3: Accommodation

Variables	Number (n))	Percentage (%)
Place of residence		
Rural village	247	100.0
House type		
Brick	205	83.0
Clay	4	1.6
Grass	4	1.6
Wood	2	0.8
Zinc/Shack (corrugated iron)	32	13.0
Total	247	100
Living with other people		
Yes	243	98.4
No	4	1.6
Total	247	100
Current living status		
Homeless	2	0.8
Living with relatives	9	3.6
Rented house	103	41.7
Own house/flat	79	32.0
Employee/family properties	54	21.9
Total	247	100
Number of permanent resident(s) living with you		
1 person	11	4.5
2 persons	19	7.7
3 persons	28	11.3
4 persons	55	22.3
5 persons	30	12.1
6 persons and above	104	42.1
Total	247	100
Number of year (s) stayed in your permanent house		
< 1 year	25	10.1
1-5 years	56	22.7

>5 years	166	67.2
Total	247	100
Number of rooms in your house		
I room	50	20.3
2 rooms	81	32.8
3 rooms	31	12.5
4 rooms	28	11.3
>5 rooms	57	23.1
Total	247	100
Other houses within the same premises		
Yes	230	93.1
No	17	6.9
Total	247	100

Respondents did not have access to potable tap water, therefore, 34.4% (n=85) fetched water from elsewhere such are wells and streams. Only one-quarter (24.3%; n=60) had access to boreholes, while 19.8% (n=49) and 14.6% (n=36) had access to tap water outside and inside their houses respectively. Respondents were responsible for disposing of their waste (89.9%; n=222). As such, waste was untidily dumped on the roadside and in flowing rivers. Only 10.1% (n=24) of the population had an arranged waste disposal system. The improper waste disposal and unhygienic environment could have resulted in widespread infestation of mosquitoes (92.2%; n=240), cockroaches (74.1%; n=183) and mice/rats (64%; n=157) in the homes as shown in table 4.4.

Table 4.4: Sanitation (n=247)

Variables	Number (n)	Percentage (%)
Water facilities		
Tap in the house	36	14.6
Tap outside the house	49	19.8

Borehole	60	24.3
Spring / river	17	6.9
Fetch water elsewhere	85	34.4
Total	247	100
Waste removal services		
Yes	25	10.1
No	222	89.9
Total	247	100
Pest infestation		
Mice/ Rat	158	64.0
Cockroaches	183	74.1
Mosquitoes	240	97.2
Ants	89	36.0
Frogs	30	12.1
Type of floor material in the house		
Cement	185	74.9
Tiles	67	27.1
Carpet	47	19.0

The state of the respondents' houses is shown in table 4.5. Forty-five-point three percent (n=112) of the respondents complained about the size of their houses while 43.0% (n=106) were in need of repairs to their houses.

Table 4.5: Problems with the state of participants' houses

Variables	Number (n)	Percentage (%)
Size	112	45.3
In need of repairs	106	43.0
Damp	5	2.0
Other	24	9.7
Total	247	100

Seventy-seven-point three percent (n=191) of the households had access to electricity each time electricity was made available by the Power Holding Company. Only 22.7% (n=56) were yet to be connected to an electricity source in the community. Tarred roads were predominantly on the access road to the community, therefore the majority of respondents (76.1%; n=188) had no tarred road in front of their houses while only 23.9% (n=59) had tarred roads. The same statistics were applicable

to gravel roads. A small portion of the population (10.9%; n=27) had gravel roads in front of their houses while the majority (89.9%; n=220) had none as indicated in table 4.6.

Table 4.6: Access to infrastructure (n=247)

Variables	**Number (n)**	**Percentage (%)**
Access to electricity		
Yes	191	77.3
Tarred road in front of house		
Yes	59	23.9
Gravel road in front of house		
Yes	27	10.9

Table 4.7 illustrates that 80.2% (n=198) of the respondents were currently unemployed, while 19.8% (n=49) were employed. Among the unemployed respondents, 61.1% (n=122) were seemingly unemployed, 16.2% (n=32) were retired and 15.2% (n=30) were in selfemployment. Housewives and students numbered 3.5% (n=7) each. Sixty-two-point three percent (n=76) of the respondents were actively looking for employment and 37.7% (n=46) were not actively looking for employment or were satisfied with their present sources of livelihood. Fifty-point eight percent (n=62) of the unemployed respondents had been unemployed for more than three years, followed by 39.4% (n=48) for one to three years, 8.2% (n=10) for six to twelve months and 1.6% (n=2) for less than six months. Among the employed respondents, 59.5% (n=29) occupied permanent positions, 24.5% (n=12) had temporary positions and 10.2% (n=5) had fixed-term positions. Only 6.1% (n=15) of the respondents were working a second or weekend job and the majority (93.9%; n=232) were not employed in any part-time job.

Table 4.7: Employment status

Variables	Number (n)	Percentage (%)
Currently employed	n=247	
Yes	49	19.8
No	198	80.2
Current status of unemployed participants	n=198	

Unemployed	122	61.6
Retired	32	16.2
Housewife	7	3.5
Student	7	3.5
Others (self-employed)	30	15.2
Actively looking for employment	n=122	
Yes	76	62.3
No	46	37.7
Duration of unemployment	n=122	
<6months	2	1.6
6-12 months	10	8.2
1-3 years	48	39.4
>3 years	62	50.8
Current job status of employment of participants	n=49	
Permanent	29	59.2
Temporary position	12	24.5
Fixed term contract	5	10.2
Others	3	6.1
Part-time or weekend job (second job)		
Yes	15	6.1
No	232	93.9
Total	247	100

Figure 4 shows respondents' mode of transportation, indicating that 60.7% (n=150) used a bicycle/motor bike to get around town, 16.2% (n=40) relied on taxis and 13.0% (n=32) relied on buses.

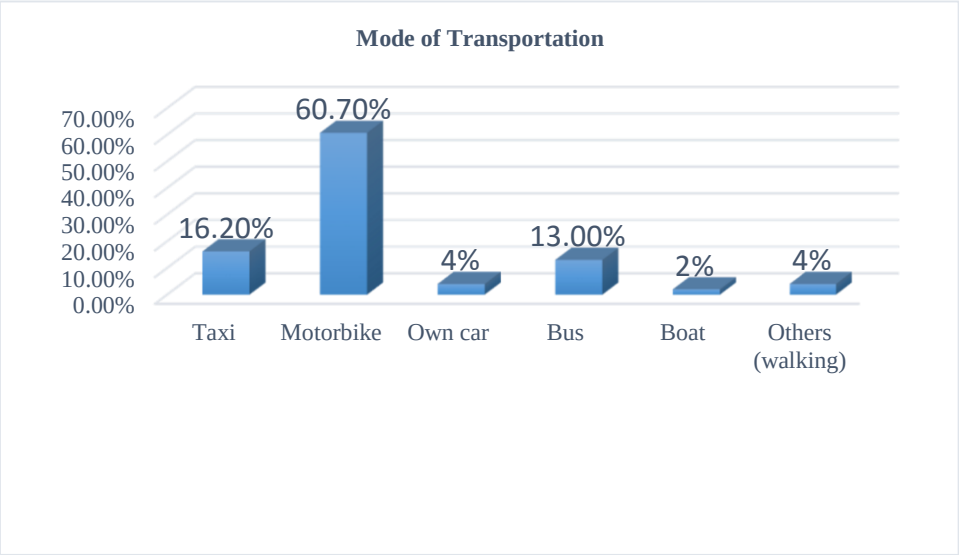

Figure 4.2: Mode of transportation of respondents

4.2.2 **Income and expenditure**

Thirty-three point two percent (n=82) of the households had a monthly income of #21, 000 - #30, 000 (Rand value: R3100-4000) while 25.5% (n=63) earned #31, 000 - #40 000 (Rand value: R4100-R5000) with 17.0% (n=42) of the households earning #15,000-#20,000 (Rand value: R2000-R3000) as illustrated in figure 4.3. Statistically significant relationships occurred at p=0.001 and p=0.012 between household monthly income and household monthly spending, and household monthly income and Food Variety Score (FVS) respectively.

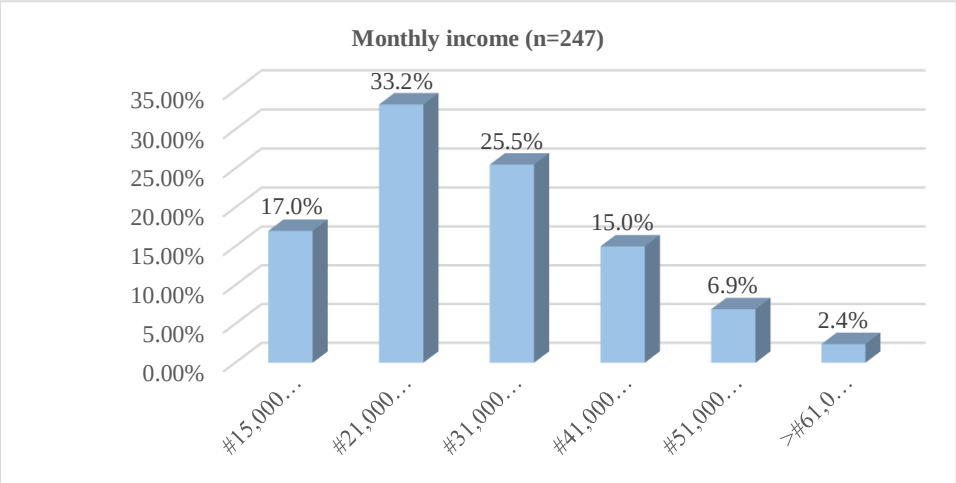

Figure 4.3: Monthly income of the household

Figure 4.4 indicates that 47.8% (n=118) of the household income was provided by one person, 46.2% (n=114) was provided by two people while 3.2% (n=8) and 2.8% (n=7) were provided by three and four people respectively. A statistical significance was observed (p=0.001) between the number of people contributing to household spending and household monthly

income.

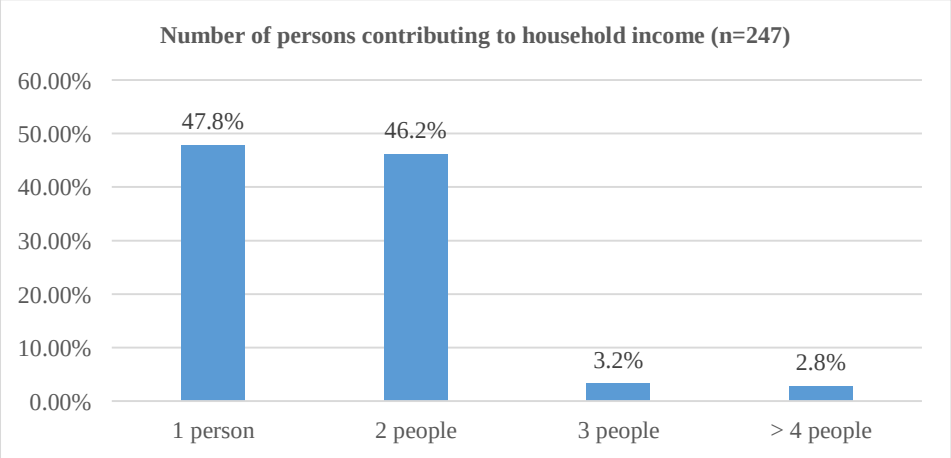

Figure 4.4: Number of people contributing to household income

Figure 4.5, reporting on the monthly spending of households on food, indicates that 38.1% (n=94) spent five to ten thousand naira (Rand value: R1000-R1500), while 31.6% (n=78) spent eleven to fiifteen thousand naira (Rand value: R1600-R2000); 14.5% (n=36) and 15.8% (n=39) spent sixteen to twenty thousand naira (Rand value: R2100-R2500) and >#25, 000 (Rand value: >R3000) respectively.

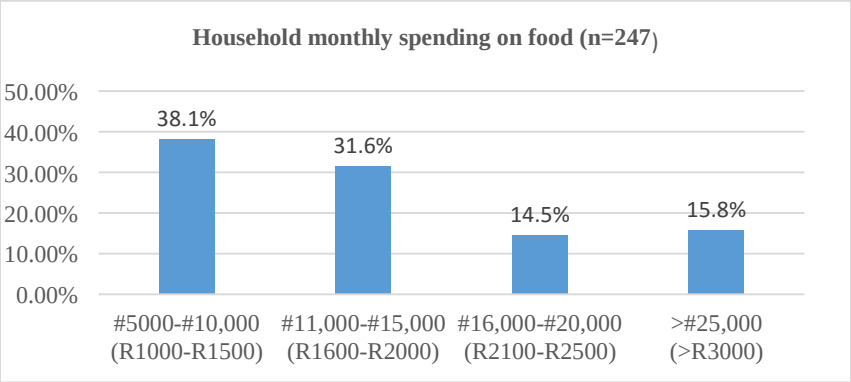

Figure 4.5: Household monthly spending on food

Respondents indicated that 37.7% (n=93) of the households sometimes did not have enough money to buy food while 25.5% (n=63) of the respondents indicated “Always”, 24.2% (n=60) indicated “Often” and only 11.7% (n=29) indicated “Seldom” and 0.8% (n=2) indicated “Never” as shown in figure 4.6.

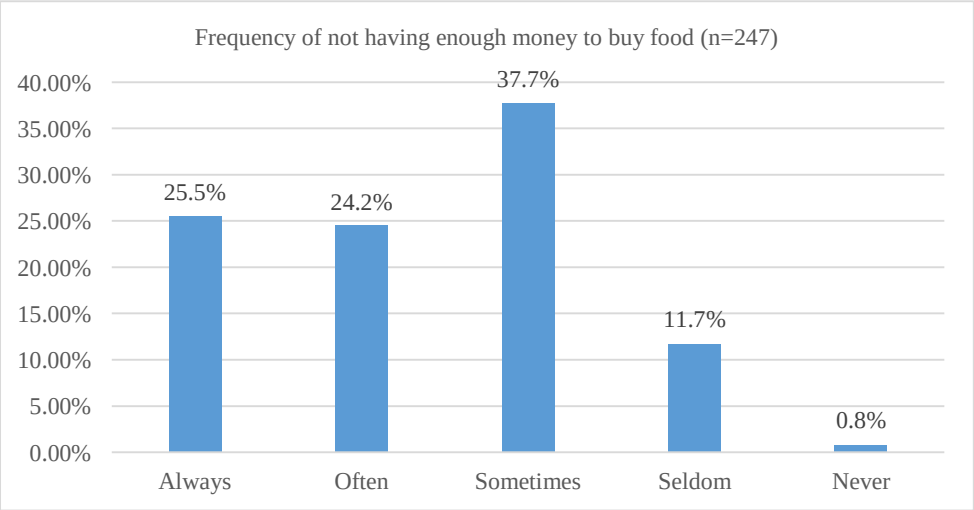

Figure 4.6: Insufficient funds to purchase food

Seventy-one percent (n=176) of the respondents bought food every day, 14.0% (n=35) bought food once a week and 11.0% (n=26) purchased food on a monthly basis as indicated in figure 4.7.

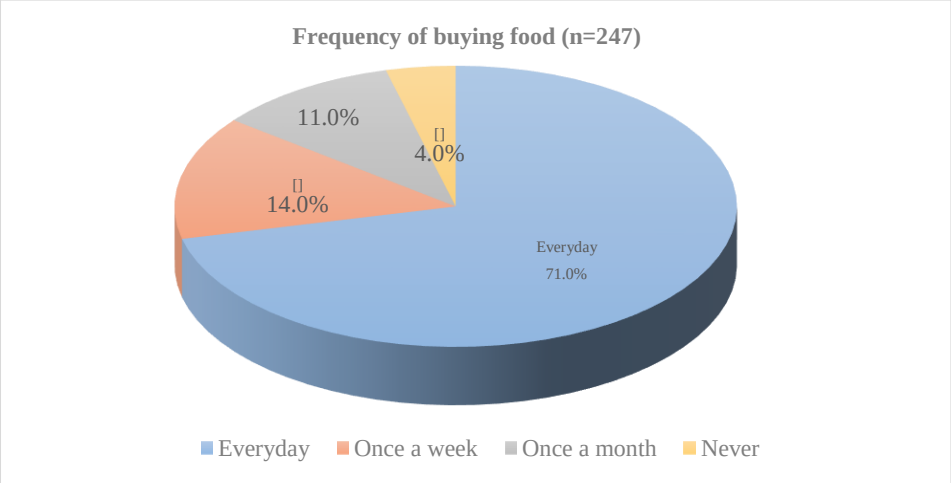

Figure 4.7: Frequency of buying food

The result on channels for buying food (Figure 4.8) shows that the majority (90.0%; n=223) of the respondents purchased their food from the open market, 4.0% (n=10) from tuck shops, and 3.0% (n=7) from street vendors and wholesalers respectively.

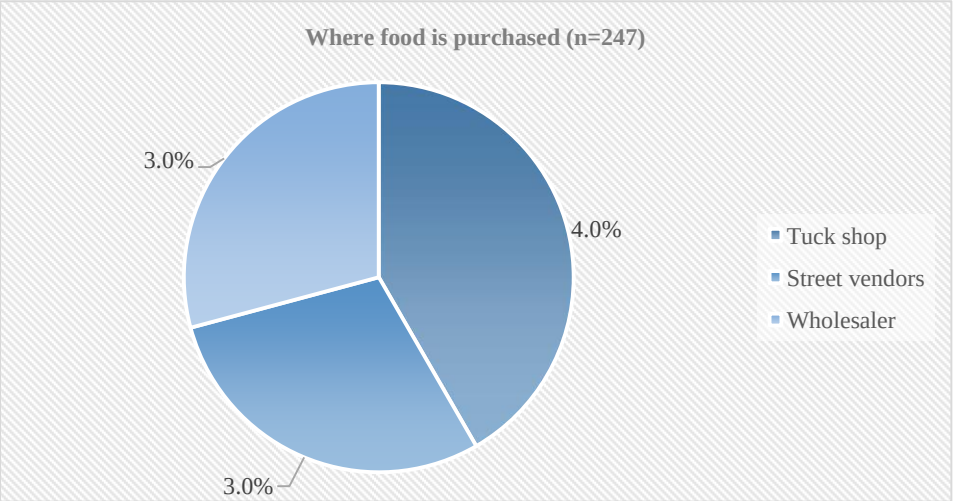

Figure 4.8: Food buying channels

The local language Kalabari is spoken by 38.5% (n=95) of the respondents while 32.8% (n=8) of the respondents who dwell in the community but are not indigenous, speak the dialect of their native origin described as “other languages” in this study and the English language was spoken in 28.7% (n=71) of the households.

The level of education varied among respondents, with 4.5% (n=11) having no formal education, 15.8% (n=39) had primary school education, 55.5% (n=137) had secondary school education, 8.9% (n=22) attended Government craft or vocational schools and 14.5% (n=36) had university education as shown in table 4.8. Statistically significant relationships were found between the level of education and employment at p=0.001 and level of education and monthly income at p=0.000.

Table 4.8: Language of caregivers and level of education

Variable	Number (n)	Percentage (%)
Language spoken in the house		
English	71	28.7
Kalabari	95	38.5
Other	81	32.8
Total	247	100
Highest education level		
None	11	4.5
Primary school	39	15.8
Secondary school	137	55.5
Government craft school	22	8.9
University	36	14.5
Other	2	0.8
Total	247	100

The results on food practices in the household shows that mothers were mostly responsible for food preparation (83.8%; n=207), deciding on what food was to be bought (83.0%; n=205) and responsible for feeding the children (88.3%; n=218). Majorly, the fathers were cited as the head of the home in 72.1% (n=178) of the households, followed by the mother in 21.1% (n=52) of the households. The father also mostly decided how much was spent on food in 70.5% (n=174) of the households while 23.3% (n=58) of the households were dependent on the mother's decision as illustrated in tables 4.9a and 4.9b.

Table 4.9a: Food practices in the household (n=247)

Variable	Number (n)	Percentage (%)
Person who prepared food in the house		
Father	14	5.7
Mother	207	83.8
Sibling	7	2.8
Grandma	3	1.2
Grandpa	1	0.4
Others (Aunt, uncle, helper)	15	6.1
Total	247	100
Person who decided what type of food to buy	**Number (n)**	**Percentage (%)**
Father	26	10.5
Mother	205	83.0
Sibling	3	1.2
Grandma	7	2.9
Grandpa	1	0.4
Others (Aunt, uncle, helper	5	2.0
Total	247	100
Person responsible for feeding/serving the children		
Father	4	1.6
Mother	218	88.3
Sibling	8	3.2
Grandma	2	0.8
Grandpa	0	0.0
Others (Aunt, uncle, helper)	15	6.1
Total	247	100

Table 4.9b: Food practices in the household (n=247)

Head of the household		
Father	178	72.1
Mother	52	21.1
Sibling	1	0.4
Grandma	2	0.8
Grandpa	6	2.4
Others (Aunt, uncle, helper)	8	3.2
Total	247	100
Person who decided how much is spent on food		
Father	174	70.5
Mother	58	23.5
Sibling	0	0.0
Grandma	2	0.8
Grandpa	5	2.0
Others (Aunt, uncle, helper)	8	3.2
Total	247	100

Meal consumption data as presented in table 4.10 indicates that 50.6% (n=125) of the respondents ate two meals a day while 42.9% (n=106) consumed three meals daily. The majority (83.4%; n= 206) ate snacks with 98.4% (n=243) of all meals eaten at home.

Table 4.10: Meal consumption of respondents

Variable	Number (n)	Percentage (%)
Number of meals eaten per day by caregivers		
1	12	4.8
2	125	50.6
3	106	42.9
>3	4	1.6
Total	247	100
Snacks consumption in between meals		
Yes	206	83.4
No	41	16.6
Total	247	100
Place of consumption of most meals by caregiver		
Home	243	98.4
Friend's place	2	0.8
School	2	0.8
Other (restaurant, food vendors….)	0	0
Total	247	100

Ninety-eight-point eight percent (n=244) of the respondents used paraffin stoves for cooking. Seventy percent (n=173) of the respondents had access to information through telephones, 50.6% (n=125) owned radios, 59.9% (n=148) owned televisions and 69.2% (n=171) had a bed and mattress. Smaller numbers of the respondents owned the rest of the household assets listed in table 4.11.

Table 4.11: Assets in household (n=247)

Variable	Number (n)	Percentage (%)
Paraffin stove	244	98.8
Telephone/cell phone	173	70.0
Bed with mattress	171	69.2
Television	148	59.9
Radio	125	50.6
Refrigerator	109	44.1
Electrical iron	76	30.8
Gas stove	46	18.6
Electrical stove	45	18.2
Mattress only	34	13.8
Dining set	33	13.4
Electrical kettle	29	30.8
Bicycle	27	10.9
Car	22	8.9
Freezer	17	6.9
Motorbike	17	6.9
Hot plate	10	4.0
Microwave	7	2.8

Table 4.12 Illustrated that all respondents (100%; n=247) used pots that were made of aluminum for cooking and most used kerosene (paraffin) for fuel (98.0%; n=242).

Table 4.12: Fuel and materials used for food preparation (n=247)

Variables	Number (n)	Percentage (%)
Pot materials		
Cast iron pot	7	2.8
Aluminum pot	247	100
Stainless steel pot	10	4.0
Clay pot	0	0
Cooking fuel		
Wood fire	31	12.6
Kerosene	242	98.0
Electricity	41	16.6

4.2.3. Fishing practices as a source of livelihood

In 79.8% (n=197) of the households, fishing was practiced to sustain their households. Only 20.2% (n=50) did not engage in fishing activities. Of the 197 respondents who fished, 27.4% (n=54) had fished for eight to ten years, and 26.9% (n=53) had fished for four to seven years.

Twenty-five-point four percent (n=50) had fished for eleven years and above. Free access to marine sources was indicated by 84.8% (n=167) of the respondents while 15.2% (n=30) claimed one form of restriction or the other. October to December was identified as the most productive season for fishing by 72.6% (n=143) of the fishers, but 83.3% (n=164) of the fishers were of the opinion that pollution due to oil, over exploitation and other illegal human activities were the reasons for reduced fishing. Monthly income from fishing ranged from fifteen to twenty thousand naira (Rand value: R1000-1500) as quoted by 47.9%(n=34) of the respondents, five to ten thousand (Rand value: <R1000-R1000) by 42.3 (n=30), twenty-five to thirty thousand naira (Rand value: R1600-R2000) by 4.2% (n=3) and forty thousand naira and above (Rand value: >R2500) by 5.6% (n=4). Twenty-seven-point four percent (n=54) of respondents fished three times a week and 26.9% (n=53) fished once a week as indicated in tables 4.13a and 4.13b. A statistically significant relationship was observed between fishing practices and monthly income into the household (p=0.005).

Table 4.13a: Fishing practices

Variable	Number (n)	Percentage (%)
People who fish	**n=247**	
Yes	197	79.8
No	50	20.2
Duration of fishing practices	**n=197**	
1-3 years	40	20.3
4-7years	53	26.9
8-10years	54	27.4
11 years and above	50	25.4
Restrictions on fishing	**n=197**	
Yes	30	15.2
No	167	84.8
Seasons for enough catch	**n=197**	
Jan-March	4	2.0
April-June	5	2.5
July-September	45	22.9
October-December	143	72.6

Table 4.13b: Fishing practices

Variable	Number (n)	Percentage (%)
Causes of reduced catch	**n=197**	
Pollution	164	83.3
Season of the year	31	15.7
Other (over exploitation)	2	1.0
Monthly income from fish	**n=71**	
#5,000 - #10,000	30	42.3
#15,000 - #20,000	34	47.9
#25,000 - #30,000	3	4.2
#40,000 and above	4	5.6
How often do you fish	**n=197**	
Every day	37	18.8
Three times a week	54	27.4
Once a week	53	26.9
Once a fortnight	38	19.3
Once monthly	15	7.6

Figure 4.9 indicates that 64.0% (n=126) of the caught fish were earmarked for consumption, while only 36.0% (n=71) were reserved for income generation due to the massive fish decline. A statistical significance was observed (p=0.004) between fishing practices and not having enough money to buy food, indicating that the decline in fish caught adversely affected expected income into the household to purchase food.

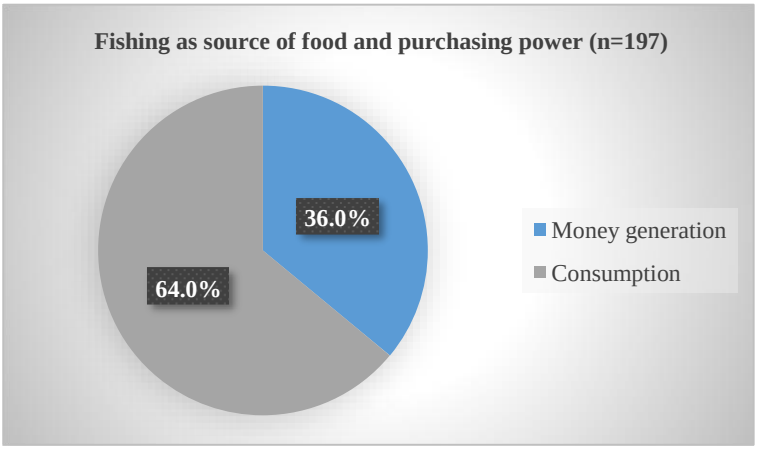

Figure 4.9: Fishing as a source of food and purchasing power

4.3 ANTHROPOMETRIC AND HEALTH INDICATORS

4.3.1 Introduction

The anthropometric indices described below provide an overview of the nutritional status of the respondents. Tables and figures indicating Body Mass Index (BMI), Waist Circumference (WC) and Waist-to-Height Ratio (WHtR) were applied to generate the data.

4.3.2 Anthropometric findings

The mean anthropometric measurements of the study population are summarized in Table 4.14. The mean weight in kilograms for the whole group averaged at 68.50kg of which the women

(70.16kg) averaged slightly above the men (66.84kg). The men's mean weight averaged slightly below that of the entire population by 1.66kg. The combination of men and women presented as an average BMI category fell into overweight (26.36kg/m^2). Women exceeded the average BMI category (1.66kg/m^2). However, no statistically significant relationship was observed for BMI between the genders (p=0.117). The men's mean waist circumference (WC) was 90.14cm while the women's mean WC was 95.46cm, which was above the cut-off point of 102cm and 88cm for men and women respectively. A statistically significant relationship was observed between BMI and WHtR for both genders and across all age groups (p=0.000).

Table 4.14: The mean and standard deviation for height, weight, BMI and waist circumference of respondents (n=247)

Variables	Mean height (m) ± SD (n=247)	Mean weight (kg) ± SD (n=247)	Mean BMI (kg/m^2) ±SD (n=247)	Mean WC (cm) ±SD (n=247)
Total group	1.61±0.065	68.50±5.089	26.36±4.926	92.80±12.097
Men (n=94)	1.64±0.065	66.84±8.606	25.07±3.854	90.14±9.525
Women (n=153)	1.59±0.065	70.16±1.572	27.66±5.998	95.46±14.669

Normal BMI (18.50-24.99) had been observed in 39.8% (n=53) and 27.1% (n=36) of women and men between the ages of 19-50 years respectively. Thirty-three-point eight percent (n=45) of the women and 22.6% (n=30) of the men fell into the overweight category (25.00-29.99). Seventeen-point three percent (n=23) of the women fell into obesity class 1 (30.00-34.99) and 5.3% (n=7) of the men of the aforementioned age were also found under the same obesity class 1 as indicated in table 4.15.

Table 4.15: Summary of BMI of men and women 19-50 years' old

Body mass index classification kg/m^2	Men 19-50 Years (n=78)	Mean ±SD	Percentage (%)	Women 19-50 Years (n=133)	Mean ±SD	Percentage (%)
Underweight (<18.50)	2	17.46±0.356	1.5	1	17.6±0	0.8
Normal weight (18.50-24.99)	36	22.23±1.819	27.1	53	22.573±2.039	39.8
Overweight (25.00-29.99)	30	27.45±1.206	22.6	45	27.49±1.447	33.8
obesity class 1 (30.00-34.99)	7	31.72±1.619	5.3	23	32.347±1.501	17.3
Obesity class 11 (35.00-39.99)	2	38.91±0.083	1.5	7	36.443±2.725	5.3
Obesity class 111 (≥40)	1	42.97±0	0.8	4	43.231±2.209	3.0

Normal (18.50-24.99) and overweight (25.00-29.99) BMI categories existed for both genders. Normal BMI for men was recorded as 66.7% (n=12) and overweight was 16.7% (n=3) while 33.3% (n=6) of the women had normal BMI and 27.8% (n=5) fell into overweight for respondents of >51years as shown in Table 4.16.

Table 4.16: Summary of BMI of men and women 51+ years old

Body mass index classification kg/m2	Men ≥51 Years (n=18)	Mean ±SD	Percentage (%)	Women ≥51 Years (n=18)	Mean ±SD	Percentage (%)
Underweight (<18.50)	1	16.37±0	5.6	1	15.58±0	5.6
Normal weight (18.50-24.99)	12	22.12±2.271	66.7	6	22.93±1.538	33.3
Overweight (25.00-29.99)	3	28.90±2.176	16.7	5	27.84±1.079	27.8
Obesity class 1 (30.00-34.99)	1	32.42±0.000	5.6	3	32.28±1.137	16.7
Obesity class 11 (35.00-39.99)	0	0.00±0.000	0.0	3	37.01±2.270	16.7
Obesity class 111 (≥40)	1	43.28±1.000	5.6	0	0.00±0.000	0.0

Figure 4.10 presents abdominal fat distribution determined by measurement of waist circumference. The majority of the women in both age groups (72.9%; n=133) for 19-50 years

old and (72.9%; n=18) for 51+ years old, demonstrated they were at risk of excessive fat distribution at the same level. Men aged 19-50 years had the lowest (3.0%; n=78) percentage of respondents found to be at risk of excessive abdominal fat distribution. Note that the cut-off for both genders being "at risk" was men >102cm; women >88cm and being "Not at risk" was men <102cm; women <88cm. Statistically significant relationships occurred between waist circumference and carbohydrate intake for men 51+ years and above (p=0.077) and between WC and Systolic Blood Pressure (SBP) and Diastolic Blood Pressure (DBP) (p= 0.000) for both.

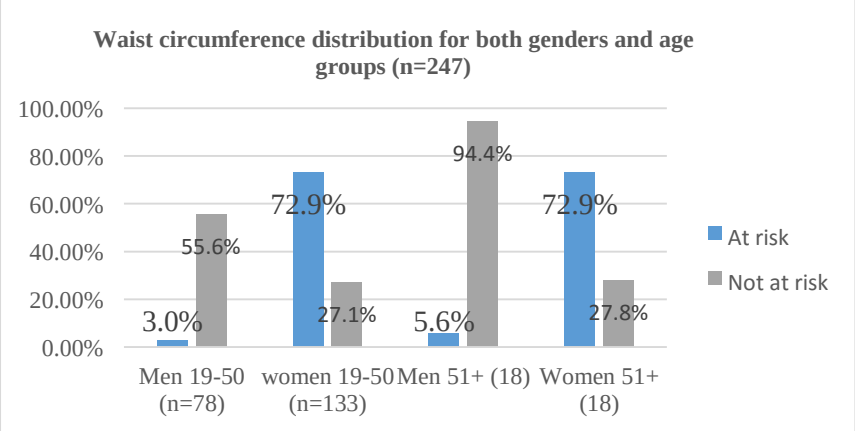

Figure 4.10: Waist circumference distribution for both genders and age groups

The waist-to-height ratio (WHtR) indicated that at risk respondents cut across all age groups. Eighty-eight-point seven percent (n=133) of the women aged 19-50 years and 88.9% (n=18) aged 51+ years old were at a higher risk compared to men of the same age range. The mean WHtR for men 19-50, women 19-50, men 51+ and women 51+ years old were 0.55, 0.60, 0.59 and 0.53 respectively. All the indices were above the cut-off point for WHtR. These statistics are presented in figure 4.11 and statistically significant relationships were observed for WHtR between the genders of the same age bracket of 51+ years and above (p=0.026); and between WHtR and SBP and DBP (p=0.000) for both.

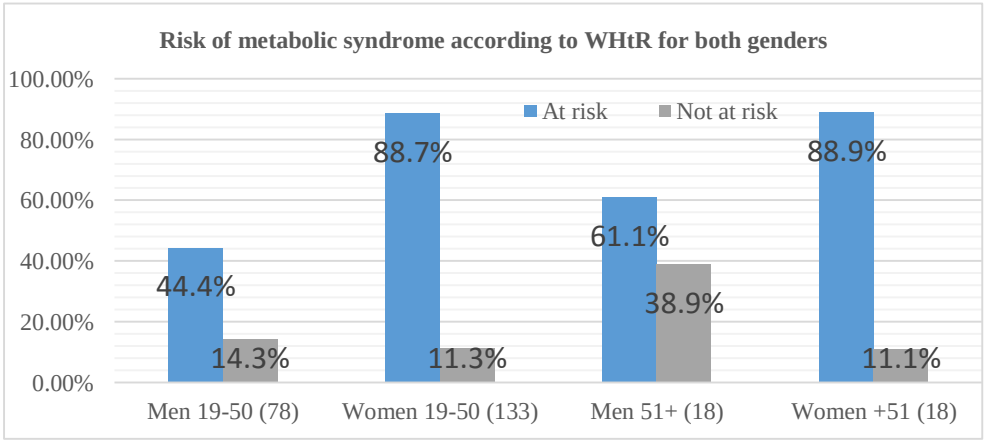

Figure 4.11: Risk of metabolic syndrome according to WHtR for both genders and age groups

Table 4.17 indicates that a good percentage of men (77.0%; n=60) and women (63.9%; n=85) in the 19-50 years' age group had normal systolic blood pressure (<120mmHg). Similarly, 22.2% (n=4) in the 51+ age group (men and women) had systolic high blood pressure (140159mmHg). Fifty percent (n=9) of the men and thirty-eight-point nine percent (n=7) of women in the 51+ age group also had normal systolic blood pressure 1(<120mmHg). High systolic blood pressure 2 (≥160mmHg) appeared mostly in women aged 51+ (33.3%; n=6). A statistically significant correlation at p=0.000 was observed between SBP and BMI for both genders and all age groups.

Table 4.17: Systolic Blood pressure (SBP) category for both genders of all age groups

	Normal BP SBP <120mmHg mmHg	Prehypertension SBP 120-139 mmHg	High BP1 SBP 140-159	High BP2 SBP 160mmHg	mean ±SD
Men 19-50 (n=78)					
n	60	8	7	3	
%	77.0	10.2	9.0	3.8	124.1±15.11
Women 19-50 (n=133)					
n	85	22	19	7	
%	63.9	16.5	14.3	5.3	126.6±20.25
Men 51+ (n=18)					
n	9	2	4	3	
%	50	11.1	22.2	16.7	132.8±24.27
Women 51+ (n=18)					
n	7	1	4	6	
%	38.9	5.6	22.2	33.3	146.9±32.62

Women aged 19-50 years had 62.4% (n=83) and men had 40.6% (n=54) of the normal diastolic blood pressure category (<80mmHg). Men and women of age 51+ had similar readings (44.4%;

n=8 and 44.4%; n=8) for NBP category. High diastolic blood pressure 1 (90-99mmHg) occurred majorly in men aged 51+ (44.4%; n=8) and (39.3%; n=7) of high diastolic blood pressure 2 (≥100mmHg) was found in women aged 51+ as shown in table 4.18. A statistically significant relationship occurred between DBP and BMI for all age groups and both genders (p=0.000).

Table 4.18: Diastolic blood pressure category for both genders and all age groups

	Normal BP DBP <80mmHg mmHg	Prehypertension DBP 80-89	High BP1 DBP 90-99	High BP2 DBP ≥100mmHg	mean ±SD
Men 19-50 (n=78)					
n	54	14	7	3	
%	40.6	10.5	5.3	2.0	81.3±7.85
Women 19-50 (n=133)					
n	83	12	25	13	
%	62.4	9.0	18.8	9.5	82.8±12.51
Men 51+ (n=18)					
n	8	1	8	1	
%	44.4	5.6	44.4	5.6	85.0±9.85
Women 51+ (n=18)					
n	8	0	3	7	
%	44.4	0	16.7	39.3	92.2±16.07

4.4 FOOD VARIETY SCORE, DIETARY DIVERSITY SCORE AND NUTRIENT ADEQUACY

4.4.1 Introduction

The Food Variety Score (FVS) consisted of a count of individual foods within the nine nutritional food groups (FAO 2010; Keding *et al*. 2012). For the purpose of this study a separate fish and seafood group was created. The Food Group Diversity Score (FGDS) indicated the number of food groups consumed over a period of seven days, measured with a Food Frequency Questionnaire (FFQ) and summarized in table 4.19. In total, individuals consumed 51 varieties of food items indicating a medium variety score (30-60 individual foods) during the seven days' data collection period. The range of the individual food items consumed was between one to 51 foods.

The results in Table 4.19 show the food group variety consumed by the Buguma community. Different food groups comprised a varying number of food types in the groups. It is noted that 22.7% (n=56) consumed four different types of meat over the seven days, 12.1% (n=30) had three different types, followed by 8.1% (n=21) who consumed five different types. Similarly, 22.67% (n=56) consumed four types of fish/seafood, 12.55% (n=31) consumed three different types and 2.83% (n=7) consumed two types. A maximum of four different dairy foods were

consumed. Sixty-eight-point four percent (n=169) consumed only one type of dairy product, 9.3% (n=23) consumed two different types of dairy products and 19.0% (n=47) did not consume any. The cereals, roots and tubers group comprised of eight different types. Thirtyeight-point five percent (n=95) consumed four different types from either cereals, roots or tubers and 20.2% (n=50) consumed three types. The egg group had only one type of egg product which 34.4% (n=85) consumed and 65.6% (n=162) had no egg. Respondents consumed four different types of either legumes or nuts from the legumes and nuts group. Forty-seven-point four percent (n=117) and 34.8% (n=86) consumed two and one different type (s) respectively.

The vitamin A rich fruits and vegetables group comprised of three types. Fifty-five-point five percent (n=137) and 27.5% (n=68) consumed one and two types of vitamin A rich fruits and vegetables respectively. Nine different types of other fruits were also noted, where 28.3% (n=70), 25.1% (n=62) and 23.1% (n=57) consumed from one, two and three different types respectively. Other vegetables also accounted for 39.3% (n=97) for two different types, 30% (n=74) for three different types and 17.8% (n=44) for one type as consumed by respondents. The respondents enjoyed a variety of items from the fats and oils food groups. Five different types were listed of which three different types (66.4%; n=164) were highly consumed, followed by four different types (16.2%; n=40) and two different types (12.1%; n=30). A statistically significant correlation was observed between FVS and the number of persons contributing to household spending $p=0.048$.

Table 4.19: Household food access as measured by food variety within the food consumed over a period of seven days (n=247)

Meat group (n=6)	Fish and seafood group (n=6)	Dairy group (n=4)	Cereals, roots and tubers group (n=8)	Eggs diversity group (n=1)	Legumes and nuts group (n=4)	Vitamin A Rich fruits and vegetables groups (n=3)	Other fruits group (n=9)	Other Vegetables group (n=5)	Fats and oils group (n=5)	Total individual foods eaten from all the groups (n= 51)

0=126 1=3 2=6 3=30 4=56 5=21 6=5	0=121 1=4 2=7 3=31 4=56 5=22 6=6	0=47 1=169 2=23 3=2 4=2	0=1 1=1 2=12 3=50 4=95 5=62 6=24 7=1 8=1	0=162 1=85	0=34 1=86 2=117 3=9 4=1	0=41 1=137 2=68 3=1	0=22 1=70 2=62 3=57 4=23 5=7 6=2 7=2 8=1 9=1	0=12 1=44 2=97 3=74 4=17 17=3	0=1 1=5 2=30 3=164 4=40 5=7	0-5=21 6-10=22 1117=39 1825=70 2642=95

Low=0-3 <30 individual foods; Medium = 30-60 individual foods; High= >60 individual food

Table 4.20 presents a summary of the food group variety. A mean ±SD of 20.83. (±6.546) of foods was observed from the food groups over a period of seven days. A maximum number of 51 different foods were consumed as indicated in section 4.4.1. The highest mean per food group occurred in the cereals, roots and tubers group (4.16; ±1.076).

Table 4.20: Summary of the food variety score within the food groups (n=247)

Food group	Means	±SD	Ranges of scores
Meat foods	1.87	0.515	0-6
Fish and seafood	1.96	0.515	0-6
Dairy products	1.17	0.476	0-4
Cereals, roots and tubers	4.16	1.076	0-8
Eggs group	1.00	0.000	0-1
Legumes and nuts	1.65	0.585	0-4
Vitamin A Rich fruits and vegetables	1.34	0.485	0-3
Other fruits	2.31	1.311	0=9
Other vegetables	2.31	0.902	0-5
Fats and oils	3.06	0.692	0-5
Total food items	20.83	6.546	0-51

Table 4.21 shows a summary of the food group diversity. The results revealed that the FGDS for the total group had a high FGD score. The majority of the respondents (98.8%; n=244) consumed foods from 6-10 different food groups. This indicated that 44.9% (n=111) consumed from eight food groups, 17.8% (n=44) from nine groups and 9.3% (n=23) consumed from six food groups. The medium dietary diversity score revealed that 1.3% (n=3) of the respondents consumed from 4-5 food groups. No respondent had a low diversity score or consumed from 0-3 food groups.

Table 4.21: Summary of Food Group Diversity (FGD) (n=247)

Number of food groups consumed (n=9)	Frequency (f)	Percentage (%)
1-3	0	0
4	1	0.4
5	2	0.9
6	23	9.3
7	66	26.7
8	111	44.9
9-10	44	17.8
Total	247	100

Low = 0-3 food groups; Medium = 4-5 food groups; High = 6-10 food groups

4.5 DIETARY NUTRIENTS INTAKE ANALYSIS AND TOP 20 FOOD ITEMS CONSUMED

The nutrient analysis of men and women 19-50 years old is shown in table 4.22. Both groups of men and women had above 12881kJ and 10093kJ energy requirement and likewise consumed excessive amounts of carbohydrates (men consumed 376.80g±100.532 and women 336.30g±69.503). A statistically significant relationship was observed between carbohydrates intake and BMI at p=0.067 for women 19-50 years old. Three (2.26%) women were found to be below the 100% requirement of DRIs for protein with men consuming an average of 82.79g±26.199 and women consuming 75.87g±18.117 of the same nutrient (protein). Sufficient consumption occurred in Thiamine for women (0.92mg) and slightly lower consumption was observed for men (0.71mg) with reference to DRIs requirement of 0.9mg and 1mg respectively. Folate had adequate consumption of 104.81% for men and 83.88% for women. Excessive consumption occurred in vitamin D (336.40%), vitamin C (169.48%), vitamin B12 (478%), iron (196.67%) and magnesium (133.37%) for men and similarly, women had the following

nutrients above the DRIs requirement of hundred percentages: Iron (134%) and vitamin C (218.63%).

Table 4.22: Mean daily nutrient intake analysis of the Men (n=78) and Women (n=133) 19-50 years old as measured by 3x24-hour recalls

Nutrients p/day	Men 19-50 years (n=73) Mean ±SD	DRIs	Men % of DRI	% Men 19-50 years <100 NARs	Women 19-50 years (n=133) Mean ±SD	DRIs	Women % of DRI	% Women 19-50 years <100 NARs
Energy (kJ) EER	13601.74±1938.917	12 881	105.59	42.47	12254.64±1482.022	10 093	121.79	4.51
Carbohydrate (mg) EAR	376.08±100.532	100	370.08	00.00	336.30±69.503	100	336.30	0.00
Total dietary fibre (g/day) AI	22.14±8.472	38	58.26	95.89	19.10±9.069	25	76.4	80.45
Protein (g) RDA	82.79±26.169	56	147.83	12.32	75.80±18.117	46	164.78	2.26
Fat (g)	101.42±32.127	-	-	-	85.66±31.134	-	-	-
Calcium (mg)AI	437.55±255.353	1000	43.76	97.26	350.34±118.467	1000	35.03	100
Iron (mg) EAR	11.80±3.713	6	196.67	2.73	10.93±3.332	8.1	134.94	13.53
Magnesium (g) EAR	453.45±258.991	340	133.37	35.61	358.19±125.456	260	137.76	15.03
Zinc (mg) EAR	12.17±19.971	9.4	129.47	68.49	8.77±5.255	6.8	128.97	43.61
Vitamin A RE (µg) EAR	336.82±118.495	625	53.89	6.85	272.94±130.330	500	54.59	74.44

Thiamine (mg)EAR	0.71±0.429	1	71.00	17.80	0.92±0.880	0.9	102.22	80.45
Riboflavin (mg) EAR	0.55±0.328	1.1	50.00	98.63	0.62±0.470	0.9	68.89	82.70
Niacin (mg) EAR	14.80±6.884	12	12.33	42.47	14.52±6.317	11	132.00	31.57
Vitamin B6 (mg) EAR	1.29±0.481	1.1	117.27	42.47	1.44±0.729	1.1	130.90	35.33
Folate (µg) EAR	335.41±238.687	320	104.81	53.42	268.41±135.003	320	83.88	35.33
Vitamin B12 (µg) EAR	9.56±4.295	2	478.00	4.109	10.20±3.685	2	510.00	0.00
Pantothenate (mg) AI	2.67±1.219	5	5.34	94.52	2.48±1.531	5	49.60	94.74
Biotin (µg/day) AI	19.75±11.995	30	65.87	86.30	18.61±19.843	30	62.03	90.22
Vitamin C (mg) EAR	127.11±71.073	75	169.48	27.39	131.81±85.969	60	218.63	15.03
Vitamin K (µg) AI	74.73±78.872	120	6.22	86.30	45.20±23.017	90	50.22	96.99
Vitamin D (µg) AI	16.82±76.790	5	336.40	80.82	3.58±10.296	5	71.60	83.46

EER: Estimated Energy Requirement (Institute of Medicine, 2003) AI: Adequate Intake; EAR: Estimated Average requirement RDA: Recommended Dietary Allowance

The nutrient analysis of men and women 51 years and above shows that both men and women consumed above DRIs requirements for energy (12881kJ and 10093 kJ respectively) and carbohydrates (100g). Similarly, protein consumption exceeded the 100% requirement for men (148.66%) and women (167.71%). However, a one hundred percent deficiency was found in both men and women for calcium intake. men had a mean iron consumption of 177.17% and women had 210.2%. Conversely, sixteen persons (94.11%) from the female group each did not meet the DRIs requirement of 100% for pantothenate and biotin. Sufficient consumption took place for vitamin D for men (100.80%) but only 50.6% was adequately consumed by the women. Vitamin B6 was consumed at high levels (1.34mg men; and 1.25mg women) which seems to be adequate with DRIs of 1.4mg and 1.3mg for men and women in the 51+ years old age category. Vitamin B12 consumption was extremely high (men 8.82±5.279 and women 11.30±4.152) for both genders compared with the 2µg recommendation by DRIs indicated on table 4.23. Significant correlations occurred between Energy intake and FVS of women 51+ (p=0.024); Energy intake and education of men 51+ (p=0.012); Energy intake and FGDS of men 51+ (p=0.024).

Table 4.23: Mean daily nutrient intake analysis of the Men (n=18) and Women (n=18) of 51+ years old as measured by 3x24-hour recalls

Nutrients p/day	Men 51+ years (n=18) Mean ±SD	DRIs	Men % of DRI	% Men 51+ years <100 NARs	Women 51+ years (n=17) Mean ±SD	DRIs	Women % of DRI	% Women 51+ years <100 NARs
Energy (kJ) EER	13663.82±2185.276	12 881	106.08	22.22	11320.79±2993.699	10 093	112.16	35.29
Carbohydrate (mg) EAR	355.24±95.706	100	355.24	0.00	336.18±68.420	100	336.18	0.00
Total dietary fibre (g/day) AI	27.98±38.241	30	93.27	88.89	16.71±5.362	21	76.57	76.47
Protein (g) RDA	83.25±21.376	56	148.66	5.55	77.15±21.390	46	167.71	0.00
Fat (g)	103.30±22.382	-	-	-	88.48±26.823	-	-	-
Calcium (mg)AI	339.88±88.492	1200	28.32	100	353.02±103.477	1200	29.41	100
Iron (mg) EAR	10.63±2.637	6	177.17	0	10.51±2.960	5	210.2	0.00
Magnesium (g) EAR	312.59±73.869	350	89.31	66.67	362.47±114.188	265	136.78	23.52
Zinc (mg) EAR	8.32±4.068	9.4	88.51	77.78	7.16±2.203±2.203	6.8	105.29	41.17
Vitamin A RE (µg) EAR	321.37±114.191	625	51.42	0.00	330.55±164.985	500	66.11	82.35
Thiamine (mg)EAR	0.72±0.487	1	172.00	83.33	0.65±0.267	0.9	72.22	82.35
Riboflavin (mg) EAR	0.52±0.175	1.1	47.27	83.33	0.56±0.281	0.9	62.22	88.23
Niacin (mg) EAR	12.49±3.464	12	104.08	0.00	11.38±3.466	11	103.45	82.35
Vitamin B6 (mg) EAR	1.34±0.502	1.4	95.71	61.11	1.25±0.444	1.3	96.15	70.59
Folate (µg) EAR	209.85±83.812	320	65.58	5.56	279.78±121.920	320	87.43	82.35
Vitamin B12 (µg) EAR	8.82±5.279	2	441.00	0.00	11.30±4.152	2	565.00	0.00
Pantothenate (mg) AI	2.52±0.993	5	50.40	0.00	2.61±1.133	5	52.20	94.11

Biotin (µg/day) AI	18.22±11.285	30	60.73	5.56	19.16±9.825	30	63.87	94.11
Vitamin C (mg) EAR	96.99±34.511	75	129.32	33.33	149.54±114.05	60	249.23	5.88
Vitamin K (µg) AI	50.07±22.425	120	41.73	0.00	46.55±15.141	90	51.72	0.00
Vitamin D (µg) AI	10.08±7.467	10	100.80	50.00	5.06±3.575	10	50.6	88.23

EER: Estimated Energy Requirement (Institute of Medicine, 2003) AI: Adequate Intake; EAR: Estimated Average requirement RDA: Recommended Dietary Allowance

Table 4.24 shows the top 20 foods list for men 19-50 years. The mean intake over three days, frequency of consumption for one day and per capita intake are presented. The table showed varieties of food items consumed by the aforementioned age group and gender and the most frequently consumed foods were carbonated cold drink (190g/day) consumed 112 times by the group, followed by *garri* (fermented cassava product and one of the staple foods in Nigeria) (194.90g/day) and sugar (8.82g/day) was consumed 111 times. Bread was consumed (129.83g/day) 94 times, followed by *fufu* (fermented cassava product with longer fermentation time compared to *garri*) (136.20g/day), which appeared 5th on the top 20 list and milk (powdered) (10.08g/day) which was 6th on the list consumed 89 and 86 times respectively. Okra soup (96.17g/day), e*gusi* soup (67.54g/day), native soup (65.77g/day), groundnut (peanut) (21.97g/day), plantain (raw/fried) (67.56g/day) and yam (55.68g/day) were consumed 75, 59, 54, 51, 36 and 30 times respectively. Fruit and vegetables consumed by this group were banana (raw) (38.55g) which appeared 11th on the list and cucumber (23.93g/day) being the 18th item on the list and eaten 46 times and 31 times respectively.

Table 4.24: Top 20 foods consumed by men 19-50 years old (n=78)

Rank	Item	Mean intake (g)	Frequency of intake	Mean intake per frequency (g)	Mean Per capita intake for 1 day (g)
1	Carbonated Cold Drink	14820.00	112	570.00	190.00
2	Garri (fermented cassava) *	15202.50	111	584.71	194.90
3	Sugar	688.33	111	26.47	8.82
4	Bread	10126.67	94	389.49	129.83
5	Fufu (fermented cassava) *	10623.33	89	408.59	136.20
6	Milk powder	786.00	86	30.23	10.08
7	Okra Soup*	7543.33	75	290.13	96.71
8	Egusi Soup*	5268.33	59	202.63	67.54
9	Native Soup	5130.00	54	197.31	65.77
10	Groundnuts	1713.33	51	65.90	21.97
11	Banana	3006.67	46	115.64	38.55
12	Beans Porridge	7633.33	44	293.59	97.86
13	Malted Milk Powder (Bounvita				

	Tea/ Milo)	550.00	39	21.15	7.05
14	Plantain (Raw/Fried)	5270.00	36	202.69	67.56
15	Pepper	30.50	34	1.17	0.39
16	Tea	2673.33	33	102.82	34.27
17	Vegetable Oil	290.67	33	11.18	3.73
18	Cucumber	1866.67	31	71.79	23.93
19	Yam	4343.33	30	167.05	55.68
20	Jellof Rice	4590.00	29	176.54	58.85

***Garri and fufu are fermented cassava products, egusi, okra and native soups are indigenous Nigerian soups with made-up recipes**

Table 4.25 indicates the 20 top foods and the average daily intake consumed by women 19-50 years old. The top food on the list is *garri* (fermented cassava product), a highly energy-dense product with 221.18g/day mean per capita intake eaten 118 times. Other energydense/carbohydrate foods consumed by this group include: cold drink, carbonated (166.02g/day), sugar (7.84g/day), bread (103.90g/day), *fufu* (fermented cassava product) (96.85g/day), jellof rice (rice cooked together with other ingredients) (65.15g/day) and beans porridge (beans cooked with palm oil and other ingredients) (70.12g/day) with frequency intakes of 164 times, 164 times, 131 times, 121 times, 74 times and 73 times respectively. However, groundnut/peanut (roasted) fell into the nut group but could be energy-dense with a mean per capita intake of 25.16g/day eaten 139 consecutive times by the group. Protein source consumed by the group was milk powder (109 times).

Similarly, cucumber and banana were the only fruit and vegetable consumed by women 19-50 years with a mean per capita intake of 27.26g/day and 33.28g/day respectively. The traditional Nigerian soups found on this group were *egusi* (60.59g/day) and native soups (58.65g/day).

Table 4.25: Top 20 food consumed by women 19-50 years old (n=133)

Rank	Item	Mean intake (g)	Frequency per intake	Mean intake per frequency (g)	Mean per capita intake for 1 day (g)
1	Garri	29859.17	230	663.54	221.18
2	Carbonated Cold Drink	22413.33	164	498.07	166.02
3	Sugar	1058.33	164	23.52	7.84
4	Okra Soup	11787.67	147	261.95	87.32
5	Groundnuts	3396.67	139	75.48	25.16
6	Bread	14026.67	131	311.70	103.90
7	Fufu	13075.00	121	290.56	96.85
8	Milk powder	986.00	109	21.91	7.30
9	Egusi Soup	8180.00	100	181.78	60.59
10	Native Soup	7913.33	96	175.85	58.62

11	Jellof Rice	8795.00	74	195.44	65.15
12	Beans Porridge	9466.67	73	210.37	70.12
13	Cucumber	3680.00	71	81.78	27.26
14	Banana	4493.33	65	99.85	33.28
15	Biscuits/Cookies	861.67	52	19.15	6.38
16	Akamu/pap (fermented corn)	4730.00	52	105.11	35.04
17	Plantain (Raw/Fried)	6833.33	52	151.85	50.62
18	Tomato and Onion (Stewed)	2793.33	51	62.07	20.69
19	Yam	6483.33	49	144.07	48.02
20	Salt	34.67	42	0.77	0.26

Garri and fufu are fermented cassava products, egusi, okra and native soups are indigenous Nigerian soups with make-up recipes

The average daily intake and 20 top foods consumed by men 51years and above are displayed in table 4.26. Carbohydrates/energy foods frequently eaten by this group include garri (cassava fermented product) (213.70g/day), carbonated cold drink (175.93g/day), sugar (7.22g/day), bread (80.56g/day), beans porridge (beans cooked with palm oil and other ingredients) (228.15g/day), rice (75.93g/day), and Akamu/pap (fermented maize product) (48.33g/day). Milk (4.67g/day) from the protein source was consumed nine times. The indigenous soups consumed included okra soup (cooked) (98.80g/day), egusi (47.50g/day) and native soup (55.37g/day) and were consumed 18 times, 11 times and 11 times respectively. The only fruit consumed by this group was banana (raw) (36.67g/day) eaten 10 times with reference to table 4.26.

Table 4.26: Top 20 foods consumed by men 51+ years old (n=18)

Rank	Item	Mean intake (g)	Frequency per intake	Mean intake per frequency (g)	Mean per capita intake for 1 day (g)
1	Gari	3846.67	32	641.11	213.70
2	Carbonated Cold Drink	3166.67	24	527.78	175.93
3	Sugar	130.00	21	21.67	7.22
4	Okra Soup	1778.33	18	296.39	98.80
5	Tomato and Onion Stewed	1661.67	18	276.94	92.31
6	Bread	1450.00	15	241.67	80.56
7	Beans Porridge	4106.67	14	684.44	228.15
8	Fufu	1536.67	13	256.11	85.37
9	Groundnuts	346.67	12	57.78	19.26
10	Egusi Soup	855.00	11	142.50	47.50
11	Native Soup	996.67	11	166.11	55.37
12	Rice	1366.67	11	227.78	75.93
13	Banana	660.00	10	110.00	36.67
14	Akamu (fermented corn)	870.00	9	145.00	48.33
15	Milk powder	84.00	9	14.00	4.67

16	Plantain (Raw and Fried)	1660.00	9	276.67	92.22
17	Palm Oil Sauce and fish	506.67	8	84.44	28.15
18	Palm Oil Sauce (Plain)	251.67	8	41.94	13.98
19	Yam	1276.67	8	212.78	70.93
20	Fish	226.67	7	37.78	12.59

Garri and fufu are fermented cassava products, egusi, okra and native soups are indigenous Nigerian soups with made-up recipes

Women 51 and above years old had a similar measurement to the other groups on the type of foods consumed. The first five foods on the list were milk powder with a mean per capita intake of 8.43g/day consumed 32 times, followed by bread with a mean per capita intake of 141.48g/day eaten 25 times, garri (fermented cassava product), okra soup and sugar with a mean per capita intake of 111.48g/day, 110.09g/day and 7.59g/day respectively. Other items on the list included; fufu (fermented cassava product) (87.96g/day) ranking 6th on the table and consumed 19 times, carbonated cold drink (137.04g/day) ranking 7th and consumed 18 times, groundnuts (19.26g/day) in 8th position and porridge beans (beans cooked with palm oil and other ingredients) (85.93g/day) in 10th position and consumed 10 times, while rice (40.37g/day) was ranked 16th and was consumed more than eight times. The only vegetable consumed by this group was cucumber (35.19g/day) consumed with a frequency of 11 times as indicated in table 4.27.

Table 4.27: Top 20 foods consumed by women 51+ years old (n=18)

Rank	Item	Mean intake (g)	Frequency per intake	Mean intake per frequency (g)	Mean per capita intake for 1 day (g)
1	Milk (Instant Filled)	151.67	32	25.28	8.43
2	Bread	2546.67	25	424.44	141.48
3	Gari	2011.67	25	335.28	111.76
4	Okra Soup	1981.67	24	330.28	110.09
5	Sugar	136.67	24	22.78	7.59
6	Fufu	1583.33	19	263.89	87.96
7	Carbonated Cold Drink	2466.67	18	411.11	137.04
8	Groundnuts	346.67	15	57.78	19.26
9	Cucumber	633.33	11	105.56	35.19
10	Beans Porridge	1546.67	10	257.78	85.93
11	Egusi Soup	906.67	10	151.11	50.37
12	Tomato And Onion (Stewed)	586.67	10	97.78	32.59
13	Malted Milk Powder (Bournvita Tea/ Milo)	165.00	9	27.50	9.17
14	Palm Oil Sauce and Fish	703.33	9	117.22	39.07
15	Plantain (Raw/Fried)	750.00	8	125.00	41.67
16	Rice	726.67	8	121.11	40.37
17	Salt	5.67	8	0.94	0.31
18	Tea	716.67	8	119.44	39.81
19	Macaroni/spaghetti	376.67	7	62.78	20.93
20	Akamu (fermented corn)	566.67	7	94.44	31.48

Garri and fufu are fermented cassava products, egusi, okra and native soups are indigenous Nigerian soups with made-up recipes

Acceptable macronutrient distribution ranges (AMDRs) and fruit and vegetable intake based on the 24-hour recalls are recorded in table 4.28. The entire group did not meet the fruit and vegetable recommendation of >400g /day with reference to WHO goals (WHO 2003). Protein contribution to daily energy was within the requirement range of 10-15% for all the groups and both genders with the following: 12.48% (men 19-50yrs), 11.95% (women 19-50yrs), 28.92% (men 51+yrs) and 27.97% (women 51+yrs). Similarly, carbohydrate contribution to energy for all age groups and both genders fell within the normal range of 55-75% while total percentage of fat contribution to energy was recorded as 26.87% and 25.78% for men and women 19-50yrs

and 28.92% and 27.97% for both genders 51+yrs respectively with a recommendation of 1530%.

Table 4.28: Acceptable macronutrient distribution ranges (AMDRs) and fruit and vegetable intake based on the 24-hour recalls (WHO, 2003)

Macronutrients	Mean ± SD	Mean % Energy	WHO Goal
Men 19-50 years old (n=73)			
Total fat (g)	101.55±21.127	26.87	15-30%
Protein (g)	82.79±26.169	12.48	10-15%
Carbohydrate (g) + Fibre (g)	398.22±109.004	60.65	55-75%
Fruits and Vegetable (g/day)	160.94±72.596		>400g
Women 19-50 years old (n=133)			
Total fat (g)	85.66±31.134	25.78	15-30%
Protein (g)	75.80±18.117	11.95	10-15%
Carbohydrate (g) + Fibre (g)	355.40±78.572	62.27	55-75%
Fruits and Vegetable (g/day)	182.17±75.864		>400g
Men 51+ years old (n=18)			
Total fat (g)	103.30±22.382	28.92	15-30%
Protein (g)	82.25±21.376	13.46	10-15%
Carbohydrate (g) + Fibre (g)	383.22±133.947	57.62	55-75%
Fruits and Vegetable (g/day)	117.17±110.573		>400g
Women 51+ years old (n =17)			
Total fat (g)	89.61±26.823	27.97	15-30%
Protein (g)	77.15±21.390	12.28	10-15%
Carbohydrate (g) + Fibre (g)	352.89±73.782	59.75	55-75%
Fruits and Vegetable (g/day)	129.18±104.670		>400g

4.6 NUTRIENT ADEQUACY RATIOS IN RELATION TO FGDS

Nutrient adequacy ratio (NAR) is the calculation of the estimated average requirement of an individual's nutrient intake using the FAO/WHO guidelines (Oldewage-Theron and Kruger 2011: 422; Oldewage-Theron and Kruger 2008: 102). Nutrient Adequacy is established taking into account the adequate consumption of foods from the various Food Groups (in this section nine food groups are presented as the meat and fish groups were combined); in other words, FGDS is a viable indicator of nutrient adequacy.

Figure 4.12 below illustrates the mean NAR of Energy and selected nutrients at different levels of the FGDS. The entire sample showed elevated variations in carbohydrate consumption, with more occurring in consuming food from six food groups at 376.08%. Energy, Protein and folate

levels seem to be stable where the group consumed food from six to nine food groups, with calcium occurring lower (28.32%) in the group that consumed food from nine food groups.

However, none of these relationships were statistically significant.

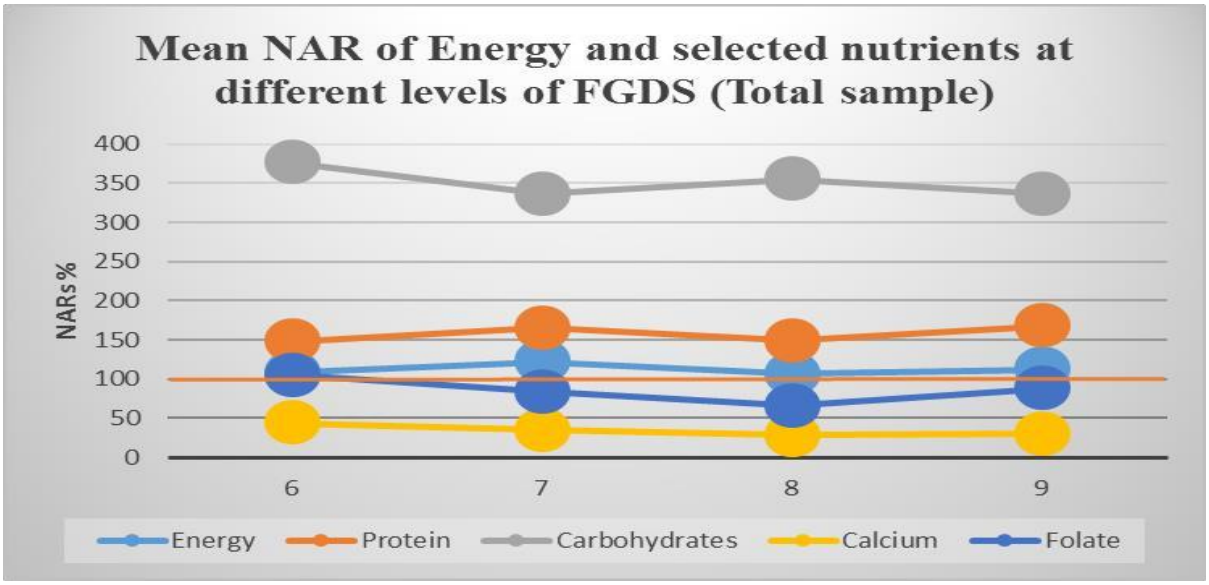

Figure 4.12: Mean Nutrient Adequacy Ratio of Energy and selected nutrients at different levels of the Food Groups Diversity Score (FGDS).

Figure 4.13 shows some selected micronutrients at different levels of the FGDS, indicating high consumption of Vitamin B12 by all the group members consuming from all nine groups (564.90%). Vitamin C, Riboflavin, calcium and Zinc looked stable at group seven and eight, with variations on the mean NAR. Vitamin B12 and vitamin C saw an increase in nutrient adequacy between consuming from eight to nine food groups.

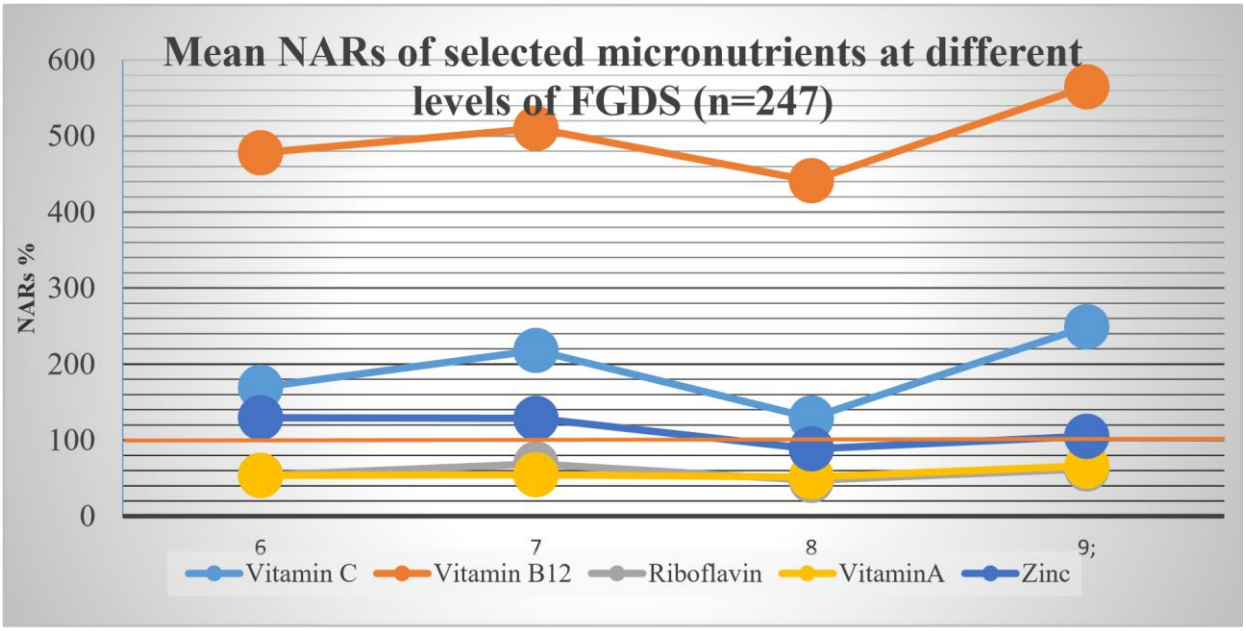

Figure 4.13: Mean NARs of selected micronutrients at different levels of FGDS

4.7 FOOD SECURITY AND COPING STRATEGIES

This section reports on the food security and coping strategies applied by the Buguma community (n=247) in order to gain access to food; it also measured incidences of not having enough money to buy food over the last 30 days. The maximum food security score generated was 168, which indicated severe food insecurity, with the minimum as 6.5 illustrating food security. The higher the score, the greater the prevalence of food insecurity, and the lower the score, the less food insecurity that existed in the households (Maxwell 2003). The individual coping strategies adopted by the community in times of hunger and severity weight were determined in a focus group discussion, and the coping strategies questionnaire as presented in Table 4.29.

Table 4.29: Coping Strategy Questionnaire for the Buguma community.

In the past 30 days, if there have been times when you did not have enough food or money to buy food, how often has your household had to:	All the time. Every day	Pretty often. 3-6 */week	Once in a while. 1-2 */week	Hardly at all. <1*/week	Never	Raw score	Severity weight	Score = Relative Frequency x weight
	7	4.5	1.5	0.5	0			
Ask for food from neighbours?							2	
Rely on less expensive food and preferred food?							1	
Send household members to relatives?							2	
Limit portion size?							3	
Reduce the number of meals eaten in a day?							1	
Skip the entire day without eating?							4	

Restrict consumption by adults in order for small children to eat?							2	
Sell some belongings to get money for food?							4	
Buy food on credit?							2	
Ask for food from welfare or church?							4	
Do some job for food/money?							2	
Exchange one commodity for another with friends?							4	
Total household score								

Severity weight: 1=least severe, 4=most severe

The individual coping strategies, the mean cumulative food security index and standard deviation (±SD) were determined for each of the coping strategies. The results are presented in Table 4.29. The cumulative score ranged from 6.5 to 168 with a mean score of 65.47. The most frequently applied coping strategies per mean score during food insecurity were 'Rely on less expensive or preferred food' with a mean score of 11.47 (±7.949), 'Limit portion size' with a mean score of 9.73 (±2.628), 'Restrict consumption by adults in order for small children to eat', 8.73 (±6.593), 'Do small jobs for money/food', 6.75 (±5.621), and 'Ask food from neighbours', 6.00 (±2.612). Other food coping strategies applied less often during time of food insecurity included; 'Send members of the household to relatives', 'Reduce the number of meals eaten in a day', 'Buy food on credit', 'Ask food/money from welfare or church organization', 'Sell some belongings in order to get money for food', 'Skip the entire day without eating' and 'Exchange one commodity for another' as presented in table 4.29.

Table 4.30: Individual coping strategies (mean ±SD) and the cumulative food security index (n=247)

Participants (247)	Ask food from neighbours	Rely on less expensive food	Send household members to relatives	Limit portion sizes	Reduce the number of meals eaten in a day	Skip the entire day without eating	Restrict consumption by adults in order for small children to eat	Sell some belongings to get money for food	Buy food on credit?	Ask for food from welfare or church organizations?	Do some jobs for food/money	Exchange one commodity for another with friends	Accumulative index
	Freque ncy X severity												(minmax)
	(07) ~x2º (max scor e 14)	**(07) ~xº (max score 7)**	**(0-7) ~x2º (max score 14)**	**(0-7) ~x3º (max** score **21)**	**(0-7) ~x1º (max** score **7)**	**(0-7) ~x4º (max Score** 28)	**(0-7) ~x2º (max Score** 14)	**(0-7) ~x4º (max Score** 28)	**(0-7) ~x2º (max Score** 14)	**(0-7) ~x4º (max Score** 28)	**(0-7) ~x2º (max Score** 14)	**0-7) ~x4º (max Score** 28)	6.5-168
Mean food security score	**6.00**	**11.47**	**3.85**	**9.73**	**2.87**	**2.13**	**8.73**	**2.14**	**2.14**	**2.41**	**6.75**	**1.25**	**65.47**
Standard deviation	**±2.6 12**	**±7.94 9**	**±4.63 1**	**±2.62 8**	**±2.63 5**	**±4.44 5**	**±6.59 3**	**±5.88 4**	**±2.04 9**	**±5.88 4**	**±5.62 1**	**±3.26 1**	**±63.201**

4.8 CORRELATIONS

Correlations were determined using SPSS software version 24.0. The Pearson correlation coefficient was used to establish whether an association existed between different variables.

Only the statistically significant correlations are presented, which are discussed along with other results as shown in table 4:30.

Table 4.31: Relationship between variables with significance occurrence

Variables	**Relationship (*r* value)**	**Significance (*p* value)**
Household monthly income and household monthly spending	0.797	0.001
Number of persons contributing to household spending and household monthly spending	0.237	0.001
Education and employment	0.388	0.001
BMI and WHtR	0.806	0.000
FVS and number of persons in the household	-0.120	0.048
WHtR for men and women (51+ years)	0.522	0.026
BMI and WC	0.806	0.001
Fishing practices and monthly income	0.134	0.005
Fishing practices and not having enough money	0.112	0.004
Monthly income and FVS	0.142	0.026
Education and monthly income	0.408	0.000
Education and age	-0.245	0.000
WC and carbohydrate intake (men 51+)	0.427	0.077
Energy intake (men and women 19-50 years) and FGDS	-0.330	0.000
Energy (men 51+ years) and FVS	0.529	0.024
BMI and systolic blood pressure	0.305	0.000
BMI and diastolic blood pressure	0.400	0.000
WC and systolic blood pressure	0.341	0.000
WC and diastolic blood pressure	0.417	0.000
WHtR and systolic blood pressure	0.361	0.000
WHtR and diastolic blood pressure	0.450	0.000
Energy intake (men 51+ years) and FVS	0.528	0.024
Energy intake (women 51+ years) and FVS	0.594	0.012
Carbohydrate intake (women 19-50 years) and BMI	0.134	0.067
Energy intake (women 51+ years) and BMI	0.017	0.076
Energy intake (men 51+ years) and Education	0.579	0.012

4.9 DISCUSSION OF RESULTS

4.9.1 Introduction

This chapter presents all the data that was collected and analyzed. Interpretation of the results showed food insecurity resulting from damaged fishing livelihoods (fish declines), high rates of unemployment and a low level of education and attainment. Food consumption patterns had a high imbalance; some were low (fruits and vegetables) while some were an excessive amount (starch-based diet) compared to DRIs requirements. This further compromised nutritional status and overall health status.

The socio-demographic characteristics of respondents showed that the majority of respondents in the present study were women (61.1%; n=151). The study by Ogah *et al*. (2013: 59) conducted in households in Abia state, Nigeria has similar findings with the current study, with the female population being higher (52.1%) than males (47.9%).

In the present study, the women (55.5%; n=137) played major roles in the family compared to the men (35.6%; n=88). Women undertook major tasks in food practices such as being responsible for preparing food (83.8%; n=207), deciding on what types of food were to be bought (83.0%; n=205) and taking responsibility for feeding /serving the children (88.3%; n=218).

A study by Flagg, Kilgore and Locher (2014: 2064) conducted in the United State of America (USA) had a contrary view as food practices were a shared responsibility by men (54%) and women (60%). Although food practices were traditionally undertaken by women in the past, responsibilities have changed in recent times as the male counterparts shared in the responsibilities of meal planning, shopping and food preparation. Flagg *et al.* (2014) further

viewed these processes as a way of caring for family member(s), although it was labour intensive and time consuming to carry out the tasks.

Furthermore, the present study reveals that the role played by women in the family does not assume that they are the head of household. Men (72.1%; n=178) took up the position as the head of the household while the women constituted the head in 21.1% (n=52) of the households. Findings from Anyanwu (2014: 118) and Kassie, Ndiritu and Stage (2014: 153) agreed with the present study on men representing the head of the household irrespective of the major roles played by women in the household. However, widowhood, divorce, family conflict or singlehood could automatically elevate the women to the head of the household. The aforementioned authors described female-headed households as those whose nutritional needs are sometimes compromised due to there being no shared responsibility, leading to poverty as basic needs remained unmet.

Poverty is a multi-dimensional and global problem. Affected people live below the poverty line with less than $1.25 daily and always have insufficient income to pay and cater for basic services (Anyanwu 2014: 118 and Omoniyi 2013: 177). This statement agrees with the findings of the present study as many of the households “sometimes” (37.7%; n=92) had insufficient funds to buy food while 25.5% (n=63) “always” had insufficient funds to buy food.

Poverty could further create deprivation influencing quality of life as reflected in the type of respondent’s accommodation in the present study. Respondents lived in brick houses (83%; n=206), needing repairs (43.0%; n=106), and were too small (45.3%; n=112) and majorly had cemented floors (74.9%; n=185). These houses looked old and were not spacious enough to accommodate an average household size of six to four persons (42.1%; n=104), as 32.8% (n=81) of the households lived in an average of two rooms. Only 23.1% (n=57) lived in fiveroomed apartments and above.

A study by Owoeye and Adedeji (2013: 99) conducted in Akure, Nigeria runs in parallel with this study on sanitation and accommodation. Owoeye and Adedeji’s findings showed that 34.8% and 31.1% of the houses also needed major and minor repairs respectively. The authors lamented that dilapidated houses and accommodation were the direct consequences of high levels of poverty.

The number of persons in an apartment also gives a vivid pictorial background of the standard of living of a household. This is supported by the study conducted in the Vaal region of South Africa by Oldewage-Theron, Kruger and Egal (2014: 14-15) on average household sizes where room density was 4.9% and 44.3% in a two to four roomed apartment. Room density is an indicator of overcrowding in a household.

The study by Schwartz (2014: 32) defined overcrowding as being when one room is occupied by more than one person. Thus, the data from the Buguma community which showed that 42.1% (n=104) of the households had an average of six persons staying in two-roomed apartments reflects overcrowding. Owoeye and Adedeji (2013) further suggested that overcrowded households could result in a higher degree of pollution and general deterioration of the environment.

Furthermore, pollution could be caused through improper waste disposal. Water and air are adversely polluted if waste is carelessly discarded and dumped in flowing water. This could generate various forms of pollution, causing water and airborne diseases (Alam and Ahmade 2013: 165).

Data collected from the Buguma community showed that the majority of respondents (89.9%; n=222) were responsible for their waste disposal and most times carelessly dropped their waste into flowing water. This creates an issue for concern as respondents fetched water majorly from wells and streams (34.4%; n=85) and only 24.3% (n=60) fetched water from other sources such as boreholes. An unhygienic environment harbours and breeds mosquitoes and other pests if control measures are not put in place. Data from the present study showed a high incidence of mosquitoes (92.2%; n=240), cockroaches (74.1%; n=183) and mice/rats (92.2%; n=240).

The study by Izah and Srivastav (2015: 16) commented that waste discharge directly into flowing waters and through soil erosion are some of the main causes of water pollution in Nigeria. Nigerian government water supplies are erratic and as such, people resort to providing water for personal use. As a result, waste management, pest control and a supply of potable water are required to reduce household communicable diseases.

Physical evidence of development was limited in the Buguma community. The majority of the roads in front of respondents' houses were untarred (76.1%; n=188) and also not gravelled

(89.1%; n=220). However, 77.3% (n=191) of households had access to an electricity source whenever it was made available by the Power Holding Company. Respondents' mode of transportation was basically riding on a bicycle/motorbike (60.7%; n=150) and only 16.2% (n=40) used taxis to get around town.

The study by Obi (2015: 28) commented on the neglect by the Nigerian government of developmental issues, with particular reference to the Niger Delta from where the oil is drilled. Complete neglect of roads and infrastructure such as schools was further decried by Ebegbulem, Ekpe and Adejumo (2013: 280-281). Education is also considered as part of development. The more knowledge an individual acquires, the better standard of living and poverty mitigation (Chevalier *et al*. 2013). An uneducated society is tied up in severe poverty in a progressive direction (Omoniyi 2013: 177).

The present study revealed that 55.5% (137) of the participants had attained secondary or high school education while 15.8% (n=39) of the respondents had only completed primary education. This study is inconsistent with the findings of Owoeye and Adedeji (2013) on education acquired, where 56.1% of the respondents did not have formal education compared to only 4.5% (n=11) in the present the study. Education remains a viable tool for empowerment and becomes imperative for future attainments in any society (Samir and Lutz 2017: 183).

Furthermore, the low educational attainment could be one of the reasons for the high rate of unemployment. The current study recorded an 80.2% (n=198) rate of unemployment in the following age groups (31-50 years 48.6%; n=120 and 19-30 years 36.8%; n=91). The study population dominantly stayed in the rural areas (100.0%; n=247). This is similar to the study by Ogah *et al.* (2013: 59) conducted in households in Abia state, were coastal populations were rurally based with low or no formal employment. Salami (2013: 18) and Ajufo (2013: 308) also commented on the unemployment rate in Nigeria which grows at 16% per annum, affecting the majority of the population (6400, 000). A statistically significant relationship occurred between education and employment at p=0.001, which implies that education is the bedrock of employment. Limited income in the household was mainly spent on acquiring food and only a small amount could be expended on health care and education (Ali *et al*. 2014: 193).

Data from the present study also revealed that 33.0% (n=82) of the households had a monthly income of twenty-one to thirty thousand naira (Rand value: R3100 – R4000) while 25.5%

(n=63) earned thirty-one to forty thousand naira (Rand value: R4100 – R5000). Forty-sevenpoint eight percent (n=118) of the households had just one person contributing to the household income and 46.2% (n=114) of the households containing an average of six people (42.1%; 104) had two persons contributing to the household income. A statistically significant relationship at *p=0.001* was evident between the number of persons contributing to household income and household monthly spending on food, implying that the fewer the people contributing to household income, the lower the level of income available in the household, which affected quality of living.

According to Owoeye and Adedeji (2013), expediting positive action to improve household income could improve the economy, otherwise quality standard accommodation and adequate foods are denied to the population. Similarly, the highest income earned in the household in a study conducted by the above authors was fifteen thousand naira, which is lower compared to the highest monthly earning of twenty-one to thirty thousand naira as reported in the current study. However, the difference between the highest income in the current study and the study of Owoeye and Adedeji (2013) may not be significant in terms of values. The study of the above authors also differs in terms of the number of respondents in the same earning category as analyzed in the present study.

Households could further be rendered handicapped and unable to meet the expected basic needs of the number of person (s) contributing to the household income as pointed out by Ali *et al*. (2014: 193). The implication of income deficits in the household invariably dictates spending and consumption patterns. Financial constraints in the households could result in spending available money on less nutritious and unwholesome foods, the reason being that these foods are cheap, available and accessible (Afolabi *et al.* 2013: 2). Thirty-eight-point one percent (n=94) of households in the present study spent between five to ten thousand naira and 31.1% (n=78) spent eleven to fifteen thousand naira monthly on foods. This could further translate into why the households “always” and “sometimes” had insufficient funds to buy food. It is clear that the amount of money available to buy food impacts the food consumed. A statistically significant relationship occurred between household income and monthly spending on food at p=0.001.

The income of respondents could be hugely affected by a damaged source of livelihood. The Buguma community had fishing as its main occupation, as this was a community where people from different parts of the province (Rivers State) came to fish. The current study indicates that

the majority (79.8%; n=197) of the respondents fished and 27.5 % (n=54) had fished for an average of eight to ten years. The best season for the highest catch was between October and December (72.6%; n=143) followed by July to September (22.9%; n=45). No restrictions were experienced on the amount of fish to be caught by 84.8% (n=167) of the participants; however, 83.3% (n=164) of the participants believed that pollution from oil sabotage and related sources had drastically reduced fish resources. Respondents who were committed to full time fishing (47.9%; n=34) claimed to have made an average monthly income of fifteen to twenty thousand naira (Rand value: R1000-1500), followed by 42.3% (n=30) said to be earning five to ten thousand naira (Rand value: <R1000-R1000). Twenty-seven-point four percent (n=54) fished three times per week with a higher rate of consumption (64.0%; n=126) and only 36.0% (n=71) fished for money generation due to the decline in fish stocks.

As stated by Belton and Thilsted (2014: 59), fish contributed significantly to food and nutrition security in African nations, particularly in places where poor individuals predominantly dwelled. Reiterating that, the protein provided by high biological, essential fatty acids and micronutrients content in fish is necessary for maintenance of good health and therefore commendable for regular consumption. However, its usefulness remains unavailable until harvested or purchased for consumption and it is a source of income for household use.

The findings of Elum, Mopipi and Henri-Ukoha (2016: 12881) and Ebegbulem, Ekpe and Adejumo (2013: 280-281) lamented the decline in fishing for a livelihood in the Niger Delta, the region in which Buguma is located. The study of Siddig *et al.* (2014: 165) ascribed the sudden decline of fish in the Niger Delta region to oil exploitation and pollution of water caused by sabotage and pipeline leakages as a result of lack of maintenance by oil producing companies. Ebegbulem and colleagues (2013) further commented on low income generation among residents in the coastal region compared to the non-coastal regions. Siddig and colleagues (2014: 165) also highlighted that the consequences of the damaged fishing industry could increase the rate of poverty, increasing food insecurity.

Data from the Buguma community showed different levels and stages of food insecurity in the households. This led households to adopt several coping strategies in a bid to manage the food shortfall. The coping strategies highlighted the availability of limited funds to purchase food within the last 30 days of the month and about 11 different coping strategies were identified. The highest score generated was 168 and the lowest was 6.5, indicating severe and minimal food insecurity respectively. Frequently applied coping strategies during food insecurity in the

Buguma community per mean score were “rely on less expensive or preferred food” with a mean score of 11.47 (±7.949), “limiting portion size” with a mean score of 9.73(±2.628),

“restricting consumption by adults in order for small children to eat” 8.73(±6.593), “doing small jobs for money/food” 6.75(±5.621) and “asking for food from neighbors” 6.00(±2.612).

The study conducted by Agada and Igbokwe (2014: 31) in North Central Nigeria was consistent with the present study as the most frequently adopted coping strategies were “relying on less preferred food (95.8%)” and “limiting portion sizes (83.5%)”. Akerele *et al*. (2013: 407) in south-western Nigeria (Ado-Ekiti, Ekiti) also affirmed similar coping strategies as the most common ways of combating short-term household food shortages. However, adopting or applying these strategies may compromise the intake of nutritionally adequate and safe foods resulting from lower qualities and quantities (Mohammadi *et al.* 2013: 381; Robaina and Martin 2013: 159).

Data from the present study had a mean ±SD of 20.83 (±6.546) for the number of foods consumed from all the food groups over a duration of seven days. A maximum number of 51 different individual foods items were consumed, indicating a medium food variety score (3060 individual foods). The highest mean per food group was recorded for the cereals, roots and tubers group at 4.16 (±1.076).

The studies of Goetzke, Nitzko and Spiller (2014: 95); Johnston, Fanzo and Cogill (2014: 420); Liu (2013: 384) and Labadarios *et al.* (2011: 11) stipulated that adequate consumption of foods from the different food groups optimized proper functioning of the body.

The nutrient intake analysis and top 20 foods were analyzed using a Food Finder 3 Software programme, a South African database. Most traditional Nigerian meals were added to the software programme in made-up forms. Make-up meals were egusi soup, okra soup, native soup and porridge beans and yam. These meals were combinations of different ingredients to form a masterpiece and this could affect the nutrient composition of some of these foods. Also, some products such as fish and seafood could not reflect in the top 20 foods lists as individual food items, because they were mixed within the made-up meals. Nutrient analysis of the 3x24hour food recall results shows imbalances in food intake. There was an indication of high consumption of macronutrients (carbohydrates) contributing to a high energy intake and fewer excess micronutrients while some were below the 100% DRIs for both genders and all age groups. A reflection of this (high intake of carbohydrate/energy foods and minimal consumption

of fruits and vegetables) also occurred in the Top 20 food lists across both genders and all age groups. The nutrient analysis also showed that men and women aged 19-50 years old consumed an average of 376.08g and 336.30g respectively and 51+ years for both genders consumed 355.24g (man) and 336.18g (woman) of carbohydrates. A similar trend occurred in protein consumption and consumption of certain micronutrients (vitamin C and Vitamin B12) in all age groups and both genders as indicated in tables 4.22 and 4.23. However, some key micronutrients such as Vitamin K, Biotin, pantothenate, calcium, riboflavin, which were below the 100% DRIs recommendation, cut across all groups and both genders. Deficiencies of micronutrients could result in malfunctioning of the body and sometimes pose a lifethreatening situation. For instance, diseases such as osteoporosis and fractures could occur due to a lack of calcium (Bhandari and Banjare 2015: 1; Ayaz *et al*. 2018: 452).

The Top 20 food lists cut across all age groups and both genders in the present study and showed that garri and fufu (fermented cassava products) from the cereal, roots and tubers group were the highest consumed products. This implied that all age groups and both genders consumed fufu and garri with frequencies as follows: women 19-50 consumed garri (111.76g/day) twenty-five times and fufu (87.96g/day) 19 times. Men 51+ consumed garri (213.70g/day) thirty-two times while fufu (85.37g/day) was eaten 13 times. Women 19-50 years old had the highest frequency of consumption as garri (221.18g/day) was consumed over two hundred and thirty times and fufu (96.85g/day) was consumed one hundred and twentyone times. Men 19-50 years consumed garri (194.90g/day) one hundred and eleven times while fufu (136.20g/day) was consumed eighty-nine times. These meals contributed high energy to the food intake. An indication of this occurred in the summary of FVS where the highest mean per (4.16; ±1.076) food group took place in cereals, roots and tubers group indicated in table

4.20.

Liu (2013: 384) reiterated that food consumption from fewer or narrowed down food groups should be avoided as no one food source can adequately provide essential nutrients needed by the body and could be detrimental to health. Particularly, high consumption of food from the cereal, roots and tubers group as demonstrated in the present study could result in weight gain due to its energy dense content (Liu 2013: 384).

A study conducted by Malta (2008: 22) in South Africa commented on the effects of inadequate intake of essential nutrients, as it depreciates the immune system by lowering the body mechanism to resist infections. Insufficient food intake and inappropriate eating patterns are

contributing factors that could manifest in weight loss and weight gain respectively (Mohammadi *et al.* 2013: 381; Robaina and Martin 2013: 159). A statement made by Malta concurs with the present study on the Top 20 foods consumed and BMI cuts across all age groups and both genders. Both genders and all age groups showed high consumption of energy dense foods. As mentioned earlier, the most prevalently consumed product (cassava) is from the cereal, roots and tubers food group. Cereal, roots and tubers are high in carbohydrate and could generate into overweight if consumed in excessive amounts.

The mean BMI for women was 27.66 kg/m^2 and for men it was 25.07 kg/m^2 indicating overweight. Similarly, the mean WC for women in all age groups indicated 95.46cm which runs above the cut-off point of ≥88cm for women. The data also indicated a high percentage of women (88.70%; n=133 and 88.90%; n=18) aged 19-50 years and 50+ respectively to be at risk of WHtR (central obesity/ central fat distribution). Women proved to be at greater risk of excessive fat distribution compared to men in the same age bracket but the indices for both genders and all age groups indicated cut-off points above the normal category with the following figures: 0.55 (men 19-50), 0.60 (women 19-50), 0.59 (men 50+) and 0.53 (women 50+). A statistically significant relationship was observed between BMI and WHtR for both genders and all age groups at p=0.000 and WHtR between both genders in the same age bracket of 51 years and above at p=0.026.

A WHtR of more than 0.5 is directly proportional to metabolic diseases. Abnormal disproportion of excessive body fat impairs one's well-being and usually develops into overweight and obesity, and majorly occurs when energy intake exceeds energy expenditure over a range of time (Ayaz *et al*. 2018: 455). Poor dietary habits, among other factors, predisposed consumers to malnutrition stemming into several NCDs (Afolabi *et al.* 2013: 2). The WHO (2011a) established a strong correlation between diet and NCDs, reiterating that the most common NCDs are cardiovascular disease, cancer, diabetes mellitus and chronic lung disease.

High systolic and diastolic blood pressure readings were common in both genders aged 51+ years in the present study; thirty-three point three percent (n=6) of women aged 51+ showed elevated Systolic Blood Pressure (SBP) category 2 (≥160mmHg) and 22.2% (n=4) of both genders in the same age group (51+) showed manifestation of SBP category 1(140-159mmHg) each. Similarly, Diastolic Blood Pressure (DBP) revealed elevated levels in category 1 (90-

99mmHg) in men (44.4%; n=8) and DBP category 2 (≥100mmHg) in women (39.3% n=7). This implies that high blood pressure was age related.

The study by Negin *et al*. (2011: 640-642) conducted in sub-Saharan Africa revealed the prevalence of hypertension in both men and women as age progresses. This is seen in the current study as 77.0% (n=60) of men and 63.9% (n=85) of women in the 19-50 years' category had their blood pressure under the normal category for systolic (≤120mmHg) blood pressure. Similarly, 62.4% (n=83) of the men and 40.6% (n=54) of the women had normal blood pressure for diastolic (≤80mmHg) blood pressure. In other words, age also played a significant role in the development of high blood pressure, apart from diet and life style being the prime causes of NCDs especially hypertension.

Weng *et al*. (2013:1719) also mentioned and recommended that a diet rich in low dairy fat, fish, seeds and nuts, legumes, whole grains and less beef could substantially lower systolic and diastolic blood pressure in the adult population.

4.10 CONCLUSION

This chapter detailed the analysis and discussion of results. The following factors were evident from the analyzed data: low education attainment, imbalances in food intakes, food insecurity and malnutrition. The aforementioned evidence was blamed on poverty from affected fishing livelihoods (fish decline) and a high rate of unemployment. In the next chapter the key findings and recommendations will be stated, addressing the current challenges and suggesting the way forward to improve and enhance the lives of people in the community and the general public.

CHAPTER 5
CONCLUSION AND RECOMMENDATIONS

5.1 INTRODUCTION

Chapter 4 presented, discussed and analyzed various results with comparisons from past literature previously mentioned in the foregoing chapters. This chapter contains the aim of the study, key findings, limitations, conclusions and recommendations from the analyzed data. The main aim of this study was to assess the fishing practices and fish consumption contribution to the nutrient profile, dietary diversity and food security of adult caregivers in a coastal community in Rivers State, Southern Nigeria. The socio-demographic questionnaire, fishing practices questionnaire, coping strategy index (food security) questionnaire, anthropometric

measurements, 24-hour dietary recall questionnaire and food frequency questionnaire were instrumental in obtaining the results presented in this research.

Fish were not adequately consumed as it were not prominent in nutrient analysis (top 20 foods consumed) and oil exploitation endangered the fishing livelihood, thereby hinders fish availability and money generation. The endangered fishing livelihood, unemployment and low levels of education were evident, as being the major underlying causes of poverty. Poverty compromised food intake as accessibility and availability were majorly subject to "lack of funds to purchase safe and healthy foods". Furthermore, food insecurity arising from poverty directly affected dietary diversity due to limited food choices, narrowing consumption of available food sources, especially carbohydrates. Lack of food diversity (adequate macronutrients and micronutrients intake) resulted in energy imbalances and malnutrition.

5.2 LIMITATIONS OF THE STUDY

i. Some respondents declined to participate due to no payment being offered for the information sought and filling of the questionnaires.

ii. Estimation of the actual consumed quantities of food for the 24-hour dietary recall could have been under- or over reported due to variations in measurement.

iii. Data took longer to capture than the estimated period and the issue of conveying research tools (transportation) was problematic arising from logistics challenges.

5.3 MAIN FINDINGS

Research revealed that the global fish stock is in a process of decline and depletion on a drastic scale. Overexploitation, use of harmful chemicals and oil pollution were some of the global reasons cited for the fish stock reduction. The coastal region of Nigeria has shared in this situation as oil spills find their way into creeks and oceans, polluting waters and killing fish stock with little or no yields of new fish stocks. Research also indicated low-income generation from the coastal regions compared to the farming regions in the hinterland in Nigeria as a result of the damaged fishing livelihood. This has caused or increased the level of poverty in the community as most households depend on fish as their source of nutrient intake and purchasing power to acquire basic needs.

The results from data collected from the Buguma community showed that most households fished (78.8%) and had fished for an average of eight to ten years (27.4%; n=54) followed by four to seven years (26.9%; n=53). The fishing livelihood was not restricted by access to marine resources (fishing quotas) (84.8%; n=167) and the most productive season for fishing occurred around October to December (72.6%; n=143). However, oil pollution (83.3%; n=164%) in the creeks and oceans had reduced fishing catches to the bare minimum. The reduction in expected fish stocks had left most households to fish majorly for consumption (64.0%; n=126) and only 36.0%; (n=71) fished for income generation. Affected income sources have resulted in poverty and a high rate of unemployment (80.2%).

Income of the households was not sufficient to acquire or attend to basic needs as 37.7% (n=93) and 25.5% (n=63) of the respondents complained of not having enough money to buy food "sometimes" and "always" respectively. Unemployment further aggravated the situation as 62.3% (n=76) had been actively looking for jobs for an average of more than three years (50.8%; n=62). The average household income was between twenty-one thousand to thirty thousand naira (Rand value: R3100-R4000) and was contributed by an average of one person (47.8%; n=118) to household monthly spending which was between five to ten thousand and fifteen to twenty thousand naira (38.1%) and (31.6%) respectively.

The low income contributed to a compromised standard of living. There was a lack of potable water and poor sanitation was evident as no proper waste disposal system was in place. Probably, the high infestation of mosquitos (92.2%; n=240), cockroaches (74.1%; n=183) and mice/rats (92.2%; n=240) may have emanated from poor sanitation practices. An average household in Buguma community accommodated six persons in, on average, two-roomed apartments, which indicated overcrowding as mentioned in 4.7. Statistically significant relationships occurred between persons contributing to household spending and monthly spending at p=0.001 and between fishing practices and monthly income at p=0.005.

Unemployment, low standards of education and poverty were contributory factors to food insecurity. Food insecurity identified in the Buguma community gathered cumulative scores ranging from 6.5 to 168 with a mean score of 65.47. As such, the respondents applied several strategies to address hunger and food shortages in their households, some of which included "relying on less expensive or preferred foods" (11.47 ±7.949), "limiting portion sizes" (9.73

±2.593), and "restricting consumption by adults in order for children to eat" (8.7 ±6.628). The negative effects of applying certain coping strategies adversely compromised nutrient adequacy. The top 20 foods consumed, dietary diversity score, food variety score, household income and monthly spending on food confirmed the level of household food insecurity in the Buguma community. Overweight resulted from poor meal intakes and practices, and generated into NCDs.

Overweight was significantly evident in this community as the average mean BMI for both genders and all age groups were recorded as 26.36kg^2. The at risk factor for WC (95.46cm) was prevalent in women and WHtR at risk factor also affected the female gender (88.70%; n=133, 19-50 years and 88.90%; n=18, 51+ years old) compared to their male (44.4%; n=78, 19-50 years and 61.1%; n=18, 51+years) counterparts, which was a frequent trend highlighted by other researchers especially in respect of the female gender. A statistically significant relationship existed between BMI and WHtR for both genders and all age groups at p=0.001 and WHtR between both genders in the same age bracket of 51+ years at p=0.026.

Food consumption of macronutrients and very few micronutrients exceeded th eDRI recommendation from the nutrient profile of the Buguma community. These imbalances in food consumption are reflected below in the recommendations for the following nutrients: Vitamin K, Biotin, pantothenate, Vitamin K, calcium, riboflavin and thiamine. The first ten foods in the table of 20 top consumed foods (Table 4.24-4.27) across both genders and all age groups reflected high consumption of energy dense foods (macronutrients). Fruits and vegetables were limited in the top 20 foods consumed for both genders and all age groups. FVS had a mean average of 20.83, indicating a medium food variety score.

Fish and seafood reflected in the nutrients analysis as mixed meals and were not prominent as individual meals in the top 20 food list. This implies that irrespective of the higher percentage of fishing geared toward consumption, actual fish consumption was still inadequate. More substantial consumption would have addressed some nutrient deficiencies reflected in the study. For example, a calcium deficiency should have been ruled out as fish supplies calcium to the body.

5.4 CONCLUSION

The findings from this study suggest that the high prevalence of food insecurity and malnutrition were direct consequences of endangered fishing livelihoods, high rates of unemployment and

low levels of educational attainment. The majority of households who fished, only caught enough fish for consumption and there was very little left over to generate an income. Low income in the households severely affected the provision of basic needs and sometimes the households had insufficient funds to buy food. Unemployment was significant in this community and was reflected in the average of one person contributing to household income. Education is one of the viable tools for the eradication of hunger and poverty and fostering development but regrettably, the majority of respondents had only secondary school education.

More consumption of energy dense foods was reflected in the FVS and top 20 foods consumed, influencing the anthropometric results for overweight and central obesity/ central fat distribution. Micronutrients deficiency resulted in poor health outcomes and malnutrition.

5.5 RECOMMENDATIONS

The affected, or endangered, fishing livelihoods, unemployment and low levels of education were identified as the genesis and prime issues influencing food insecurity in the community. Firstly, the endangered fishing livelihood needs rehabilitation. Community chiefs and elders could arrange workable ways of protecting marine resources from illegal pipeline sabotage, which is the major cause of oil spills in the creeks and oceans. The community needs to take charge of their source of income generation to reduce the degree of food insecurity.

Secondly, the high rate of unemployment needs urgent attention. The government and private organizations could address the unemployment rate by exploring alternative sources of income for the community through job creation and business empowerment. Business empowerment could take the shape of funding businesses such as manufacturing of fishing implements, fish farming, transportation (motorcycles or vehicles for transportation) and other aspects of agriculture apart from fishing.

Thirdly, the low level of education needs to be addressed by providing tuition-free education to enable children from low-income households to acquire an education. Furthermore, there is a need to organize workshops and training in crafts and relevant skill acquisition for selfemployment.

5.5.1 RECOMMENDATION FOR POLICY MAKERS

Government

i. Government needs to revisit some of the nutrition initiative programmes such as Operation Feed the Nation (OFN), Green Revolution (GR), Lower River Basin Development Authorities (LRBDA), National Agricultural and Land Development Authority (NALDA) and the Directorate of Foods, Roads and Rural Infrastructure Food Security in Nigeria (DFRRIFSN). The programmes were useful tools for poverty alleviation and food security enhancement. However, these programmes failed due to mismanagement. There is a need for an investigation to find out why these programmes failed and measures should be put in place to revive and improve them so that they can function again.

ii. Community-based nutrition programmes for proper dissemination of nutrition education on healthy food preparation, eating and lifestyles to combat overweight or at risk of overweight found among the residents of this community should be implemented.

Non- Governmental Organizations (NGOs)

i. NGOs could also get involved in empowering communities in different skill acquisition training programmes that could create self-employment. They could also take part in programmes on the dissemination of nutrition knowledge and enhancing good eating habits and lifestyle.

ii. They could prioritize the execution of some essential projects to benefit the community's health. For instance, the provision of potable water and proper waste disposal systems to improve sanitation and the health of the populace.

iii. They could escalate community needs that NGOs cannot handle and community leaders cannot deal with to higher authorities. This would assist in fostering developments, thereby alleviating suffering and poverty.

5.5.2 RECOMMENDATIONS FOR THE COMMUNITY

Livelihood protection, involvement in multiple sources of income generation and improving skills in organized programmes for self-empowerment and job creation could improve food security. Government initiatives lack proper coordination and usually take longer to implement; therefore, community-based volunteers could more effectively foster implementation of government programmes and initiatives at grassroots level.

5.5.3 RECOMMENDATIONS FOR FUTURE RESEARCH

i. Evaluation of food preparation methods and other health indices including BMI to assess the nutritional status with reference to the women in this community. ii. Assessing the fishing economy and food security of the core fishermen/women, and appraising their impact on nutrition security and standards of living.

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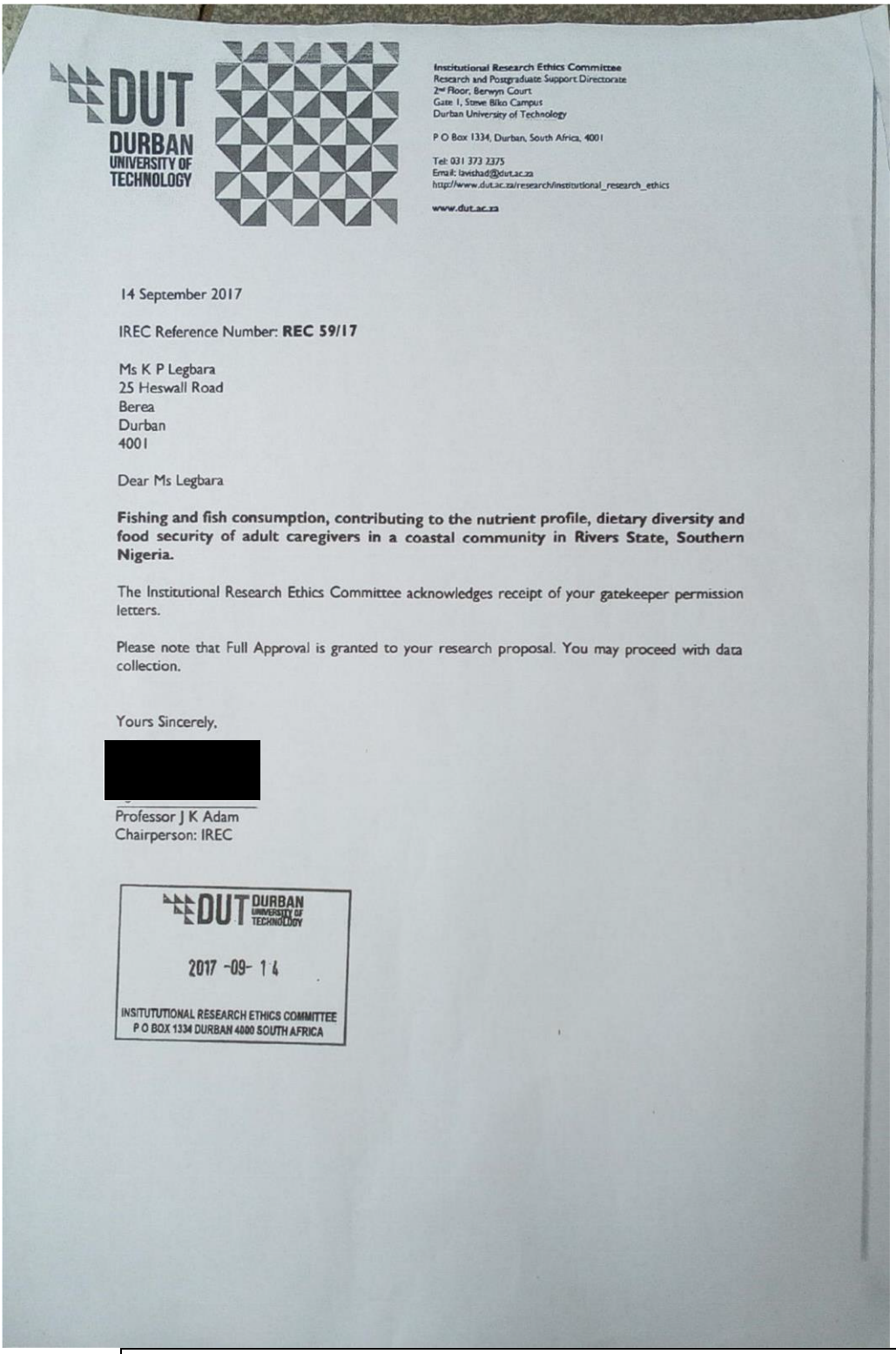
ANNEXURES

IREC Approval –A-1



DUT
DURBAN UNIVERSITY OF TECHNOLOGY

Institutional Research Ethics Committee
Research and Postgraduate Support Directorate
2nd Floor, Berwyn Court
Gate 1, Steve Biko Campus
Durban University of Technology

P O Box 1334, Durban, South Africa, 4001

Tel: 031 373 2375
Email: lavishad@dut.ac.za
http://www.dut.ac.za/research/institutional_research_ethics

www.dut.ac.za

14 September 2017

IREC Reference Number: **REC 59/17**

Ms K P Legbara
25 Heswall Road
Berea
Durban
4001

Dear Ms Legbara

Fishing and fish consumption, contributing to the nutrient profile, dietary diversity and food security of adult caregivers in a coastal community in Rivers State, Southern Nigeria.

The Institutional Research Ethics Committee acknowledges receipt of your gatekeeper permission letters.

Please note that Full Approval is granted to your research proposal. You may proceed with data collection.

Yours Sincerely,

[redacted]

Professor J K Adam
Chairperson: IREC

DUT DURBAN UNIVERSITY OF TECHNOLOGY
2017 -09- 14
INSITUTUTIONAL RESEARCH ETHICS COMMITTEE
P O BOX 1334 DURBAN 4000 SOUTH AFRICA

Buguma Local Government Area Approval -A-2

Annexure A

DUT DURBAN UNIVERSITY OF TECHNOLOGY

Faculty of Applied Sciences
Department of Food and Nutrition
P.O.box 1334
Durban
4000
05/06/2017

The secretary,
Asari Toru Local Government Area,
Buguma,
Rivers State, Nigeria

Dear Sir,

RE: Request for permission to conduct Research in your Local Government Area (LGA)

I am currently studying towards a Master's degree in the department of Consumer Science: Food and Nutrition at Durban University of Technology. I wish to hereby solicit your permission to carry out an investigation on my research project in your LGA. The investigation is mainly with the adult caregivers in the household.

Research titled: Fishing and fish consumption contributing to the nutrient profile, dietary diversity and food security of adult caregivers in a coastal community in Rivers State, Nigeria.

The aim of the study is to assess fishing practices and fish consumption, contribution to the nutrient profile, dietary diversity and food security of adult caregivers in a coastal community. The result from this study will provide baseline data on fish consumption and its contribution to health of the people in coastal communities; will in used to developing nutrition education training modules on fish consumption for the community and in planning nutrition

intervention programs. The findings from this study could be made available to the community or anyone if requested and will be available in the Durban University of Technology library.

Two hundred and fifty adult caregivers from the households will be required to participate in the research. The researcher will approach the household with an information letter and consent form. Each participant will be asked to complete the socio-demographic questionnaire, fishing practices, 24-hour dietary recall, coping strategies index, and food frequency questionnaires. The participants will also be measured and weighed to complete the anthropometric assessment questionnaire and also do a measure of their blood pressure. It will also be explained to each participant that, the information is confidential, and a participant number will be used, no names will be used in the study, participation is voluntary and there is no cost in participating. Personal information will be stored in the Department of Food and Nutrition in a locked cupboard and will be destroyed after a five-year period by use of a shredding machine. Only the researcher and Supervisor will have access to the information. Electronic evidence will be protected with a password

The study will be conducted through the Durban University of Technology, under the supervision of Professor Carin Napier (031- 373 2326, Email:carinn@dut.ac.za) of the Food and Nutrition Department and will be co-supervised by Professor Alexandra Hart (+2348037244818, Email: dradhartust@yahoo.co.uk) of Rivers State University of Science and Technology, Rivers State, Nigeria.

Your approval and assistance would be sincerely appreciated.

Yours faithfully

Kadi, Prudence Legbara (Researcher)

Email: kadilegbara@gmail.com; Cell phone: +27635757940 and +2348035078903

I have read through this letter and I hereby give permission to the researcher to conduct research in Asari- Toru Local Government Area (LGA) – Buguma, Rivers State, N igeria.

[redacted] +2347034864261

Name of Secretary Contact number

[redacted] [redacted] 21/7/2017

Email address Signature Date

Buguma council of chiefs'/community approval –A-2

Annexure A

Faculty of Applied Sciences

Department of food and nutrition

P.O.box 1334

Durban

4000

The Council of Chiefs

Buguma community

Kalabari Kingdom.

Rivers State, Nigeria

Dear Sir,

RE: Request for permission to conduct Research in your community

I am currently studying towards a Master's degree in the department of Consumer Science: Food and Nutrition at Durban University of Technology. I will like to ask for your permission to carry out an investigation on my research project in your community. The investigation is mainly with the adult caregivers in the household.

Research title: Fishing and fish consumption contributing to the nutrient profile dietary diversity and food security of adult caregivers in a coastal community in Rivers State, Nigeria.

The aim of the study is to assess fishing practices and fish consumption, contribution to the nutrient profile, dietary diversity and food security of adult caregivers in a coastal community. The result from this study will provide baseline data on fish consumption and its contribution to health of the people in the coastal communities, will be used in developing nutrition education training modules on fish consumption for the communities and in planning nutrition intervention programs. The findings from this study could be made available to the community or anyone if requested and will be available in the Durban University of Technology library.

Two hundred and fifty adult caregivers from the households will be required to participate in the research. The researcher will approach the household with an information letter, requesting for participation. If participants agrees to be part of the study, a consent form will be issued to the

participant and also will be asked to sign the consent form. Each participant will be asked to complete the socio-demographic questionnaire, fishing practices, 24 hour dietary recall, coping strategies index, and food frequency questionnaires. The participants will be measured and weighed to complete the anthropometric assessment questionnaire and also do a measure of their blood pressure. It will also be explained to each participant that, the information is confidential, and a participant number will be used, no names will be used in the study, participation is voluntary and there is no cost in participating. Personal information will be stored in the Department of Food and Nutrition in a locked cupboard and will be destroyed after a five year period by use of a shredding machine. Only the researcher and Supervisor will have access to the information. Electronic evidence will be protected with a password

The study will be conducted through the Durban University of Technology, under the supervision of Professor Carin Napier (031- 373 2326, Email:carinn@dut.ac.za) of the Food and Nutrition Department and will be Co- supervised by Professor Alexandra Hart (+234 8037244818, Email: dradhartust@yahoo.co.uk) of Rivers State University of Science and Technology, Rivers State, Nigeria.

Your approval and assistance would be sincerely appreciated.

Yours faithfully

Kadi, Prudence Legbara (Researcher)

Email: kadilegbara@gmail.com; Cell phone: +27635757940 and +2348035078903

I have read through this letter and I hereby give permission to the researcher to conduct research in Buguma community, Rivers State, Nigeria.

[redacted]

[redacted]

Name of chief/leader

Contact number

BUGUMA COUNCIL
SIGN
DATE 11/09/17
OF CHIEFS

NIL

11/09/2017

Email address

Signature

Date

Annexure C

LETTER OF INFORMATION

Dear participant,

Thank you for giving me your time to talk to you about my research project.

Title of the Research Study:
Fishing and fish consumption, contributing to the nutrient profile, dietary diversity and food security of adult caregivers in coastal community in Durban, KwaZulu Natal, South Africa

Principal Investigator/s/researcher: (Kadi Prudence Legbara,
BSc Honours: Consumer Science)

Co-Investigator/s/supervisor/s: (Prof. Carin Napier (DTech: Food Service Management)

Purpose of the Study:

We are all encouraged to eat foods that supplies needed nutrients that our bodies require for optimum (good) health. Fish is one of those foods that contains valuable nutrients for health maintenance and fishing on the other hand can serve as means of livelihood creating employment for the residents of coastal communities. In recent times, it been observed that fish consumption is very low among consumers particularly in South Africa and even in coastal communities where it's believed that fish is in abundance. Low fish is associated with heart disease. Therefore, this study seeks to access the fishing practices and fish consumption, contribution to the nutrient profile, dietary diversity and food security of coastal community in Durban, KwaZulu Natal, South Africa.

Procedures of study

- The researcher will contact you to make an appointment to collect the information from you.
- Ethical clearance was obtained from the DUT ethics committee
- You will be asked to sign a letter of consent, indicating that you are willing to participate in the research study and that the researcher has clearly explained the study and procedures involved to you.
- The study will consist of five different sections questionnaire and will be completed in an interview situation and this process could take up to 60 minutes to complete, we will assist you to complete the questionnaire.

The questionnaires will include

- A Socio-demographic questionnaire
- A Food Frequency questionnaire to determine food variety and dietary diversity.
- Three 24-Hour recall questionnaire
- Coping strategies index questionnaire
- Fishing practices questionnaire

We will also weigh and measure you, take your blood pressure and waist circumference in the privacy of your own home at a time that suits you. You will not have to remove your clothing except for shoes and jackets/ jerseys but will adjust the sleeve of your left hand clothing during blood pressure measurement.

Please note the following:

- Participation is voluntary and you can withdraw at any time with no penalty.
- No payment will be given to any of the participants.
- There is no cost to the participants if they agree to partake in the study.
- Participants will be issued a number and no personal information such as names will be recorded.

The results of the study will be made available to the community if requested, after the study has been concluded; no personal information such as names will be mentioned. The study hopes that the results will help implement nutrition intervention programmes in the community.

Research related injury:
No injuries are expected in this study.

For any questions or concerns please feel free to contact my supervisor or the Ethics committee.

Your participation will be greatly appreciated and thank you for your time.
Kind Regards
Kadi Prudence Legbara (Researcher 0635757940)

Persons to Contact in the Event of Any Problems or Queries:
Supervisor: Prof. Carin Napier (DTech: Food Service Management)
Supervisor contact: 0313732326 carinn@dut.ac.za
The Institutional Research Ethics administrator: 031 373 2900.
Complaints can be reported to the DVC: TIP, Prof S Moyo on 031 373 2577 or moyos@dut.ac.za

Annexure D

Statement of agreement to be a field worker in the study

- I here confirm that, I have been informed by the researcher Kadi Prudence Legbara about the nature, conduct, benefit and risk of the study.
- I have received, read and understood the written information (fieldworker letter of information) regarding the study.
- I am aware that I have to be trained before taking part in the research. In view of the requirement of the research, I agree that the data collected during the study can be processed n a computerized system by the researcher.
- I have had sufficient opportunity to ask questions and (of my own free will) declare myself prepared to be a fieldworker in the study.

---------- ---------- ---------- ----------

Full name of fieldworker Date Time signature

I, KP Legbara (Name of researcher) herewith confirm that the above participant has been fully informed about the nature, conduct and risks of the above study.

---------- ---------- ----------

Full name of researcher Date signature

---------- ---------- ----------

Full name of witness (if applicable) Date signature

---------- ---------- ----------

Full name of guardian (if applicable) Date signature

DUT DURBAN UNIVERSITY OF TECHNOLOGY

INSTITUTIONAL RESEARCH ETHICS COMMITTEE

CONSENT

Statement of Agreement to Participate in the Research Study:

- I hereby confirm that I have been informed by the researcher, _____ (Name of Researcher), about the nature, conduct, benefits and risks of this study - Research Ethics Clearance Number: _____,
- I have also received, read and understood the above written information (Participant Letter of Information) regarding the study.
- I am aware that the results of the study, including personal details regarding my sex, age, date of birth, initials and diagnosis will be anonymously processed into a study report.
- In view of the requirements of research, I agree that the data collected during this study can be processed in a computerized system by the researcher.
- I may, at any stage, without prejudice, withdraw my consent and participation in the study.
- I have had sufficient opportunity to ask questions and (of my own free will) declare myself prepared to participate in the study.
- I understand that significant new findings developed during the course of this research which may relate to my participation will be made available to me.

_____	_____	_____	_____
Full Name of Participant	**Date**	**Time**	**Signature / Right Thumbprint**

I, _____ (name of researcher) herewith confirm that the above participant has been fully informed about the nature, conduct and risks of the above study.

_____	_____	_____
Full Name of Researcher	**Date**	**Signature**
_____	_____	_____
Full Name of Witness (If applicable)	**Date**	**Signature**
_____	_____	_____
Full Name of Legal Guardian (If applicable)	**Date**	**Signature**

Annexure F

Food and Nutrition Consumer Sciences

SOCIO-DEMOGRAPHIC QUESTIONNAIRE

This questionnaire covers certain aspects of your life, including work and personal details, health and illness, lifestyle and social life that is relevant to health. The answers to these questions will be kept strictly confidential and the information will not be identifiable on any reports or publications.

1. GENERAL INFORMATION

Participant number: _____Name of community _____

Interviewer: _____ Date _____

Please answer all questions by marking the correct answer with **X,** except where otherwise indicated.

Where do you live? .....

2. PERSONAL INFORMATION

2.1 Your role in the family

Father	Mother	Grandfather	Grandmother	Other, specify……..

2.2 How old are you?

19-30 years	31-50 years	>51 years

2.3 Gender:

Male	Female

3. ACCOMMODATION AND FAMILY COMPOSITION

3.1 Do you live in?

Town/City	Rural village	Township	Other, specify……...

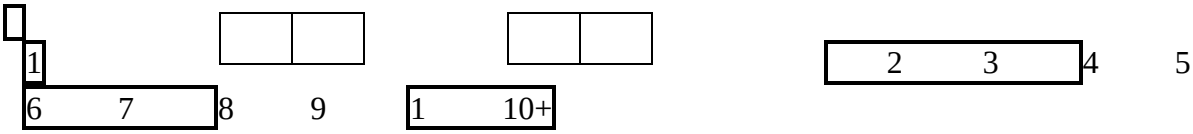
3.2 How are you currently living?

Homeless	
Living with relatives	
Living with friends	
Rented house/flat	
Own house/flat	
Employees Properties	
Other, specify…….	

3.3 Do other people live in the house with you?

Yes	No

3.4 How many people are permanent residents living in the house with you? (Only if these people eat and sleep in this house at least 4 days a week?)



3.5 How long have you been staying permanent in this house?

< 1 year	1-5 years	>5 years

3.6 In what type of house are you staying?

Brick	Clay	Grass	Wood	Zinc/shack

3.7 How many rooms does your house have?

1 room	2 rooms	3 rooms	4 room	>5 rooms

3.8 Are there other houses/shacks within the same yard of the main house?

Yes	No

3.9 Do you have the following facilities/ services at home?

3.9.1 Water

Tap in the house	
Tap outside the house (in yard)	

Borehole	
Spring / river / dam water	
Fetch water from elsewhere	

3.9.2 Toilet facilities

None	
Pit latrine	
Flush / sewage	
Bucket system	
Other, specify…….	

3.9.3

Waste removal	Yes	No
Tarred road in front of house	Yes	No
Gravel road in front of house	Yes	No
Access to electricity	Yes	No

3.9.4

3.9.5

3.9.6

3.10 To what extent do you have problems with the state of your house (e.g. size, repairs, damp, etc.)?

……..……

3.11 Do you have problems with the following?

Mice/Rats	
Cockroaches	
Mosquitoes	
Geckos	
Ants	
frogs	
Snakes	
Bed Bugs	

3.12. What is the floor inside your house made of?

Cement	
Tiles	
Carpet	
Dirt	

Sand/mud	
Dung	
Other, please state	

4. **WORK STATUS AND INCOME**

4.1. Are you currently employed?

Yes	No

If YES, go to Question 4.5.

4.2. If NO, how would you describe your current status (tick one box only)?

Unemployed	Retired	Housewife	Student	Other, specify……

4.3. Are you actively looking for paid employment at the moment?

Yes	No

4.4. How long have you been unemployed?

< 6 months	6-12 months	1-3 years	> 3 years

4.5. If YES (question 4.1) is your current job a:

Permanent position	Temporary position	Fixed term contract	Other, specify…….

4.6. Are you doing part time jobs as a second job on weekends and school vacations?

Yes	No

4.7 What is the exact title of your current job?
(Including self-employed)

4.8. What is the total income in the household per month?

#15,000-#20,000	#21,000-#30,000	#31,000-#40,000	#41,000-#50,000	#51,000-#60,000	#61,000 and above

4.9. How often do you not have enough money to buy food for you and your family?

Always	Often	Sometimes	Seldom	Never

4.10. How many people e.g. partner, relatives & others (including yourself) contribute to your household income from any source, (including wages/salary from paid employment, money from second or odd jobs income from savings investments, pension, rent or property, benefits and or maintenance etc.) in the last 12 months?

People

0	1	2	3	4	5	6	7	8	9

4.11. How often do you buy food?

Every day	Once a week	Once a month	Other, specify……

4.12. Where do you buy food?

Tuck shop	Street vendor	Wholesalers	market	Other, specify……

4.13. What type of transport do you use to get around?

Taxi	
Bus	
Boat	
Own car	
Bicycle/ Motorbike	
Other Specify	

4.14. How much money is spent on food PER MONTH? (Tick only one box)

#5,000-#10,000	#11,000-#15,000	#16,000- #20,000	#25,000 and above

5 EDUCATION AND LANGUAGE

5.1. What is your highest education level?

None	Primary School	Secondary school	Govt craft school	university	Others

5.2 What language is spoken mostly in the house?

English	Kalabari	Others, please specify

5.3 How many children (in the household) have birth certificates?

None	1	2	3	4	5	6	7	8	All

5.4 How many children have completed their immunization schedule?

None	1	2	3	4	5	6	7	8	All

5.5 Has any children in your household died in the past?

Yes	No

5.6. If yes how many ……..

5.7. Do you know the cause of death?

Yes	No

5.8. If yes, what was the reason……..

5.9 Number of children attending school

None	1	2	3	4	5	6	7	8	All

5.10. How do the children get to school?

Walk	Bus	Taxi	Parents car	Other, specify…….

Food practices in the household

Tick one block for every question:	Father	Mother	Sibling	Grandma	Grandpa	Aunt	Uncle	Cousin	Friend	Other
5.11 Who is mainly responsible for food preparation in the house?										
5.12 Who decides on what type of										
food is bought for the household?										
5.13 Who is mainly responsible for feeding/serving the children?										
5.14 Who is the head of this household?										
5.15 Who decides how much is spent on food?										

5.16 How many meals do you eat per day?

0	1	2	3	> 3

5.17 Where do you eat most of your meals?

Home	Friends	Work	School	Other, specify…….

5.18 Where do your children eat most of their meals?

Home	Friends	School	Other, specify…….

5.19**.** Do you eat snacks?

Yes	**No**

5.20. If you eat snacks, specify…….. **Cx**

6. ASSETS

6.1 Does your home have the following items and how many?

	Yes
Electrical stove	
Gas stove	
Primus or paraffin stove	
Microwave	
Hot plate	
Radio	
Television	
Refrigerator	
Freezer	
Telephone/ Cell phone	
Bed with mattress	
Mattress only	
Lounge suite	
Dining room suite	
Electrical iron	
Electrical, kettle	
Car	
Bicycle	
Motorbike	

6.2 What type of fuel do you usually use for food preparation?

Wood fire	Paraffin	Electricity	Gas	Coal/Charcoal	Other, specify……

6.3 What type/s of material are your pots made off (tick all relevant options)?

Cast iron	Aluminium	Stainless steel	Clay	Other, specify……

Thank you very much for your co-operation. We appreciate the time.

Annexure G

FOOD AND NUTRITION CONSUMER SCIENCES

Anthropometric and Blood Pressure measurements

1. Number of the participant _____ Name of community_____

2. Interviewer:_____Date:_____

1. Section A:

1. Body weight (kg)	1. Body weight (kg)	2. Height/Length (cm)	2. Height/Length (cm)	BMI Kg/(m)^2
kg	kg	cm	cm	

2. Section B

3. Waist circumference	3. Waist Circumference	Height (cm)	Height (cm)	WHtR
cm	cm			

Blood pressure measurement

3. Section C4. Blood pressure	4. Blood pressure	Mean
/	/	

Annexure H

24 – HOUR RECALL

Participant Number: _____ Name of community_____

Interviewer _____ Date: _____ / _____ / _____ Tick what the day was yesterday:

Monday	Tuesday	Wednesday	Thursday	Friday

Would you describe the food that you ate yesterday as typical of your habitual food intake?

Yes	1	No	2

If not, why? _____

I want to find out about everything you ate or drank yesterday, including food you pick from the veld. Please tell me everything you ate from the time you woke up to the time you went to sleep. I will also ask you where you ate the food and how much you ate.

Time (approximately)	Place (Home, school, etc)	Food description and preparation method	Amount	Amount in g (office use Only)	Code (office use only)

During the morning at work or at home					

Time (approximately	Place (Home, school, etc)	Description of food and Preparation method.	Amount	Amount in g (office use Only)	Code (office use only)
Middle of th e day (Lunch time)					
During the a fternoon					

At night (din ner time)					

Time (approximately	Place (Home, school, etc)	Description of food and preparation method.	Amount	Amount in g (office use Only)	Code (office use only)

After dinner, before going to sleep					
* Do you take any vitamins (t ablets or syrup)		Yes	1	No	2
Give the brand name and of the vitamin/tonic: dose					
* Do you receive a mealie me al mix (PVM) at the clinic?		Yes	1	No	2
How often do you eat this?			Dail y	Weekly	Monthl y
How much do you eat at a e? tim					
* Do you receive PVM drink mix at the clinic?		Yes	1	No	2
How often do you eat this?			Dail y	Weekly	Monthl y
How much do you eat at a e? tim					

Annexure I **FOOD AND NUTRITION CONSUMER SCIENCES**

FFQ LIST OF FOODS AND FOOD GROUPS DIVERSITY

Participant number_____ Name of community_____

Interviewer: _____Date: _____

PLEASE INDICATE THE FOOD YOU ATE DURING THE PAST SEVEN (7) DAYS BY AN (X)

GROUP 1: Meat Foods (Meat, Poultry, Fish) Diversity	**Y**	**N**
Meat (Chicken)		
Meat (Beef)		
Meat (Mutton)		
Meat (Pork)		
Meat (Goat)		
Dried Meat (Biltong)		
All Tribe/Offals/Runners and Heads		
Processed Meats (Viennas / Polony, Russians, Boerewors Sausage		
GROUP 2: Fish and seafood		
Fish (fresh / whole)		
Fish (dried / whole)		
Tinned Fish (Pilchards/Tuna, sardine, Gelsha)		
Seafood (Prawns, periwinkles, oysters, Crab, Shrimp, Crayfish)		
GROUP 3: Eggs Diversity	**Y**	**N**
Eggs		
GROUP 4: Dairy Products Diversity	**Y**	**N**
All Milk		
Evaporated milk (Unsweetened)		
Condensed milk		
Instant filled milk		
Full cream milk		
All Cheese		
Custard		
Ice Cream		

Yogurt		
Buttermilk		
GROUP 5: Cereals, Roots and Tubers Diversity	**Y**	**N**
All Rice		
Maize (Pap, Mealie Rice, Mealie Meal, Samp, Porridge, Corn on the cob, Popcorn, Sweet Corn)		
Macaroni/Pasta/Spaghetti		
All Bread (White/ Brown/ Whole Wheat)		
Dumpling/Steamed Bread/Fat Koek		
Scones/Biscuits		
Breakfast Cereals (Corn Flakes, Oats, Weet Bix, Matabela)		
All Tubers/Roots (yam, cassava, Sweet Potato)		
Potatoes		
GROUP 6: Legumes and Nuts	**Y**	**N**
All Beans dried including bean sprouts		
Dried Peas		
Lentils		
Peanuts and Nuts		
Soya		
wheat and guinea corn		
GROUP 7: Vitamin A Rich Fruits and Vegetables Diversity	**Y**	**N**
Pumpkin		
Carrots		
Wild Leafy Vegetables (ukazi, bitter and water leaf) Fresh and Dried – includes fresh herbs		
Spinach		
Butternut		
Apricots (Appelkoos)		
Peach (yellow cling)		
Mango		
GROUP 8: Other Fruits (and juices) Diversity	**Y**	**N**
Deciduous Fruits		
Apple		
Peaches		
Pear		
Grapes (black/green)		

Cucumber		
Sub – Tropical Fruit	**Y**	**N**
Lemon		
Orange		
Egg plant		
Banana		
Pineapple		
Avocado		
Kiwi fruit		
Watermelon		
Guava		
Paw- Paw		
Juices	**Y**	**N**
Juice (100% pure juice e.g. Ceres/Liquifruit)		
GROUP 10: Other Vegetables Diversity	**Y**	**N**
Onions		
Cabbage		
Beetroot		
Tomatoes		
Green beans (fresh)		
Peas (fresh)		
Cauliflower		
Chili (red/green)		
Lettuce		
Green\ Yellow\ Red Pepper		
Okro		
Frozen Vegetables (Mixed)		
Ginger & Garlic (Fresh)		
Gem squash		
GROUP 9: Oils and Fats Diversity	**Y**	**N**
Butter		
Vegetable oil (all brands)		
Olive oil		
Margarine		
Lard (animal fat)		
Salad dressing/oil - mayonnaise		
Potato Crisps		

Egusi		
Coffee Creamer (Cremora, Ellis Brown)		

Annexure J

FOOD AND NUTRITION: CONSUMER SCIENCES

FISHING PRACTICES QUESTIONNAIRE (FPQ)

Participant number …… Name of community

……..

Interviewer …….…… DATE ……../……/……..

Please tick the appropriate option with X 1.

Do you fish?

Yes	No

2. How long have you been fishing?

1-3years	4-7years	8-10years	10years and above

Is there any restriction to fishing?

Yes	No

3. Do you have a season for enough catch?

Jan-march	April- June	July - September	October- December

4. Do you know the reason (s) for reduced catch?

Yes	No

4.1. If yes, what is the cause of reduced catch?

Oil pollution	Season of the year	Others,Please specify

5. Why do you fish?

To earn money	For consumption	Others

5.1. If you sell your catches, roughly how much do you make in a month

#5,000 - - #10,000	#15,000 -#20,000	#25,000-#30,000	#40,000 and above

6. How often do you fish?

Everyday	Three times weekly	Once weekly	Once a fortnight	Once monthly	Others

Annexure K FOOD AND NUTRITION CONSUMER SCIENCES

COPING STRATEGIES INDEX

Participant's number: _____ Name of community: _____

Interviewer: _____ Date ……

In the past 30 days, if there have been times when you did not have enough food or money to buy food, how often has your household had to:	All the time? Every day	Pretty often? 3-6 */week	Once in a while? 1-2 */week	Hardly at all? <1* /week	Never	Raw score	Severity weight	Score = Relative Frequency x weight
Relative frequency score								

a. Ask for food from neighbours?							2	
b. Rely on less expensive and preferred food?							1	
c. Send household members to relatives?							2	
d. Limit portion sizes?							3	
e. Reduce the number of meals eaten in a day?							1	
f. Skip entire days without eating?							4	
g. Restrict consumption by adults in order for small children to eat?							2	
h. Sell some belongings in order to get money to buy food?							4	
i. Do you buy food on credit?							2	
j. Ask for food from welfare or church organisations?							4	
k. Do small job for food/money?							2	
l. Exchange one commodity for another with friends							4	
TOTAL HOUSEHOLD SCORE								

Severity weight: 1=least severe; 4=most severe

Annexure L

27 May 2019

To whom it may concern

Dissertation written by Ms Kadi Prudence Legbara

This letter confirms that I have edited the Dissertation entitled **Fishing and Fish Consumption Contributing to the Nutrient Profile, Dietary Diversity and Food Security of Adult Caregivers in a Coastal Community in Rivers State, Southern Nigeria** by Ms Kadi Prudence Legbara for linguistic and grammatical correctness.

I am a qualified editor and proof reader.

Michael Vermeer
Editor/ Proofreader 082

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