PJN
ISSN 1680-5194

PAKISTAN JOURNAL OF NUTRITION

ANSInet
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan
Mob: +92 300 3008585, Fax: +92 41 8815544
E-mail: editorpjn@gmail.com

Pakistan Journal of Nutrition 14 (10): 727-734, 2015
ISSN 1680-5194

Food Consumption Patterns and Nutritional Status of People Living with HIV in Calabar

M.A. Mgbekem[1], I.J. Atangwho[2], E. Duke[1], N. Ukam[3], M. Ojong[4], M.E. John[1], E.U. Eyong[2] and C. Chiotu[1]
[1]Department of Nursing Science, University of Calabar, Calabar, Nigeria
[2]Department of Biochemistry, University of Calabar, Calabar, Nigeria
[3]Department of Home Economics, University of Calabar, Calabar, Nigeria
[4]Department of Nursing, Madonna University Elele, Port Harcourt, Nigeria

Abstract: Alterations in nutritional status are common with HIV infections. Wasting syndrome increases predisposition to opportunistic infections. Food consumption pattern is a known determinant factor for nutritional problems among PLWH. This study was conducted at the Heart-to-Heart Clinic of General Hospital Calabar, to assess food consumption patterns of PLWH. One hundred and twenty eight (128) subjects (50 males and 78 females) made of 50 HIV+ve on treatment (ART), 50HIV+ve not on treatment (NART) and 28 non infected control group. Ethical clearance and consent was obtained from Centre for Clinical Governance, Research and Training, Ministry of Health Calabar while participation was voluntary. Data collection was done by trained field workers for measurement of weight and height, food frequency questionnaire. The results showed significant differences in consumption pattern of carbohydrates (chi = 15.994, df = 6, $p<0.05$), legumes (chi = 9.871, df = 4, $p<0.05$), fats/oil at $p<0.001$ level. The most commonly consumed foods were cassava and cassava products, plantain, rice, bread, fish and some fruits and vegetables. Vegetables and fruits were consumed only 3-6 times a week. Body Mass Index (BMI) was significantly lower in NARTs. This study showed that food consumption patterns and changes in Body Mass Index (BMI) are synergistically interwoven among PLWH.

Key words: Food, consumption pattern, HIV, PLWH, nutritional status

INTRODUCTION

Human Immunodeficiency Virus (HIV) is one of the worst infections that have decimated the human population especially in the resource compromised societies such as the developing African countries. In Africa alone, nearly 25 million are living with HIV/AIDS; the vast majority of them adults in the prime of their working and productive age (Amballi *et al*., 2007; Klassen and Goff, 2013). About 15 million people in Africa are reported to have died of AIDS, while about 12.1 million children have been orphaned in Africa because of the infection (Amballi *et al*., 2007).

Nigeria is reported to be the second in the world with the highest number of new HIV infections reported each year and an estimated 3.7 percent about 3.4 million people of the population are estimated to be living with HIV (UNAIDS, 2012). The need to scale up nutrition assessment and education is thus pertinent to slow the progression of the disease (Federal Republic of Nigeria, 2012). Nutrition appears to be one of the major factors that play a critical role in the prevalence of HIV/AIDS, yet it is taken for granted. According to Odesanmi (1995), "nutrition for people who are rich, is satisfaction in the fact that there is no food items that are beyond reach; for the poor, there is consolation in the fact that only what can be afforded is eaten and for the average majority there is solace in the fact that there is no obvious problem with what to eat". Although everyone knows how to eat, not everyone knows how to nourish his or herself. Deciding what, when and how much to eat is a complex process that requires knowledge of food groups and factors such as food availability, taste, appetite, money and time that influence a person's food consumption. Nutrition is a significant determinant of individual health status which in deficiency state results in malnutrition. Malnutrition in severe cases leads to low serum nutrients status, altered metabolism, chronic inflammation and compromised immune system (Kotler, 2000; Mgbekem *et al*., 2011; Sachdeva *et al*., 2011), which often accounts for the strong positive correlation of malnutrition or its co-existence with infectious diseases such as HIV/AIDS. According to Odesanmi (1995), "nutrition for people who are rich, is satisfaction in the fact that there is no food items that are beyond reach; for the poor, there is consolation in the fact that only what can be afforded is eaten and for the average majority there is solace in the fact that there is no obvious problem with what to eat". Although everyone knows how to eat, not everyone knows how to nourish his or herself. Deciding what, when and how much to eat

Corresponding Author: Mary A. Mgbekem, Department of Nursing Science, University of Calabar, Calabar, Nigeria

is a complex process that requires knowledge of food groups and factors such as food availability, taste, appetite, money and time that influence a person's food consumption. Nutrition is a significant determinant of individual health status which in deficiency state results in malnutrition. Malnutrition in severe cases leads to low serum nutrients status, altered metabolism, chronic inflammation and compromised immune system (Kotler, 2000; Mgbekem *et al*., 2011; Sachdeva *et al*., 2011), which often accounts for the strong positive correlation of malnutrition or its co-existence with infectious diseases such as HIV/AIDS.

Food classification: Carbohydrates- are energy giving foods. Individuals' energy needs depend on the physiological needs, physical activities as well as the health status. Carbohydrates sources include foods such as rice, yam, maize, potatoes (Irish and sweet), bread, cassava, plantain, millet, sorghum and many others. HIV infected persons who have no symptoms require 10% more energy (Batterham, 2005, Food and Nutrition Technical Assistance, (FANTA, 2001) above the level recommended for healthy non-HIV infected persons of the same age, sex and physical activity level. During symptomatic HIV, energy requirement increases by approximately 20-30% to maintain adult body weight. Low energy intake with increased energy demands due to HIV infection and related infection leads to HIV related weight loss and wasting (WHO, 2005; Tang *et al*., 2002).

Proteins: Proteins are known as body building foods that promote cell growth, tissue repairs and growth. They are essential for the formation of body enzymes, hormones and antibodies. Protein ingestion largely determines the lean body mass. A decrease in protein quantity and quality is strongly associated with HIV disease progression and death in HIV-positive persons (Mitchell *et al*., 2000). A review of accessible evidence noted that protein requirements of 1.0 to 1.4 g/kg are indicated for maintenance of lean mass and 1.5 to 2.0 g/kg for anabolism (Mirmiran *et al*., 2006; Sachdeva *et al*., 2011). Nutritionally, there are two types of proteins viz-animal and plant proteins. Animal proteins are of a higher quality since they provide a complete complement of all the nutritionally essential amino acids needed for the proper functioning of the body. Sources of these proteins include: meat, poultry, fish; eggs, fresh and sour milk. On the other hand, plant proteins commonly obtained from legumes (e.g., beans, Soya beans, groundnuts and other nuts) may be lacking in one or more essential amino acids. However, when the plant proteins are properly combined, they can provide good quality protein (WHO/FAO, 2002). Disease conditions, particularly infectious diseases, often increase the body's protein needs. This is even worse with HIV infection which destroys the immune system, a protein dependent system. Increase protein intake is therefore an essential and a necessity in strengthening the immune system.

Fats and oils: Fats and oils are good sources of energy in the diet, especially when one needs extra energy to help gain weight. Fats and oils provide more than twice the energy of an equivalent amount of carbohydrates. Additionally, they also add flavour and taste to food that helps stimulate appetite and are good sources of fat-soluble vitamins-A, D, E and K. Abnormalities of lipid metabolism are well reported in HIV-positive patients, especially those receiving anti-retroviral (ARV) therapy. The infection increases fat oxidation in the presence of fat mal-absorption induced by diarrhea, suggesting that more fat than carbohydrate is used as fuel source (Arpadi, 2000; Arpadi *et al*., 2000). WHO Technical Advisory Group on nutrition and HIV/AIDS (WHO/FAO, 2002) recognizes that individualized advice regarding fat intake might be required in individuals on antiretroviral therapy and among those with persistent diarrhea.

Legumes: Legumes are edible seeds of plants which are divided into two groups: the pulses and the oilseeds. Pulses are the dried edible seeds like beans, peas and lentils while oilseeds are used primarily for their oil content, examples include groundnut, soybeans, sesame seeds (beneseed) (Newby and Tucker, 2004). Legumes are reported to be rich in essential fatty acids like oleic and linoleic acids (Butt and Batool, 2010; Onimawo and Akubor, 2005). Most legumes with the exception of groundnut and soybeans are said to contain less than 3% fat (Augustine and Klein, 1989). Legumes proteins have a deficiency of essential sulphur-bearing amino acids namely methionine and cystine, but are rich in lysine (Butt and Batool, 2010; Onimawo and Akubor, 2005). This makes the combination of legume protein with cereal protein very close to providing an ideal source of dietary protein for humans. Legumes are also known to contain toxic components that interfere with digestive processes and prevent efficient utilization of the legume proteins. However simple processing and heat treatment are needed to prepare them for human consumption (Ene-Obong, 2001).

Fruits and vegetables: Fruits and vegetables offer the most rapid, cost effective and adequate supplies of vitamins, minerals and fibres to people. Fruits are the succulent or fleshy covering of nuts while vegetables are understood to mean the leafy outgrowth of plants used as food. Fruits and vegetables have high content of water and abundance of cellulose. The cellulose or fibres promote elimination of waste and prevents high blood cholesterol (Williams *et al*., 2009; Nnam, 2011). Fruits and vegetables are recommended for weight

control where necessary because of their low energy density (Shiundu, 2002; Mirmiran *et al*., 2006). Fruits and vegetables are rich in vitamins and minerals like ascorbic acid, vitamin A, iron, zinc, thiamin, riboflavin implicated for immune system maintenance (Williams *et al*., 2009; Nnam, 2011; Shiundu, 2002). Two daily servings of fruits, three daily serving of vegetable and a one third to be dark green or orange vegetable is recommended by the Healthy People 2010 in the United States of America (Morbidity and Mortality Weekly Report, 2007).

Micronutrients: Micronutrients are vitamins and minerals that the body needs in small amount to maintain good health (Drain *et al*., 2007a). Vitamins are organic compounds occurring in natural foods either as such or as utilizable precursors which are required in minute amounts for normal growth, maintenance and reproduction (Drain *et al*., 2007b). They protect the body against opportunistic infection (Dreyfuss and Fawzi, 2002) by ensuring that the lining of skin, lungs and gut remains healthy and that the immune system functions properly. Of special importance are vitamin A, C, E, certain B-group vitamins. Water-soluble vitamins are excreted in urine and must be consumed more often. Fat-soluble vitamins (A, D, E and K) are stored in the liver and can reach toxic levels if taken in large doses. Studies have found that people infected with HIV are more likely to show signs of micronutrients deficiencies, compared to uninfected people (Dreyfuss and Fawzi, 2002). Specifically, low concentrations of antioxidant micronutrients (vitamin A, vitamin C, carotenoids, Zinc, iron, vitamin E and selenium) have been found in the blood of various populations (Tang *et al*., 2005; Solomon and Orozco, 2002).

Trace elements: Trace elements are micronutrients required in minute quantities by individuals to maintain good health, example iron (Fe). Iron deficiency is viewed as a nutritional disorder and severe deficiency state results in anaemia (Owiredu *et al*., 2011; Meidani *et al*., 2012). Food sources of iron include: millet, rice (brown), sweet potato leaves, amaranthus tree, soya bean, groundnut, cowpeas, kidney bean, mushrooms among others (Jiamton *et al*., 2012; Ojofeitimi, 2009). Mushrooms have been said to have medicinal properties, such as anti-tumour, immune system-boosting and antibacterial properties, vitamins E and D, numerous carbohydrates, minerals, bioflavonoids and Zinc (Zn) thus containing antioxidants essential for immune system boosting (Figueira *et al*., 2014). Zinc (ZN) is an essential trace element, a part of some enzymes that take part in food digestion, metabolism and reproduction functions (Oguntibeju *et al*., 2009). Zinc is implicated in diarrhea and common cold management, wound healing and immune response. Food sources of zinc include: red meat, poultry, fish, sea foods, whole cereals and dairy products. Zinc is low in plant sources due to dietary fibre, oxalate and phytic acid as they inhibit its absorption. It is essential that the required dietary allowance (RDA) of these elements be met to keep people healthy especially those whose immune status is compromised. Iron for instance, is required for the formation of red blood cells needed for transportation of oxygen in the body. The trace element is even more important in women of child-bearing age as large amount of blood is needed to maintain pregnancy, lactation and menstruation.

Nutritional status and HIV: As HIV treatment is becoming increasingly available in developing countries (Halloran, 2006; Omisakin, 2014), there is, however, a worry about how the drugs work in people with little information about nutrition requirement in management of the disease; the drugs and their side effects, as the disease often causes diarrhea, loss of appetite, weight loss and increased energy expenditure (Batterham, 2005; Tang *et al*., 2005). Solomon *et al*. (2002) opined that adequate calorie, protein and micronutrients intake is important to maintain and restore malnutrition related immune dysfunction since that HIV infection often leads to malnutrition and poor diet in turn speeds up the disease's progress. Despite the success of antiretroviral therapy in reducing the HIV load in patients, HIV sequence analysis reveals that maintaining a good nutritional status is essential in prevention of metabolic co-morbidities (Katzenstein *et al*., 2010; Klassen and Goff, 2013). Previous studies have shown that nutritional intervention improves weight gain in HIV-infected persons (Stambullian *et al*., 2007; WHO/FAO, 2002; World Food Programme, 2003) while adequate nutrition has a strong predictor of survival of HIV infected persons (Newby *et al*., 2004).

Mid-upper arm circumference (MUAC): Mid upper arm circumference (MAC) is another indicator in anthropometric measurements. It is an indicator of the amount and muscle in the upper arm, an area found to be seriously wasted during HIV infection. The hand that is not frequently used is the one that is measured with a tape in centimeters. The Mid-upper arm circumference (MUAC) was measured at the midpoint of upper arm (between the shoulder bone and the tip of the elbow) locating the midpoint after bending the arm to a 90-degree angle at the elbow. During measurement it was ensured that the upper arm was hanging down the side of the body freely and relaxed. The MUAC was measured thrice to the nearest ±0.1 cm and average taken as the MUAC reading.

Theoretical framework: The following theories guided the study:

1: Causal pathway, nutritional status and disease progression in HIV infection
2: Vicious Cycle of Malnutrition

Objective: Specific objectives were to:

1: Assess the food consumption pattern of HIV infected clients on ART centre in Calabar
2: Determine the changes in body mass index of people living with HIV in Calabar

Hypothesis: This study is designed to determine if there is a significant relationship between food consumption pattern and anthropometric measurements among HIV infected persons in Calabar.

MATERIALS AND METHODS

A descriptive research design was adopted for this study carried out in the Heart-to Heart Clinic, General Hospital, Calabar, where HIV-infected persons are counseled, tested and treated. The study population consisted of 128 subjects divided into 3 groups: 50 HIV sero-positive on Antiretroviral Therapy (ART), 50 HIV sero-positives Not on Antiretroviral Therapy (NART) and 28 HIV sero-negative control group.

Data collection: A self-administered questionnaire on food frequencies was administered to the subjects in the Clinic, in order to obtain nutrition information on types of food consumed, frequently and the reasons for their consumption. Body weight, height and mid upper arm circumference of the subjects were also measured for anthropometric assessment. The body mass index (BMI) of the subjects was assessed using a weighing scale, height-meter and a tape. The individual's height was measured while standing erect without shoes, against wooden measuring tape graduated in meters (M) placed against the wall. The subjects stood on a flat surface with the two feet placed together, with the shoulders and hands hanging freely by the sides. The weight was obtained using a bathroom scale graduated in kilogrammes (kg) with minimum clothing and without shoes. The weight and height data obtained were used to calculate the body mass index (BMI) that is the weight in kilogrammes divided by the square of the height in meter. A flexible tape was used to measure the mid upper arm circumference of the subjects. A focused group discussion comprising of 15 clients divided into three groups was employed to elicit information on the food consumption patterns and the disease condition. The study protocol was approved by the Research Ethics and Training, Ministry of Health Cross River State, Nigeria and informed consent was obtained from all clients.

Statistical analysis: Information obtained was coded and analyzed using a computer to obtain frequencies and percentages. The data was evaluated by ANOVA followed by a post hoc (LSD) test using SPSS Version 15.0. A p-value of less than 0.05 was considered statistically significant. Data were expressed as the Mean±SEM. Food consumption pattern analysis a method of assessing total food consumption allows one to determine the effects of many dietary components, considered collectively. Foods consumed were collapsed into food groups to guide the focused groups' determination of factors influencing their consumption pattern.

RESULTS

The scope of the study covered only the food frequency and anthropometrics profiles of the subjects.

Protein was a non staple food among the subjects, the most frequently consumed protein foods were fish (21.9%), snails (12.5%), chicken (10.9%), eggs (9.3%) and yoghurt (9.4%). Other less frequently consumed were milk (8.6%), offal (7.8%), meat (4.8%) and game (4.7%). The result revealed no significant difference among the groups (chi = 10.752, df = 16, $p>0.05$).

Palm oil was the most frequently consumed (54.7%) at various numbers of times in a week. This was followed by vegetable oil (14.4%) and butter (14.1%). Melon (12.5%) was consumed in form of soup. The least consumed source of fats/oils was beneseed (sesame seed, 3.9%). The statistical analysis using chi-square = 37.918, df = 8, $p<0.001$ showed significant difference among the groups.

The consumption frequency of legumes showed that beans (cowpea) was more frequently consumed by the subjects (58.6%) followed by groundnut (28.1%), while soybean (13.3%) had the list consumption frequency. The tested result showed significant difference among the groups as chi = 9.871, df = 4, $p<0.05$.

Findings of fruits consumption was not significant among the study groups as shown in chi 12.181, df = 22, $p<0.05$. The probability of this finding can be attributed to the preparation methods employed by the subjects.

Fruits consumption pattern showed no significant difference in the analysis of chi-square result of 17.607 df = 24, $p<0.05$ as the fruits were consumed in small quantities.

The mean BMI of NART subjects was significantly lower compared to ART and control subjects.

DISCUSSION

Food is a physiological need of humans. Food consumption in the phase of infection is an absolute necessity to maintain a healthy nutritional state. Food consumption in this study is reported based on common or potential usage in the Nigerian context and total responses of the subjects. Adequate food consumption relies on food variety. Varity makes meals more interesting as well as helps to ensure that a diet

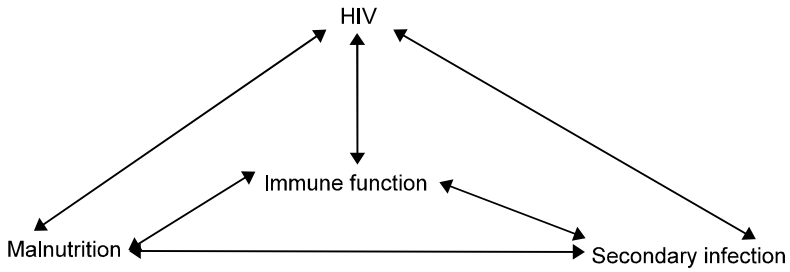

Fig. 1: Model of interaction of human immunodeficiency virus (HIV) infection, Nutritional state and immune function

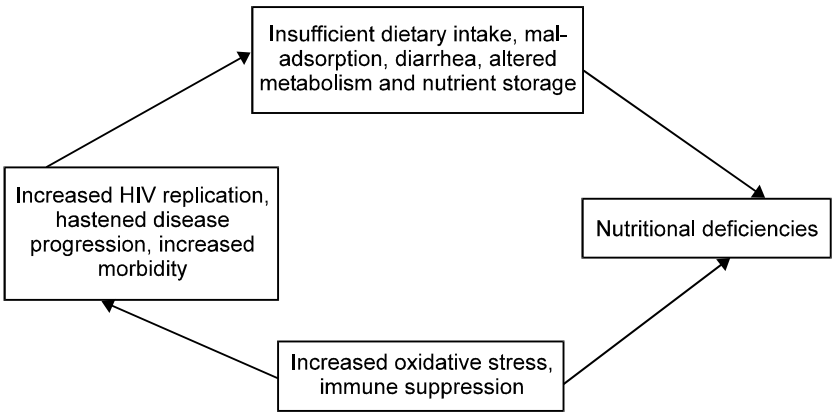

Fig. 2: Vicious Cycle of Malnutrition and HIV Progression (Source: Semba and Tang, 1999)

contains sufficient nutrients and photochemical (Ene-Obong, 2001; Ojofeitimi, 2009; Pasupathi *et al*., 2009). Although the phytochemicals are not an absolute requirement of the diet, they do provide significant health benefits. The type of food and the number of servings to consume depends on age, physiological state and health status.

Food consumption of major staples is reported based on total responses of the subjects. There was a significant difference in the distribution of carbohydrate consumption among the different groups probably due to its abundance and cost. Consumption of over three times in a week indicated that the food was consumed almost every day in a week. This substantially reflected food availability and affordability as well as source of energy needed to meet health status. This result is in agreement with Mgbekem *et al*. (2011), WHO (2003), Nerad *et al*. (2003), Food and Nutrition Technical Assistance Project (2001) findings that state food consumption pattern in most populations depends on its availability and affordability.

Fats/oils consumption in the different groups showed a significant difference ($p<0.001$) in agreement with earlier reports of Pasupathi *et al*. (2009), Ojofeitimi (2009) which indicated that fats/oil may exacerbate decrease intake of food due to anorexia. This finding also correlates with Arpadi (2000), Arpadi *et al*. (2000), WHO/FAO (2002) reports that HIV infection increases fat oxidation which is usually not in sufficient amount since there is often malabsorption and/or diarrhea among HIV infected persons.

Legumes: Legumes consumption was found to be significant among the subjects because most of the subjects asserted that it was a source of protein for them and could be consumed in different forms with other foods (Onimawo and Akubor, 2005; Newby and Tucker, 2004; Ene-Obong, 2001).

Fruits and vegetables: Fruit and vegetables offer the most rapid and cost effective method of providing adequate supplies of vitamins, minerals and fibres to people (Williams *et al*., 2009). Fruits and vegetables supply the body with vitamins and minerals which contain micronutrients needed to perform variety of vital functions in the body such as improving oxidative stress indicators in HIV (Gil *et al*., 2005). Fruits and vegetables consumption was very low among the groups. Findings of this study revealed that majority of the subjects consumed these food items in very small quantities attributing the low consumption rate to cost and/or not being available all the time (seasonal practically). The probable explanation for this could be majority, especially of the untreated (NART) group had poor knowledge on the types/variety of foods that improve general health and immune system to fight infection.

Table 1: Distribution of carbohydrate consumption by the different groups

	ART (%)	NART (%)	Control (%)	Total (%)
Cassava	11 (8.6)	28 (21.8)	12 (9.4)	51 (39.8)
Plantain	23 (17.9)	10 (7.8)	6 (4.7)	39 (30.4)
Potatoes	4 (3.1)	1 (0.7)	2 (1.6)	7 (5.4)
Yam	12 (9.4)	11 (8.6)	8 (6.3)	31 (24.3)
Total	50 (39)	50 (39)	28 (22)	128 (100)

Chi = 15.994, df = 6, p<0.05 (S)

Table 2: Distribution of protein consumption by the different groups

Type	ART (%)	NART (%)	Control (%)	Total (%)
Chicken	7 (5.5)	6 (4.7)	1 (0.8)	14 (11)
Eggs	5 (3.9)	4 (4.1)	3 (2.3)	12 (9.3)
Fish	10 (7.8)	13 (10.2)	5 (3.9)	28 (21.9)
Game	1 (0.8)	3 (2.3)	2 (1.6)	6 (4.7)
Meat	6 (4.7)	9 (7.0)	4 (3.1)	19 (14.8)
Milk	4 (3.1)	3 (2.3)	4 (3.1)	11 (8.5)
Offals	3 (2.3)	4 (3.1)	3 (2.3)	10 (7.7)
Snails	6 (4.7)	6 (4.7)	4 (3.1)	16 (12.5)
Yoghurt	8 (6.3)	2 (1.6)	2 (1.6)	12 (9.5)
Total	50 (39.1)	50 (39)	28 (21.8)	128 (99.9 = 100)

Chi = 10.752, df = 16, p<0.05 (NS)

Table 3: Distribution of fats/oils consumption by the different groups

Type	ART (%)	NART (%)	Control (%)	Total (%)
Beneseed	1 (0.8)	0 (0.0)	4 (3.1)	5 (3.9)
Butter	4 (3.1)	8 (6.3)	6 (4.7)	18 (14.1)
Melon	4 (3.1)	7 (5.5)	5 (3.9)	16 (12.5)
Palm oil	36 (28.1)	31 (24.2)	3 (2.3)	70 (54.6)
Vegetable oil	5 (3.9)	4 (3.1)	10 (7.8)	19 (14.8)
Total	50 (39)	50 (39.1)	28 (21.8)	128 (99.9 = 100)

Chi = 37.918, df = 8, p>0.001

Table 4: Distribution of legumes consumption by the different groups

Type	ART (%)	NART (%)	Control (%)	Total (%)
Beans	34 (26.5)	28 (21.8)	13 (10.2)	75 (58.5)
Groundnut	14 (10.9)	15 (11.7)	7 (5.5)	36 (28.1)
Soya bean	2 (1.6)	7 (5.5)	8 (6.3)	17 (13.4)
Total	50 (39)	50 (39)	28 (39)	128 (100)

Chi = 9.871, df = 4, p<0.05

Table 5: Distribution of vegetables consumption by the different groups

Vegetable type	ART (%)	NART (%)	Control (%)	Total (%)
Afang	3 (2.3)	3 (2.3)	2 (1.6)	8 (6.2)
Atama	2 (1.6)	4 (3.1)	3 (2.3)	9 (7.0)
Bitter leaf	4 (3.1)	5 (3.9)	6 (4.7)	15 (11.7)
Cabbage	0 (0.0)	1 (0.8)	0 (0.0)	1 (0.8)
Editan	1 (0.8)	2 (1.6)	0 (0.0)	3 (2.3)
Green	3 (2.3)	2 (1.6)	2 (1.6)	7 (5.5)
Okra	4 (3.1)	6 (4.7)	1 (0.8)	11 (8.6)
Onions	7 (5.5)	5 (3.9)	2 (1.6)	14 (11)
Pepper	5 (3.9)	3 (2.3)	3 (2.3)	11 (8.6)
Pumpkin	10 (7.8)	9 (7.0)	4 (3.1)	23 (17.9)
Tomatoes	6 (4.7)	7 (5.5)	2 (1.6)	15 (11.8)
Water leaf	5 (3.9)	3 (2.3)	3 (2.3)	11 (8.5)
Total	50 (39)	50 (39)	28 (21.9)	128 (99.9 = 100)

Chi = 12.181, df = 22, p<0.05 (NS)

This finding correlated with many reports (Mgbekem *et al*., 2011; Williams *et al*., 2009; Nnam, 2011; Tang *et al*., 2005; Newby and Tucker, 2004; Ene-Obong and Maduekwe, 2001). The food consumption frequency also corroborated with the theoretical frameworks (Semba and Tang, 1999; Jackson and Rogers, 2007).

Table 6: Distribution of fruits consumption by the different groups

(%) Fruits	ART (%)	NART (%)	Control (%)	Total (%)
Apple	1 (0.8)	0 (0.0)	2 (1.6)	3 (2.4)
Avocado	2 (1.6)	1 (0.8)	2 (1.6)	5 (4)
Banana	9 (7.0)	10 (7.8)	3 (2.3)	22 (17.1)
Carrot	2 (1.6)	2 (1.6)	1 (.8)	5 (4)
Cucumber	3 (2.3)	4 (3.1)	2 (1.6)	9 (7.0)
Egg plant	3 (2.3)	6 (4.7)	3 (2.3)	12 (9.3)
Guava	1 (0.8)	4 (3.1)	1 (0.8)	6 (4.7)
Mango	1 (0.8)	3 (2.3)	1 (0.8)	5 (3.9)
Orange	9 (7.0)	10 (7.8)	8 (6.2)	27 (21)
Pawpaw	9 (7.0)	4 (3.1)	2 (1.6)	15 (11.7)
Pineapple	7 (5.4)	3 (2.3)	2 (1.6)	12 (9.3)
Udara	1 (0.8)	2 (1.6)	1 (0.8)	4 (3.2)
Water melon	2 (1.6)	1 (0.8)	0 (0.0)	3 (2.3)
Total	50 (39)	50 (100)	28 (100)	128 (100)

Chi = 17.607, f = 24, p<0.05 (NS)

Table 7: BMI and MUAC of the subjects

Subjects	BMI	MAC
Control	23.21±0.45	26.28±0.63
NART	21.39±0.57[a b]	24.80±0.57[a]
ART	23.78±0.59[b]	26.96±0.63[b]

Result expressed as Mean±SEM. a: p<0.05vs control, b: p<0.05 vs NART Mean BMI of NART subjects was significantly lower compared to ART and control subjects

Anthropometric measurements of the subjects: HIV is well known for causing severe weight loss referred to as wasting. Findings showed significant (p<0.05) difference in the BMI and MUAC of NART compared with control and ART subjects. Although the mean BMI (21.39±0.57) of NART subjects was within normal range, most of the subjects in this group had BMI less than 18.5 kg/m^2 indicating under-nutrition when compared with WHO (1995) reference standard suggesting changes in the make-up of the body even if the overall weight seems to be normal (Midha *et al*., 2014; WHO, 2005; Sheehan and Macallan, 2004). In energy expenditure; people with HIV tend to burn around 10% calories more while resting compared to those not infected, loss of appetite and inability to eat due to sores in the mouth or throat that may give rise to pain when swallowing. Diarrhoea and nausea are among the many reasons purported to cause weight loss among HIV positive subjects (Tang *et al*., 2002; Tang *et al*., 2005; Batterham, 2005).

Conclusion: There is complex, synergistic relationship between HIV infection and nutrition. Poor food consumption pattern including inadequate micronutrients exposes individuals to opportunistic infections. Antiretroviral drugs with adequate food consumption could be the cheapest and easiest tool of managing HIV infection especially in resource limited country like Nigeria and Calabar in particular.

REFERENCES

Amballi, A.A., A. Ajibola, S.A. Ogun, O.F. Ogunkolo, L.O. Salu, K.S. Oritogun and V.A. Oyegunle, 2007. Demographicnpattern and haematological profile in people living with HIV/AIDS in a university teaching hospital. Sci. Res. and Essay, 2: 315-318.

Arpadi, S.M., P.A. Cuff, D.P. Kotler, J. Wang, M. Bamji and M. Lange *et al.*, 2000. Growth velocity, fat-free mass and energy intake are inversely related to viral load in HIV-infected children. J. Nutr., 130: 2498-2502.

Arpadi, S.M., Growth failure in children with HIV infection 2000. J. Acquired Immuno Deficiency Syndrome, 25 Supplement, 1: S37-S42.

Augustine, J. and B.P. Klein, 1989. Nutrient composition of raw, cooked and sprouted legumes. In: Legume chemistry, technology and human nutrition. Mathews, R.D., Dekkor, M. Inc. 32 N.Y.

Batterham, M.J., 2005. Investigating heterogeneity in studies of resting energy expenditure in persons living with HIV/AIDS: a meta-analysis. Am. J. Clin. Nutr., 81.

Butt, M.S. and R. Batool, 2010. Nutritional and Functional Properties of Some Promising Legumes Protein Isolates. Pak. J. Nutr., 9: 373-379.

Drain, P.K., R. Kupka and W.W. Fawzi, 2007a. Micronutrients in HIV-positive persons receiving antiretroviral therapy. Am. J. Clin. Nutr., 85: 333-345.

Drain, P.K., R. Kupka, F. Mugusi and W.W. Fawzi, 2007b. Micronutrients in HIV-positive persons receiving highly active antiretroviral therapy. Am. J. Clin. Nutr., 85.

Dreyfuss, M.L. and W.W. Fawzi, 2002. Micronutrients and vertical transmission of HIV-1. Am. J. Clin. Nutr., 75: 959-970.

Ene-Obong, H.N. and E.U. Maduekwe, 2001. Bioavaailability of trace elements in South-eastern Nigerian meals and the effect on dietary components. Nigeria J. Nutr. Sci., 22: 4-12.

Ene-Obong, H.N., 2001. Eating Right. University of Calabar Press, Calabar.

Federal Republic of Nigeria, 2012. Global AIDS Response Country Progress Report, Nigeria.

Figueira, M.S., L.A. Sa, A.S. Vasconcelos, D.R. Moreira, P.S.O.C. Laurindo, D.R. Ribeiro, G.S. Santos, P. Guzzo, M.F. Dolabela and S. Percario, 2014. Nutritional supplementation with the mushroom *Agaricus sylvaticus* reduces oxidative stress in children with HIV. Canadien J. Infectious Diseases Med. Microbiol., 25: 257-264.

Food and Nutrition Technical Assistance (FANTA) Project, 2001. HIV/AIDS: A Guide for Nutritional Care and Support. Food and Nutrition Technical Assistance Project. Academy for Educational Development, Washington DC.

Gil, I., L. Lewis and Martinez, 2005. Effect of increase of dietary micronutrient intake on oxidative stress indicators in HIV/AIDS patients. Int. J. Vitamin Nutr. Res., 75: 19-27.

Halloran, J., 2006. Increasing survival with HIV: impact on nursing care. Am. Assoc. of Colleges of Nursing Clin. Issues, 17: 8-17.

Jackson, M.O, and B.W. Rogers, 2007. Meeting Strangers and Friends of Friends: How Random are Social Networks? Am. Eco. Rev., 97: 890-915.

Jiamton, S., J. Pepin, R. Suttent, S. Filteau, B. Mahakkanukrauh, W. Hanshaoworakul, P. Chaisilwattana, Suthipinittharm X. Jin, J.R. Beguerie, D. Sze and G.C.F. Chan, 2012. Ganoderma lucidum (Reishi mushroom) for cancer treatment. Cochrane Library of Systematic Reviews.

Katzenstein, D., S. Koulla-Shiro, M. Laga, J. Moatti, 2010. Learning and doing:operational research and access to HIV treatment in Africa. AIDS, 24: S1-S4.

Klassen, K. and L.M. Goff, 2013. Dietary intakes of HIV-infected adults in urban UK. Eur.J. Clin. Nutr., 67: 890-893.

Kotler, D.P., 2000. Nutritional alterations associated with HIV infection. J. Acqquired Immune Deficiency Syndrome, 25: S81-S87.

Meidani, M.I., F. Rezaei, M.R. Maracy, M. Avijgan and K. Tayeri, 2012. Prevalence, severity and related factors of anemia in HIV/AIDS patients. J. Res. in Med. Sci., 17: 138-42.

Mgbekem, M.A., M.E. John, I.B. Umoh, E.U. Eyong, N. Ukam and B.O. Omotola, 2011. Plasma Antioxidant Micronutrients and Oxidative Stress in People Living with HIV. Pak. J. Nutr., 10: 214-219.

Midha, T., V. Krishna, B. Nath, R. Kumari, Y.K. Rao, U. Pandey and S. Kaur, 2014. Cut-off of body mass index and waist circumference to predict hypertension in Indian adults. World J. Clin. Cases, 2: 272-278.

Mirmiran, P., L. Azadbakht and F. Azizi, 2006. Dietary diversity within food Groups: An indicator of specific nutrient adequacy in Tehranian women. J. Am. College of Nutr., 25: 354-461.

Mitchell, D.C., B.M. Shannon, J. McKenzie, H. Smiciklas-Wright, B.M. Miller and M. Tershakovec, 2000. Lower fat diets for children did not increase food costs. J. Nutr. Edu., 32: 100-103.

Morbidity and Mortality Weekly Report (MMWR), 2007. Fruits and Vegetables consumption among adults in the United States. Morbidity and Mortality Weekly Report, 56: 213-217.

Nerad, J., M. Romeyn, E. Silverman, J. Allen-Reid, D. Dieterich, J. Merchant, V.A. Pelletier, D. Tinnerello and M. Fenton, 2003. General nutrition management in patients infected with human immunodeficiency virus. Clinical Infectious Diseases, 36: S52-S62.

Newby, P.K., D. Muller and K.L. Tucker, 2004. Associations of empirically derived eating patterns with plasma biomarkers: a comparison of factor and cluster analysis methods. Am. J. Clin. Nutr., 80: 759-767.

Newby, P.K. and K.L. Tucker, 2004. Empirically derived eating patterns using factor or cluster analysis: a review. Nutr. Rev., 62: 177-203.

Nnam, N.M., 2011. Bioactive Compounds in Plants Foods with Potential Health Benefits and Double Burden of Malnutrition. In: Processdings; 2nd Federation of Afr. Nutr. Societies Congress (FANUS), 29-37.

Odesanmi, W.O., 1995. Forword. In: Nutrition and Diet Therapy for Health Care professionals in Africa by F. Smith, and E. Ojofeitimi, Ibadan, Y-Books.

Oguntibeju, O.O., A.J. Esterhuyse and E.J. Truter, 2009. Possible benefits of Micronutrient supplementation in the treatment and management of HIV infection and AIDS. Afr. J. Pharmacy and Pharmacol., 3: 404-412.

Ojofeitimi, E.O., 2009. Principles and Practice of Nutrition for Public Health Practitioners. Ile Ife. Nonesuchhouse Publishers.

Omisakin, F., 2014. A qualitative study f self-management needs of people living with HIV/AIDS in semi-rural areain Kwazulu-Natal South Africa. West Afr. J. Nursing, 25: 84-94.

Onimawo, I.A. and I.P. Akubor, 2005. Food chemistry: Integrated approach with biochemical background. Food Chemistry. Ambik press Ltd Benin City, Nigeria.

Owiredu, W.K.B.A., L. Quaye, A. Amidu and O. Addai-Mensah, 2011. Prevalence of anemia and immunological markers among Ghanaian HAART-naïve HIV-Patients and those on HAART. Afr. Health Sci., 11: 2-15.

Pasupathi, T., P.J. Ramchandran, G. Sindhu and G.B. Saranvan, 2009. Enhanced oxidative stress markers and antioxidant imbalance in HIV infection and AIDS patients. J. Sci. Res., 1: 2.

Sachdeva, R.K., A. Sharma, W. Ajay, V. Dogra, Singh and S. Varma, 2011. Dietary adequacy of HIV infected individuals in north India-A cross-sectional analysis. Ind. J. Med. Res., 134: 967-971.

Semba, R.D. and A.M. Tang, 1999. Micronutrients and the pathogenesis of human immunodeficiency virus infection. Br. J. Nutr., 81: 181-189.

Sheehan, L.A and D.C. Macallan, 2004. Determinants of energy intake and energy expenditure in HIV and AIDS. Nutr., 16: 101-106.

Shiundu, K.M., 2002. Role of African Leafy vegetables (ALVs) in alleviating food and nutrition in Africa. Afr. J. Food and Nutr. Sci., 2: 96-97.

Solomon, J., De P. Truchis and J.C. Melchior, 2002. Body composition and nutrition parameters in HIV and AIS patients. Clin. Chem. and laboratory Med., 40: 1329-1333.

Solomon, S.N.W. and M. Orozco, 2002. Micronutrients and HIV infection. Am. J. Clin. Nutr., 75: 1128-1129.

Stambullian, M., S. Feliu and N. Slobodianik, 2007. Nutritional Status in Patients with HIV and AIDS. Br. J. Nutr., 98: S140-S143.

Tang, A.M., J. Forester, D. Spiegelman, T.A. Knox, E. Tchetgen and S.L. Gorbach, 2002. Weight loss and survival in HIV-positive patients in the era of highly active antiretroviral therapy. J. Acquired Immune Deficiency Syndrome, 31: 230-236.

Tang, A.M., J. Lanzilloltt, S.K. Hendrick, J. Gerrior, M. Ghosh, M. Woods and C. Wanke, 2005. Increasing risk of 5% or greater unintentional weight loss in a cohort of HIV-infected patient, 1995-2003. J. AIDS, 40.

UNAIDS, 2012. UNAIDS Report on the global AIDS epidemic. 'Global Report: Annexes.

WHO, 1995. WHO Expert Committee on Physical Status. Physical Status: The Use and Interpretation of Anthropometry. Geneva, Switzerland: World Health Organization Consultation. WHO, Geneva, Switzerland.

Williams, I.O., A.J. Edet, M.A. Agiang and O.O. Lawal, 2009. Fruit and Vegetables intake pattern and body mass index (BMI) of Postgraduate students in the University of Calabar, Nigeria. Nig. J. Nutr. Sci., 30: 42-49.

World Food Programme, 2003. Food is first Defense in the fight against AIDS: a press release programme: International AIDS Conference in Barcelona. Retrieved from: wfp@wfp.org, www.wfp.org.

World Health Organization (WHO), 2003. Nutrient requirements for people living with HIV/AIDS. Report of a technical Consultation. WHO, Geneva, Switzerland

World Health Organization (WHO), 2005. Consultation on Nutrition and HIV/AIDS in Africa: Evidence, Lesson and Recommendations for Action. Report of a technical Consultation. WHO, Geneva, Switzerland.

World Health Organization/Food and Agriculture al Organization, 2002. Living well with HIV/AIDS: A manual on nutritional care and support for people living with HIV/AIDS. WHO/FAO. Rome.