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Title: The impact of Eating Habits on the Nutritional Status of People Living with HIV/AIDS in Barbados

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Abstract

Background: Human immunodeficiency virus is a life debilitating disease that aggressively attacks the immune system of an infected person. In Barbados, though the prevalence of HIV/AIDS has remained constant over the years, there is lack of documented information in respect to the impact of eating habits on nutritional status as well as effectiveness of treatment.

Aim: To evaluate the impact of dietary habits on nutritional status of people living with HIV/AIDS infection by assessing nutritional and clinical parameters.

Design: A cross-sectional descriptive study was conducted, which utilized a structured questionnaire, anthropometric measurements and CD4/Viral Load from pre-existing records to assess the nutritional status of people living with HIV/AIDS infection in Barbados.

Setting: An outpatient clinic and nutrition center at the Vashti Inniss Empowerment Center.

Subjects: The population sample (n = 106) consisted of n = 49 males and n = 57 females medically diagnosed with HIV/AIDS and registered at the Ladymeade Reference Unit and or the National HIV/AIDS Food Bank. Random convenient sampling was used.

Results: Females had significantly higher body fat percentages ($p < 0.001$) and body mass index ($p < 0.001$). Males had significantly lower CD4 count ($p < 0.049$) and significantly higher viral load ($p < 0.006$). Significant correlation between dietary intake and nutritional status was observed predominantly in the male population. 71% of the patients exhibit signs of food insecurity but there was no significant difference between the two genders ($p = .845$).

Conclusion: There was lack of significant associations between eating habits and nutritional status among the target population. However, the results of the study revealed that the potential risk for co-morbidities among female patients was prevalent, and males exhibited signs of poor disease outcomes. Food insecurity is a growing concern that needs immediate address.

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Introduction

Statement of Problem

Human immunodeficiency virus (HIV) is a life threatening debilitating disease that aggressively attacks the immune system of an infected host leaving them vulnerable and at risk for opportunistic infections. The virus, first identified in the late 1980's was associated with the sexual activity of homosexual men who often presented with unusual infections and rare malignancies that coined the term "Slim Disease (Sharp and Hahn, 2011). However since the proliferation of the virus, it is currently understood that HIV is a sexually transmitted disease spread through the contact of infected blood and bodily fluids despite the sexual orientation of the host.

The UNAIDS (2013) reported that since the global epidemic of HIV/AIDS, approximately 75 million people had become infected. At the end of 2012, 35.3 million people were living with HIV infection with approximately 1.6 million dying from AIDS related causes. In the Latin America region, cases of HIV/AIDS were documented as stabilized where an estimated 1.4 million people were now living with HIV infection. The Caribbean on the other hand reflected high HIV prevalence despite having a relatively small epidemic.

HIV population statistics revealed that after sub-Saharan Africa, the Caribbean was one of the most heavily affected regions in the HIV/AIDS epidemic. Additionally, adult prevalence in 2011 was approximately 1% higher than in any other world region outside of sub-Saharan Africa, indicating that the Caribbean was ranked second in the world for the highest estimated rates of HIV/AIDS infection (UNAIDS 2013).

Barbados, one of the countries that make up the Caribbean chain of islands is the most easterly and constitutes a land mass of 430km^2. Purported population statistics abstracted from the 2010 census indicates that approximately 277,821 people currently reside in the eleven parish nation. Since the inception of the HIV/AIDS epidemic in 1984, a total of 3426 cases of HIV/AIDS infection have been recognized in Barbados. According to the Barbados HIV/AIDS Surveillance Report 2010 the predominant mode of transmission among these people contracting HIV was sexual intercourse and perinatal transmission.

In an effort to curtail the detrimental effects that HIV/AIDS has on the socio economic status in developing countries, the Government in 2002 mandated the treatment option of anti-retro therapy drugs (ART) at a public clinic designed to facilitate the specific needs of people living with HIV/AIDS infection. This has resulted in fewer reported cases of disease progression and a decline in the number of AIDS related deaths (Barbados HIV/AIDS Surveillance Report 2010).

However, despite the tremendous advance in medical care, the human immunodeficiency virus is multifactorial and people living with HIV/AIDS infection not only face sickness but are subjected to low productivity and declining income (Ivers et al., 2009). A review article by Colecraft (2008) explained that HIV/AIDS was associated with biological and social factors that affected the individual's ability to consume and utilize food resulting in weight loss, poor nutritional status and quality of life.

The introduction of the National HIV/AIDS Food Bank in Barbados sought to address these short comings by providing monthly food hampers, nutrition assessment, monitoring and education to people living with HIV/AIDS. With the majority of the population receiving public treatment relying heavily on this assistance, it is apparent that an issue of food insecurity was a growing concern in addition to the prevalence of poor nutritional status and dietary intake.

Purpose of the Study

The purpose of this study therefore was to evaluate the nutritional status of people living with HIV/AIDS infection in Barbados attending the Ladymeade Clinic/National HIV/AIDS Food Bank by assessing their dietary intake, anthropometric and clinical characteristics.

Scope and objectives of the Study

- to determine what percentage of the population is food insecure;
- to determine the major source of food procurement of the target population;
- to determine what effect HAART has on the appetite of the target population;
- to determine what percentage of the population receives nutritional counseling and how often;
- to determine what percentage of the population uses nutritional supplements.

Research Question

What is the association between eating habits and nutritional status among people living with HIV/AIDS infection in Barbados?

Hypothesis

H_a: There is an association between eating habits and nutritional status among people living with HIV/AIDS infection in Barbados.

H_o: There is no association between eating habits and nutritional status among people living with HIV/AIDS infection in Barbados.

Significance of the Study

There is lack of documented research on the nutritional status of people living with HIV/AIDS infection in Barbados. Although patients receive medical treatment and nutrition intervention at each clinic visit there is no statistical evidence that tracks the effectiveness of these treatment options. Thus the study presents itself in a contemporary arena where it contributes to the knowledge pool by acting as a pilot study.

Data collected seeks to reflect changes that occur in nutritional habits and nutritional status after the diagnosis of HIV. It highlights body composition changes after initiation of ART and may assist health care providers in understanding the effects of treatment and nutrition on body composition. Additionally, the study also highlights the role food assistance plays in the lives of people living with HIV/AIDS as food insecurity is precursor for poor health status.

Findings from the study can be used in the preparation and implementation of short term nutrition intervention programs which allows health care professionals to advise patients on their diets with appropriate nutritional practices. Therefore this research project seeks to not only address the relationship between the role of dietary intake and nutritional status but provide a snapshot of the current health status of people living with HIV/AIDS in Barbados.

Literature Review

The Pathophysiology of HIV/AIDS

The life cycle of the human immunodeficiency virus (HIV) is a complex process that depends on the duration and outcome of both target cells and cell activation. The virus gains access into the host through the contact of infected blood and bodily fluids such as semen, vaginal secretion and breast milk. During initiation of contraction, immediate damage to the immune system is not observed even though its stimulation facilitates viral replication. Proteins located on the surface of the HIV viron form spikes that allow the virus to attach and bind to the receptors on CD4 cells where it deposits its contents. CD4 cells are subsequently rendered disable and the viral genome is reverse transcribed into DNA by the viral enzyme reverse transcriptase (Simon et al., 2006).

As infection is established, the virus protein integrase in addition to the host's DNA repair enzymes, invert the viral genome into an active domain of the host's chromosomal DNA. An integrase binding host factor facilitates integration that reprograms the CD4 cells to manufacture, assemble and release virons (Simon et al., 2006; Nelms et al., 2010). Simultaneously, the depletion of CD4 cells and the propagation of viral load initiate the innate immune system to recognize viral nucleic acids and genomes in an attempt to stimulate transcriptional activation of proinflammatory cytokines and type I interferons (IFNs). Type I IFNs bind to IFN αβR on infected and neighboring cells and transduce signals that activate the expression of hundreds of IFN-stimulated genes to block virus replication and spread (Iwasaki, 2012).

However, the dynamic structure of the virus allows it to evolve and establish chronicity in the host despite immune responses. Such that HIV virons concentrate on the surface of follicular dendritic cells where there shed intermittently to establish this chronic state of infection and elevate immune response to further facilitate the ultimate destruction of the immune system (Duggal et al 2011). Once infection becomes systemic and CD4 turnover rate is high, the HIV virus causes virotoxic effects on the gastrointestinal tract, the largest reservoir and crucial element in host defense, the peripheral blood and all other body components including the central nervous system (Volberding and Deeks 2010; Duggal et al., 2011).

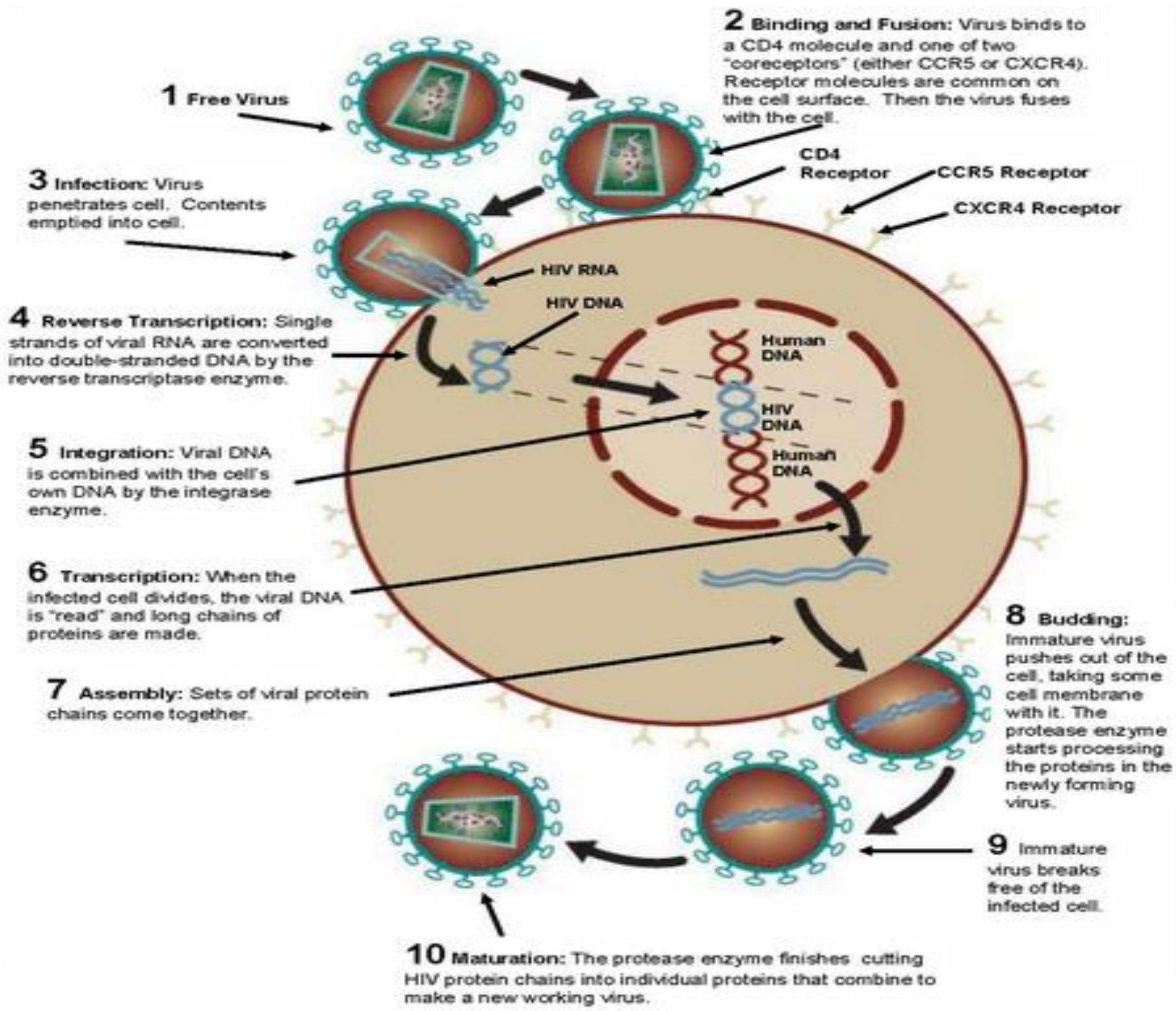

Figure 1 The Life Cycle of the Human Immunodeficiency Virus (Nelms et al., 2011)

Mahan et al. (2012) advanced that after infection with HIV, the virus progresses through four clinical stages: acute infection, clinical latency, symptomatic HIV and progression of HIV to acquired immunodeficiency syndrome (AIDS). Mahan et al. (2012) further added that the acute infection stage was characterized as the time of transmission to the host until the production of detectable antibodies with rapid replication and significant decline of CD4 cell count could be observed. Volberding and Deeks (2010) inferred that infected hosts during this time present with a myriad of flu-like symptoms that may usually go unnoticed because as they subside approximately after 1-2 weeks after inception.

Clinical latency which follows the acute infection stage is experienced when the immune response reaches its viral set point. The host may not exhibit further signs of flu-like symptoms for a long period of time though the virus remains active and constantly replicating. The degenerative effective on the immune system experienced at this stage makes the body incapable of resisting the virus. As CD4 cell count continues to rapidly decline ($>500mm^3$) the host becomes susceptible to opportunistic infections and advances to the symptomatic HIV infection stage.

Once the symptomatic HIV infection stage is acknowledged, further deterioration of immunological defense is recognized and the onset of AIDS is established. The Center for Disease Control and Prevention (2014) defines AIDS as an acute decline in the body's CD4 cell count ($>200mm^3$) and the presence of one or more opportunistic infections. In addition, the syndrome is usually accompanied by unexplained weight loss of more than 10%, fever and diarrhea that may prolong for more than a month. Nelms et al. (2011) suggests that these complications may be a direct effect of hormonal deficiencies, irregularity of cytokines, chronic inflammation and metabolic demands of medication.

The Manual of Clinical Nutrition Management (2011) further added that people living with HIV/AIDS infection were not only susceptible to opportunistic infections but were also predisposed to neurological dysfunctions and gastrointestinal ailments that impacted tremendously on their nutritional status and quality of life. Without adequate treatment and health care, neoplasms such as Kaposi sarcoma and non-Hodgkin lymphoma develop with the further advancement of the disease.

The initiation of highly active anti-retro therapy drugs (HAART) in 2005, has seen the number of AIDS reported cases and AIDS related deaths as declining globally from 1.9million in 2001 to 1.6 million in 2012 (UNAIDS, 2013). The primary goal of HAART is to achieve and maintain long-term viral suppression, approximately 50copies/mL, and immunological restoration by disrupting the life cycle of the virus (Hendricks et al 2009; Nelms et al., 2011). Adherence to HAART therefore becomes paramount in order to improve the life expectancy and immune function of people living with HIV/AIDS.

Nutritional Implications of HIV/AIDS

Understanding the role of nutrition in the management of HIV/AIDS progression is crucial as the high metabolic demands of the virus often lead to the malnourishment of infected hosts. Ivers et al (2009) discusses that undernutrition and HIV status were interrelated in a negative feedback loop resulting in severe effects on the resilience of individuals, households and by extension communities. Ivers et al. (2009) further discussed that a lack of access to appropriate food and the direct effect that HIV had on the impaired metabolic functions in absorption, storage and utilization of nutrients precipitated immunity, nutrient deficiencies and increased the vulnerability of infectious diseases.

The World Health Organization (WHO) (2003) concurred that indeed infectious diseases have been known to cause a change in the energy requirements of infected persons as inflammation and the production of cytokines necessary to ward of diseases were metabolically costly. Duggal et al. (2012) explained that cytokine production was over exaggerated in HIV infection as a means to down regulate the multiplication of virus cells. Therefore, if the body is deprived of adequate nutrition during this stage, the constant release of chemical substances from the white blood cells eventually causes a change in the endocrine system that leads to the breakdown of amino acids and subsequently unwanted loss of lean body mass.

In addition to the increase in metabolic demands, the reduction in dietary intake as a result of opportunistic infections also precipitates the process of weight loss. Oral lesions, periodontal and salivary disease cause itching, pain, burning sensations and alter the taste of food (Nelms et al., 2011). Side effects of HAART, depression and other psychological factors may also hinder the ability of people living with HIV/AIDS to consume food which contributes to the prevalence of malnutrition.

Independently, malnutrition has the capability to reduce CD4 cells and cause immunodeficiency (Katona et al., 2008), coupled with HIV/AIDS both conditions amplify each other resulting in a vicious cycle of decreased immunity, increased susceptibility to infections and increased nutrient requirements, which not adequately met can lead to more malnutrition (Colecraft, 2008).

The gastrointestinal (GI) tract consists of the largest reservoir of CD4 cells; Duggal et al. (2012) inferred that as a result of HIV infection the GI tract becomes vulnerable to bacterial infections and as such patients may present with nausea, vomiting and diarrhea. Simultaneously, the virus destroys the microvilli of the small intestine inhibiting absorption and storage of nutrients. Thus malabsorption precipitates malnutrition and malnutrition in turn aggravates the morbidity and mortality HIV/AIDS infection.

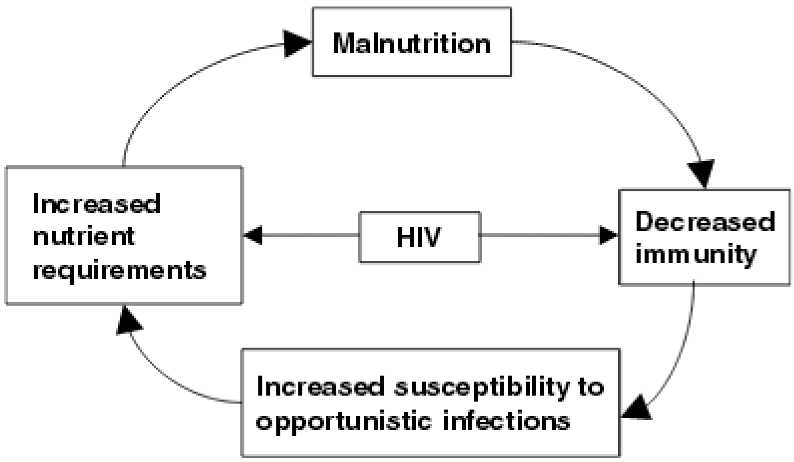

Figure II: The Vicious Cycle of Malnutrition and HIV/AIDS (Colecraft, 2006)

Macronutrient Requirements for People Living with HIV/AIDS

Energy

Babameto and Kotler (1997) pointed out that extensive research has been performed to determine the effects of HIV infection on body composition. The studies have led to the conclusion that the low energy intakes combined with increased energy demands from the virus are the major driving forces behind the changes of body weight. This notion was advanced by the Hsu et al. (2005) which stated that people living with HIV/AIDS had an overall increase in total energy expenditure when compared to their otherwise healthy counterparts. Hence, research evidence has deduced that energy requirements for people living with HIV/AIDS be increased to 10% for asymptomatic patients to facilitate weight maintenance and physical activity with an approximate increase of 20-30% in symptomatic patients to sustain body weight.

Protein

The Manual of Clinical Nutrition Management (2011) infers that protein is an essential macronutrient required for normal body functioning and immunity. In disease states, the absence of adequate energy intake converts body fat and protein to a synthesizable form of fuel to maintain general body operations (Hsu et al., 2005),   the effects is a reduction in lean body mass and compromised immunity. Though there is insufficient data to support an increase in protein intake for people living with HIV/AIDS above the normal requirements for health (0.8g/kg/body weight.), special attention should be given to the stage of the disease, nitrogen balance studies, physical activity levels and coexisting morbidities when recommending protein to an infected host.

Fats

Though there is no evidence indicating that an increase need in total fat is necessary for people living with HIV/AIDS, contradicting studies have shown that dietary fat recommendations differ within this population and indeed specific fatty acids such as omega-3 have a positive effect on the immune system (Hsu et al., 2005; Mahan et al., 2012). The Manual of Clinical Nutrition Management (2011) further endorses that a diet inclusive of omega-3 fatty acids reduces the risk of lipodystrophy and other metabolic modulations which occur in people living with HIV/AIDS.

Micronutrient Requirements for People Living with HIV/AIDS

Enwonwn (2006) purported that a prominent feature of HIV/AIDS infection is the depletion of micronutrient status. De Pee and Semba (2010) inferred that micronutrients are important for immunity, growth and psychomotor development not only because they catalyze processes in the body but they are also key components of essential tissues. Research evidence indicates that low blood levels and decreased dietary intakes of micronutrients result in rapid disease progression and mortality rates (WHO 2003). Thus micronutrient consumption should be encouraged in HIV/AIDS infected patients as it has been correlated with positive health outcomes.

Vitamin A

According to Mahan et al. (2012) vitamin A is a class of three pre formed metabolic compounds that play an essential role in cell recognition, growth, development, immune function and nucleic acid synthesis. In people living with HIV/AIDS, vitamin A is essentially important and deficiency usually results in lymphoid tissue atrophy, depressed cellular immunity, impaired IgG responses to protein antigen and pathologic alterations of mucosal surfaces (Duggal et al., 2012).

Vitamin C

Vitamin C is a powerful antioxidant that undergoes single-electron oxidation by reacting with potentially toxic oxygen species such as the superoxide or hydroxyl radicals. In addition vitamin C promotes resistance to infection through its involvement with the immunologic activity of leukocytes, the production of interferon, the process of inflammatory reaction and the integrity of the mucous membranes. Research has shown that a deficiency in vitamin C resulted in the inability of phagocytic cells to produce tubulin, impairing chemotaxis and the inability to engulf and destroy microorganisms.

Vitamin D

Vitamin D functions primarily like a steroid hormone and is involved in interactions with cell membrane receptor proteins that affect gene transcription in a wide variety of tissues (Mahan et al., 2012). In addition vitamin D is also affiliated with immunoregulatory and lymphocyte differentiation, in vitro studies have shown that vitamin D modulates the function of monocytes and lymphocytes including cytokine synthesis. Furthermore vitamin D was positively correlated with CD4 lymphocyte count and deficiency was associated with defective microbicidal activation of macrophages and bacterial infections (Babameto and Kotler, 1997).

Vitamin E

Vitamin E has a functional role in protecting the body against the damaging effects of metabolically formed free radicals while facilitating the resistance against diseases (Mahan et al., 2012). In people living with HIV/AIDS infection, vitamin E is essentially important for its antioxidant defense as it decreases the prevalence of oxidative stress (Enwonwn, 2006). Research has shown that vitamin E deficiency results in the reduce killing power of leukocytes and it is therefore recommended that people living with HIV/AIDS consume higher than normal levels of vitamin E to enhance immune response and resist diseases.

Vitamin B_{12}

Vitamin B_{12} plays a fundamental role in the metabolism of propionate, amino acids and single carbon respectively (Mahan et al 2012, 86). In addition, vitamin B_{12} is also responsible for new cell development and maintenance of the nerve cells. Deficiencies have been known to cause an interference with both the replication of stimulated leukocytes and antibody formation. Research has found that an improvement in vitamin B_{12} consumption either by dietary or supplement intake was associated with positive elevation in CD4 cell count.

Iron

Iron has been recognized as an essential nutrient for more than a century because of its ability to oxidize and reduce reactions. Iron functions as a transport for oxygen and carbon dioxide and is also an active component of cytochromes which are involved in cellular respiration and ATP generation. In addition iron also plays a critical role in immune function and cognitive performance and becomes essential to sustain normal immune function (Mahan et al, 2012). Katona and Katona-Apte (2008) reported that iron deficiency was associated with impaired cell-mediated immunity, reduction in neutrophil action with decreased bacterial and myeloperoxidase activity. It was also reported that lowered body defenses against disease and diminished brain function was also as a result of iron deficiency. Despite the presented information, research studies have indicated that the effects of iron deficiency on the immune system still remain unclear.

Zinc

Zinc is an essential trace mineral required for over 300 body activities and functions. It is a significant cofactor in the formation of enzymes and nucleic acids and plays a critical role in the structure of cell membranes, immune cell function and transport of vitamin A (Katona and Katona–Apte, 2008). Duggal et al., (2012) purported that zinc deficiency influences both lymphocyte and phagocyte cell functions and affects more than 100 metallo-enzymes that are zinc dependent. Studies have shown that zinc has an indirect effect in weight control and wasting as it inhibits tumor necrosis factor, a cytokine responsible for precipitating the process of wasting seen in HIV/AIDS patients.

Selenium

Selenium serves as antioxidant and contributes to the antibody responses and cytotoxicity of natural killer cells (Duggal et al., 2012). Coupled with vitamin E, the potency of selenium is reinforced in its ability to protect against oxidative damage. Studies conducted in people living with HIV/AIDS have shown that selenium deficiency resulted in an impair immune system, faster disease progression and reduced survival.

Anti-retro therapy in HIV/AIDS

Anti-retro therapy (ART) is a specially formulated treatment method used in the management of HIV/AIDS. These drugs comprise of more than twenty anti-retro viral agents from six mechanistic classes. Popular ART regimens revolve around nucleoside and nucleotide reverse transcriptase inhibitors (NRTIs), non-nucleoside reverse transcriptase inhibitors (NNRTIs) and protease inhibitors (PI) which target the three viral enzymes reverse transcriptase, protease and integrase in an attempt to delay disease progression.

According to Anabwani and Navario (2005) a combination of these drugs are necessary to facilitate successful management of HIV infection. However ARTs have been associated with causing harmful metabolic interactions with food, other ART drugs and drugs used to treat opportunistic infections. These reactions have been associated with the development of insulin resistance, dyslipidemia, lipodystrophy, lactic acidosis, osteopenia and osteoporosis (Enwonwn 2006).

Nerad et al. (2003) inferred that the presence of these metabolic changes may induce patients to cease ART or to change to less effective antiretroviral regimens. It was further discussed that drug food interactions influenced serum drug concentrations which in turn increased the likelihood of side effects.

On the other hand, Dee and Semba (2010) stated that ART impacted positively on nutritional status because of its ability to reconstitute the immune system and reduce the occurrence of opportunistic infections. It was further inferred that by reducing opportunistic infections especially those responsible for diarrhea and malabsorption, patients living with HIV/AIDS would experience weight gain followed by an increase in appetite as a result of the high metabolic demands of ARTs.

However this notion cannot be used to generalize the entire HIV/AIDS population as food security is paramount in developing countries affected by the epidemic.

Food Security and HIV/AIDS

According to the World Food Summit (1996) food security exists when all people at all times have access to sufficient, safe and nutritious foods to maintain a healthy and active life. To clearly define food security both physical and economic access to food must meet the dietary needs as well as food preference of an individual. Thus the definition of food security is satisfied when the three pillars: food availability (sufficient quantities of food available on a consistent basis), food access (having sufficient resources to obtain appropriate foods for a nutritious diet) and food utilization (appropriate use based on knowledge of basic nutrition care as well as adequate water and sanitation) are met.

Conversely, food insecurity is defined as the limited or uncertain availability of nutritionally adequate, safe foods, or the inability to acquire personally acceptable foods in socially acceptable ways (Ivers et al., 2009). This definition is based on the notion that persons who are food insecure have one or several of the following characteristics: insufficient quantity of food, limited diversity of food groups, poor safety of food, feelings of hunger or anxiety regarding access to food and procurement of food in socially unacceptable manners.

Anema et al (2009) indicated that general population estimates for food insecurity were significantly higher among persons living with HIV/AIDS infection and Iver et al. (2009) inferred that despite major advances in HIV therapy, people living with this virus not only encounter illness but were also subjected to low productivity, declining income and making increasingly difficult choices among competing needs such as food.

Weiser et al. (2011) stated that food insecurity was associated with a range of negative health outcomes among people infected with the HIV/AIDS virus. Anema et al (2009) added that studies have shown that food insecurity was a major risk factor for ART non adherence as individuals were of the belief that ARTs must be taken with some form of substance and has led them to skip doses in the absence of available or accessible food.

Non-adherence to ART as a result of food insecurity was also affiliated with missed clinic visits and a reduced uptake of ART drugs. Because food facilitates the absorption and effectiveness of drugs, the absence or lack thereof has been known to cause a profound effect on the efficacy of ARTs decreasing their prolific effect by approximately 30%.

Repetitive treatment interruptions due to competing demands between food and other resources has been associated with significantly lower CD4 cell counts in patients living with HIV/AIDS in a British Colombian study. Ivers et al. (2009) stated that these unwanted outcomes caused undesirable effects in drug therapy and prohibited the positive effects of ARTs on weight maintenance, recuperation and immune function.

Methodology

Study Population and Design

This descriptive cross sectional study employed the use of random convenient sampling to gather a sample size of 106 HIV/AIDS infected patients. The population sample was obtained from both the Ladymeade Reference Unit (LRU) and the National HIV/AIDS Food Bank in Barbados. Inclusion criteria for this study involved persons medically diagnosed with HIV/AIDS and registered with the LRU and or the National HIV/AIDS Food Bank. Individuals, who were not medically diagnosed with HIV/AIDS, not registered at either institution, under the age of 20, pregnant or had medical devices such as pacemakers and or steel placements were excluded from this study.

The efficacy of this research paper was reviewed and approved by the Barbados Ministry of Health Research Ethics Committee/ Institutional Review Board. Permission to conduct research at the Barbados HIV/AIDS Food Bank was granted by the Chief Medical Officer of the Barbados Ministry of Health. Study protocol was conducted to ensure the confidentiality of consented patients.

Data Collection Instrument

Self-administered questionnaires were used to extract information pertaining to socio-demographics, food security and dietary intake. Questions relating to food security were adapted and extrapolated from the USDA Food Security Survey Module 2012; dietary intake was recorded using a modified food frequency which comprised of foods from the six Caribbean food groups (staples, legumes, food from animals, fruits and vegetables, fats and oils) with examples taken from the National HIV/AIDS Food Bank pantry list (See Appendix).

Body composition was assessed by anthropometry and bioelectrical impedance analysis (BIA). Height (cm) was obtained using a calibrated stadiometer and upper mid arm circumference (UMAC) was collected with the use of a measuring tape following standard anthropometric procedures. Body mass index (BMI), weight (kg), visceral fat as well as fat and fat free mass was obtained using the Omron hand to foot bioelectrical impedance analyzer. Recent CD4 cell count and viral load of consented patients was provided by the LRU data analyst.

Food Security Analysis

Food security status was analyzed using pre-existing guidelines provided by the USDA Food Security Survey Module for measuring house food security. Responses were coded and summed in order to categorize the levels of food security among the target population. A score of 0 indicated high food security, a score between 1-2 and 3-5 indicated marginal and low food security respectively.

Dietary Analysis

Dietary intake was analyzed using nutritiondata.self, an online food data base used to provide the nutritional content of foods. Total calories, macronutrients (carbohydrates, protein, fat, fiber) and micronutrients (vitamin A, B_{12}, C, D, E, iron, zinc and selenium) consumed were documented for each patient and entered in SPSS.

Statistical Analysis

Data analysis was conducted with the use of Statistical Package for the Social Sciences (SPSS) version 12. In order to obtain a comprehensive view of the target population data was sorted by gender, where an independent Student T-test was used to establish nutritional and biochemical characteristics. Descriptive statistics expressed in the form of frequencies and percentages was used to analyze nutritional status parameters such as nutrition counseling and nutrition supplement consumption. Chi-Square and Pearson's correlation was also employed to determine the association between dietary intake and nutritional status across the genders living with HIV/AIDS infection in Barbados; statistical significance was accepted at $p < 0.05$ and $p < 0.001$.

Findings

Table I: Anthropometric and Clinical Characteristics of People Living with HIV/AIDS infection in Barbados

	Gender	n	Mean	Std. Deviation	Std. Mean Error	p-value
Age (yrs.)	Female	57	45.23	12.504	1.656	.501
	Male	49	43.71	10.239	1.463	
Height (cm)	Female	57	162.939	6.5962	.8737	**<0.001***
	Male	49	173.806	6.4022	.9146	
Weight (kg)	Female	57	73.575	18.3902	2.4358	.445
	Male	49	70.941	16.7421	2.3917	
BMI (kg/m^2)	Female	57	27.654	6.5478	.8673	**<0.001***
	Male	49	23.435	5.0678	.7240	
Muscle Mass (%)	Female	54	25.556	4.2470	.5779	**<0.001***
	Male	44	38.582	4.0651	.6128	
Body Fat (%)	Female	54	38.267	9.8021	1.3339	**<0.001***
	Male	44	17.836	7.6653	1.1556	
Visceral Fat	Female	54	7.39	2.942	.400	.511
	Male	44	6.89	4.854	.732	
MUAC (inches)	Female	57	12.068	2.1554	.2855	.192
	Male	49	11.567	1.7047	.2435	
CD4	Female	51	513.76	289.258	40.504	**.049***
	Male	41	396.80	265.815	41.513	
Viral Load	Female	51	6077.06	18767.550	2627.983	**.006***
	Male	41	39059.27	80233.447	12530.359	

p value significant at p < 0.05

Table I shows the anthropometric and clinical characteristics of people living with HIV/AIDS infection in Barbados. From the table it can be established, that females had significantly higher body mass indices and body fat percentages indicated by the p value ($p < 0.001$). In addition CD4 count and viral load were significantly lower in females than males indicated by the p values .049 and .006 respectively. When males were compared to females, they were significantly taller with higher muscle percentages ($p < 0.001$).

Table II: Nutrition Intake Characteristics of People Living with HIV/AIDS Infection Barbados

	Gender	n	Mean	Std. Deviation	Std. Mean Error	p-value
Calories	Female	57	2597.772	698.3118	92.4937	.318
	Male	49	2466.343	640.3757	91.4822	
Carbohydrates	Female	57	328.468	75.0442	9.9398	.247
	Male	49	312.588	63.5452	9.0779	
Protein	Female	57	128.516	36.6333	4.8522	**.079***
	Male	49	115.867	36.6326	5.2332	
Fat	Female	57	88.105	35.6265	4.7188	.458
	Male	49	82.945	35.5606	5.0801	
Fiber	Female	57	29.253	12.7461	1.6883	.349
	Male	49	50.600	170.7864	24.3981	
Vitamin A	Female	57	3756.465	3727.9508	493.7791	.228
	Male	49	2911.853	951.2354	135.8908	
Vitamin C	Female	57	99.326	57.3020	7.5898	.535
	Male	49	92.978	46.0583	6.5798	
Vitamin D	Female	57	83.623	44.5643	5.9027	.573
	Male	49	78.241	53.4043	7.6292	
Vitamin E	Female	57	7.444	2.8326	.3752	.768
	Male	49	7.284	2.7164	.3881	
Vitamin B_{12}	Female	57	6.019	2.4060	.3187	.781
	Male	49	5.886	2.5095	.3585	
Iron	Female	57	22.856	6.0427	.8004	**.062***
	Male	49	20.743	5.3724	.7675	
Zinc	Female	57	14.328	4.6659	.6180	.356
	Male	49	13.455	5.0225	.7175	
Selenium	Female	57	270.886	64.7500	8.5763	.100
	Male	49	247.896	78.0135	11.1448	

***p value significant at <0.05**

Table II shows the nutrition intake differences between males and females infected with HIV/AIDS in Barbados. It was observed from the table that females consumed significantly higher amounts of protein when compared to their counterparts ($p < 0.079$). Additionally, iron consumption was also significantly higher among females than males ($p < 0.062$).

Table III: Correlation between Dietary and Nutritional Status Parameters of Female Participants living with HIV/AIDS infection in Barbados

		Weight	BMI	Muscle Mass	Body Fat	Visceral Fat	MUAC	Viral Load	CD4
Calories	Correlation	-.063	-.023	.029	-.052	-.133	.115	-.052	-0.75
	Significance	.640	.867	.834	.708	.339	.396	.717	.603
Carbohydrates	Correlation	-.066	-.049	.058	-.063	-.108	.010	-.007	-.043
	Significance	.626	.720	.677	.653	.435	.939	.963	.767
Protein	Correlation	-.124	-.071	-.034	-.040	-.124	.107	-.066	.041
	Significance	.358	.600	.806	.773	.370	.428	.647	.775
Fat	Correlation	-.095	-.066	.042	-.087	-.200	.110	-.100	-.055
	Significance	.481	.628	764	.534	.146	.415	.485	.701
Fiber	Correlation	-.143	-.100	-.046	-.043	.062	.032	-.055	-.007
	Significance	.288	.460	.744	.758	.654	.813	.699	.960
Vitamin A	Correlation	.045	.063	-.035	.046	.144	.024	-.104	.150
	Significance	.738	.644	.800	.739	.300	.860	.467	.295
Vitamin C	Correlation	.143	.178	-.266	-.003	.178	.136	.216	.060
	Significance	.288	.186	.100	.981	.199	.313	.128	.678
Vitamin D	Correlation	-.149	-.160	.143	-.214	-.205	-.065	-.186	.109
	Significance	.268	.235	.301	.119	.137	.631	.191	.444
Vitamin E	Correlation	.037	.051	.077	-.042	-.130	.203	.142	-.025
	Significance	.784	.707	.580	.763	.347	.130	.321	.859
Vitamin B_{12}	Correlation	-.083	-.052	.103	-.011	-.128	.088	-.031	.046
	Significance	.540	.698	.457	.939	.357	.513	.830	.750
Iron	Correlation	-.189	-.184	.111	-.174	-.223	-.030	-.216	.124
	Significance	.159	.170	.423	.208	.105	.822	.128	.387
Zinc	Correlation	-.134	-.099	.026	-.066	.-141	.059	-.076	-.034
	Significance	.320	.463	.854	.636	.311	.665	.595	.812
Selenium	Correlation	-.122	-.082	.032	-.002	-.133	.119	-.066	.047
	Significance	.366	.546	.820	.986	.339	.376	.645	.744

*** Correlation significant at the 0.01 and 0.05**

Table III shows the correlation between dietary intake and nutritional status parameters of female patients. From the table it can be observed that dietary intake of female participants had no significant effect on their nutritional status as all p values were above 0.05.

Table IV: Partial Correlation between Dietary Intake and Nutritional Status Parameters of Female Participants living with HIV/AIDS infection in Barbados

		Weight	BMI	Muscle Mass	Body Fat	Visceral Fat	MUAC	Viral Load	CD4
Calories	Correlation	-.220	-.133	-.046	-.082	-.012	.088	-.115	-.097
	Significance	.212	.453	.795	.647	.945	.619	.518	.586
Carbohydrates	Correlation	-.107	-.052	-.016	-.023	.029	.117	-.070	-.111
	Significance	.545	.769	.929	.897	.873	.512	.692	.533
Protein	Correlation	**.308***	-.195	.114	-.068	-.037	.062	-.158	.035
	Significance	**.064***	.268	.521	.703	.837	.727	.371	.842
Fat	Correlation	-.321	-.252	-.051	-.158	-.106	-.012	-.183	-.067
	Significance	.064	.150	.776	.374	.549	.948	.299	.708
Fiber	Correlation	-.167	-.107	-.080	-.051	-.010	.004	.084	-.041
	Significance	.345	.547	.654	.773	.955	.983	.637	.820
Vitamin A	Correlation	-.036	.035	-.133	-.052	.123	.130	-.021	.161
	Significance	.839	.843	.453	.772	.487	.463	.905	.364
Vitamin B_{12}	Correlation	-.126	-.058	.057	.112	-.019	.108	-.098	.086
	Significance	.478	.744	.750	.529	.917	.543	.582	.628
Vitamin C	Correlation	.211	.222	-.266	-.066	**.292***	.132	**.311***	.020
	Significance	.230	.207	.128	.711	**.094***	.456	**.073***	.910
Vitamin E	Correlation	.004	.050	-.028	.017	.086	.240	.164	-.053
	Significance	.982	.778	.877	.926	.629	.172	.354	.766
Vitamin D	Correlation	-.061	-.128	.083	-.164	-.079	-.017	-.170	.092
	Significance	.732	.471	.641	.353	.656	.923	.336	.605
Iron	Correlation	-.237	-.256	.055	-.174	-.130	.005	**-.306***	.095
	Significance	.178	.144	.755	.324	.462	.976	**.079***	.594
Zinc	Correlation	**-.377***	**-.303***	-.010	-.152	-.154	-.088	-.141	-.100
	Significance	**.028***	**.082***	.954	.389	.384	.619	.426	.572
Selenium	Correlation	-.198	-.116	-.047	.077	-.005	.163	-.149	.048
	Significance	.261	.514	.793	.665	.977	.357	400	.785

***Correlation significant at 0.01 and 0.05**
Controlled Variables: age, level of education, annual income, employment status, food security, nutrition supplement consumption and meal replacement consumption

Table IV shows the partial correlation between dietary intake and nutritional status of female patients. Controlled variables for this type of analysis were age, level of education, annual income, employment status, food security, nutrition and meal replacement consumption. It was observed that visceral fat and viral load had positive significant correlations with vitamin C (r = 292, p<0.094); (r = 311, p<0.073). Iron intake had a negative significant correlation with viral load (r= -306, p<0.079) while zinc was negatively correlated with body weight and body mass index (r = -377, p <0.028); (r = -303, p<0.082). Protein intake on the other hand was positively correlated with body weight (r = 308, p<0.064).

Table V: Correlation between Dietary Intake and Nutritional Status Parameters of Male Participants living with HIV/AIDS infection in Barbados

		Weight	BMI	Muscle Mass	Body Fat	Visceral Fat	MUAC	Viral Load	CD4
Calories	Correlation	.083	.059	-.008	.139	.035	.113	.228	.067
	Significance	.571	.086	.961	.368	.824	.439	.151	.677
Carbohydrates	Correlation	.102	.076	-.015	.112	.037	.087	.051	.159
	Significance	.571	.602	.921	.468	.813	.553	.750	.322
Protein	Correlation	.132	.093	-.073	.164	.082	.186	**.321***	-.002
	Significance	.366	.525	.639	.287	.597	.201	**.041***	.992
Fat	Correlation	.055	.058	.023	.113	.040	.105	.270	.080
	Significance	.708	.695	.883	.467	.797	.474	.088	.620
Fiber	Correlation	.127	.129	-.168	.196	.140	.089	-.075	-.109
	Significance	.384	.379	.274	.203	.365	.543	.640	.496
Vitamin A	Correlation	.063	.028	.009	.025	-.029	.056	-.067	.126
	Significance	.665	.847	.952	.872	.854	.701	.679	.431
Vitamin C	Correlation	**.382***	**.413***	**-.353***	**.382***	**.363***	**.325***	.034	.143
	Significance	**.007***	**.003***	**.019***	**.011***	**.016***	**.022***	.834	.373
Vitamin D	Correlation	-.029	-.103	.044	-.012	-.073	-.083	.008	-.115
	Significance	.841	.480	.776	.937	.636	.573	.962	.475
Vitamin E	Correlation	.103	.104	.032	.070	.086	.148	.013	.143
	Significance	.482	.478	.839	.652	.580	.311	.938	.373
Vitamin B_{12}	Correlation	-.125	-.150	.144	-.142	-.157	-.028	.247	.043
	Significance	.393	.304	.352	.358	.309	.851	.119	.788
Iron	Correlation	.130	.084	.039	.044	-.024	.149	.175	.027
	Significance	.373	.567	.804	.779	.875	.308	.274	.866
Zinc	Correlation	.065	.038	-.046	.156	.024	.134	.224	.073
	Significance	.655	.793	.765	.311	.875	.359	.159	.652
Selenium	Correlation	.008	-.034	.073	-.020	-.060	.067	**.315***	.056
	Significance	.959	.815	.638	.899	.701	.646	**.045***	.729

***Correlation significant at 0.01 and 0.05**

Table V shows the correlation between dietary intake and nutritional of male patients living with HIV/AIDS in Barbados. From the table it can be observed that protein had a positive correlation with viral load (r = 321, p <0.041). Vitamin C was positively correlated with weight (r =382, p <0.007) body mass index (r = 413, p <0.003), body fat (r = 382 p <0.011), visceral fat (r =363 p <0.016) and mid-upper arm circumference (r = 325 p <0.022). However the was a negative correlation between vitamin C and muscle mass (r = -353 p <0.019). In addition, selenium was positively correlated with viral load (r = 315 p <0.045).

Table VI Partial Correlation between Dietary Intake and Nutrition Status Parameters in Males Living with HIV/AIDS Infection in Barbados

		Weight	BMI	Muscle Mass	Body Fat	Visceral Fat	MUAC	Viral Load	CD4
Calories	Correlation	.278	.216	-.135	.174	.161	.274	**.483***	-.341
	Significance	.235	.360	.569	.462	.497	.243	**.032***	.142
Carbohydrates	Correlation	.165	.127	.041	.034	.063	.185	**.402***	.283
	Significance	.485	.593	.865	.888	.791	.435	**.079***	.226
Protein	Correlation	.255	.191	-.216	.187	.175	.301	**.505***	-.259
	Significance	.277	.419	.360	.429	.462	.196	**.023***	.271
Fat	Correlation	.280	.233	-.138	.182	.181	.272	**.511***	-.315
	Significance	.232	.323	.561	.443	.444	.245	**.021***	.176
Fiber	Correlation	.220	.228	-.176	.272	.273	.097	-.143	-.123
	Significance	.351	.333	.458	.246	.245	.684	.549	.605
Vitamin A	Correlation	.283	.123	-.161	.104	.019	.358	.177	-.256
	Significance	.226	.604	.499	.664	.937	.121	.456	.276
Vitamin C	Correlation	**.386***	**.386***	-.308	.333	.334	**.428***	**.450***	-.133
	Significance	**.093***	**.093***	.186	.151	.150	**.060***	**.046***	.577
Vitamin D	Correlation	.294	.105	-.255	.209	.005	.413	.165	-.208
	Significance	.208	.658	.279	.379	.984	.070	.487	.380
Vitamin E	Correlation	.349	.303	-.031	.084	.185	.320	.336	-.115
	Significance	.132	.194	.896	.724	.436	.169	.148	.628
Vitamin B_{12}	Correlation	.071	.017	-.051	-.019	.023	.133	.314	-.007
	Significance	.766	.944	.832	.936	.923	.576	.178	.977
Iron	Correlation	.303	.125	-.133	.130	.038	**.411***	**.508***	-.362
	Significance	.194	.599	.575	.584	.874	**.072***	**.022***	.117
Zinc	Correlation	.194	.097	-.120	.126	.028	.239	**.424***	-.289
	Significance	.411	.685	.615	.597	.906	.310	**.062***	.216
Selenium	Correlation	.195	.125	-.070	.062	.110	.254	**.458***	-.138
	Significance	.410	.598	.770	.796	.643	.280	**.042***	.562

***Correlation significant at 0.01 and 0.05**
Controlled Variables: age, level of education, annual income, employment status, food security, nutrition supplement consumption and meal replacement consumption

Table VI shows the partial correlation between dietary intake and nutritional status of male patients living with HIV/AIDS. Controlled variables for this type of analysis were age, level of education, annual income, employment status, food security, nutrition and meal supplement consumption. From the table it was observed that calories, carbohydrates, protein and fat had positive correlations with viral load. Vitamin C also exhibited positive correlations between body weight, body mass index, mid arm circumference and viral load. Additionally iron consumption was positively correlated with mid upper arm circumference and viral load. Zinc ($r = 424$ $p < 0.062$) and selenium ($r = 458$ $p < 0.042$) were also positively correlated with viral load.

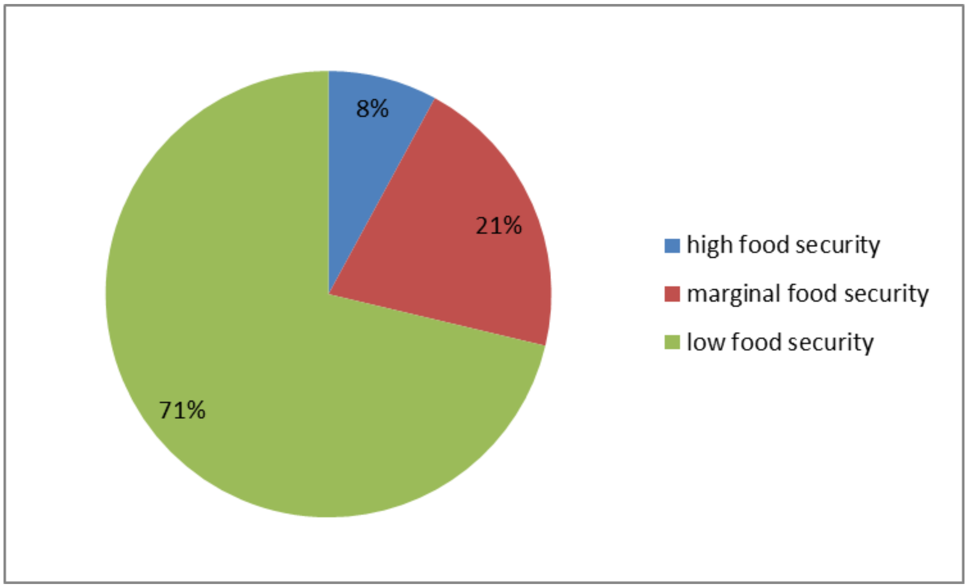

Figure III: Food Security Status among Patients Living with HIV/AIDS infection in Barbados

Figure III depicts percentage of food security among people living with HIV/AIDS infection in Barbados. 71% of the patients' exhibits attributes of low food security, 21% were marginally food secure while a mere 8% expressed high levels of food security.

Table VII: Comparison of Food Security Levels between Males and Females Living with HIV/AIDS in Barbados

	Gender		p value
	Female	Male	
High Food Security	4 8.2%	4 7.4%	.845
Marginal Food Security	12 22.8%	9 18.4%	
Low Food Security	57 70.2%	49 73.5%	

Table VII shows the different levels of food security among male and female patients living with HIV/AIDS in Barbados. Low food security was recognized the highest among the male patients (73.5%) while high and marginal food security was recognized the highest among the female patients, 8.2% and 22.8% respectively. However, Chi Square analysis revealed that there was no statistical significance between the two genders in respect to food security (p <0.845).

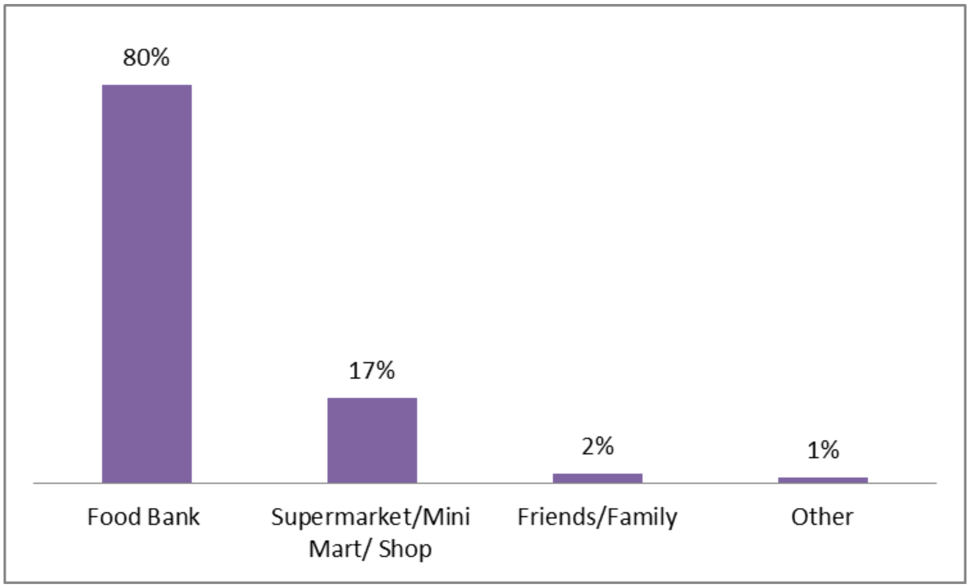

Figure IV: Means of Obtaining Food of People Living with HIV/AIDS Infection in Barbados

Figure IV depicts the ways in which patients obtain their food supply. More than half of the target population was dependent on the National HIV/AIDS Food Bank (80%). 17% were capable of obtaining their food supply from supermarkets and stores alike, while 2% was dependent on friends and family and the remaining 1% sourced their food items from places other than was mentioned.

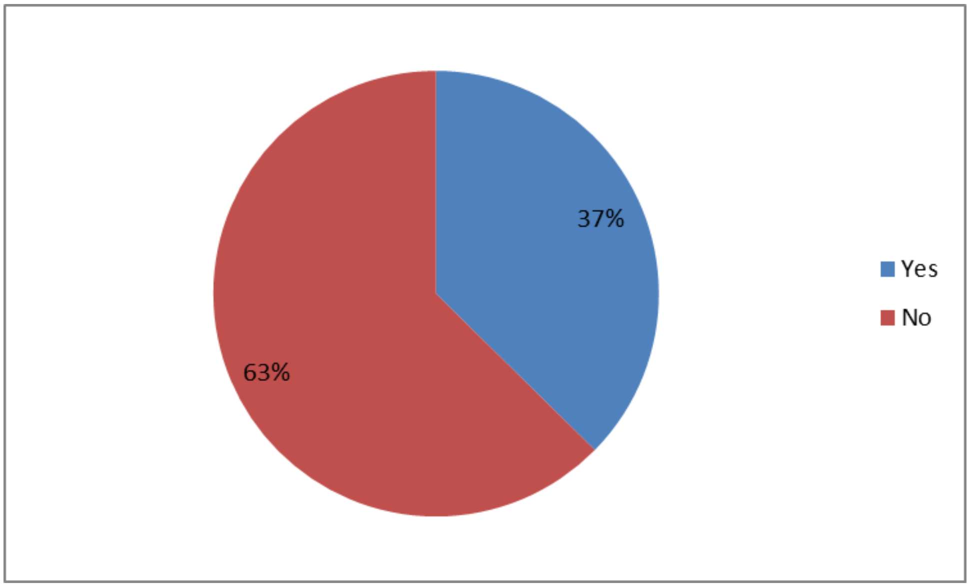

Figure V: People Living with HIV/AIDS Infection in Barbados Receiving Nutrition Counseling

Figure V depicts the percentage of patients who receive nutrition counseling that attend the Ladymeade Clinic and National Food Bank. More than half of the target population received nutritional counseling, 63% while 37% did not.

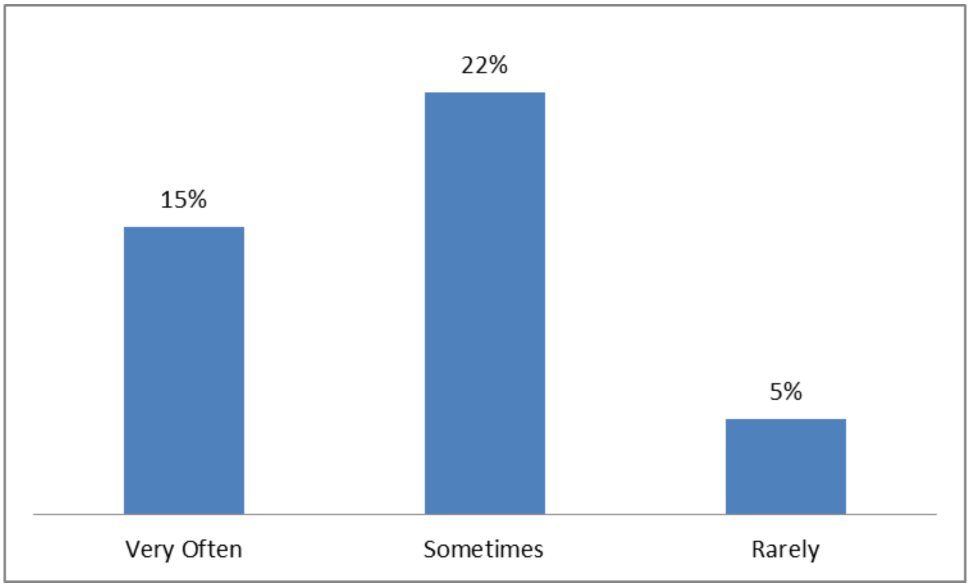

Figure VI: Frequency of Nutritional Counseling among People Living With HIV/AIDS Infection in Barbados

Figure VI depicts the frequency of nutritional counseling among people living with HIV/AIDS in Barbados. 15% indicated that they received nutritional counseling very often, while 22% stated they sometimes received nutritional counseling. The remaining patients (5%) rarely received nutritional counseling.

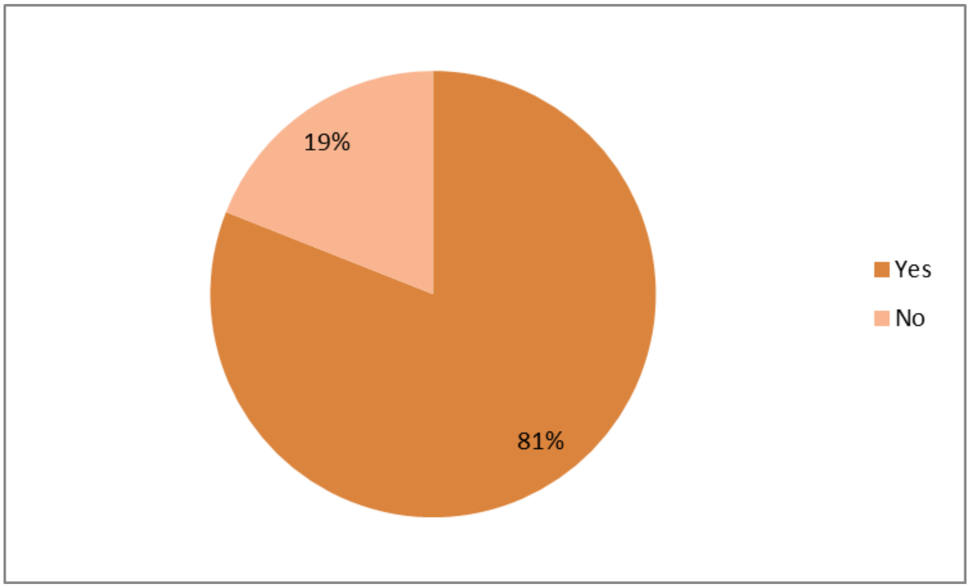

Figure VII: Nutritional Supplement Consumption among People Living with HIV/AIDS Infection in Barbados

Figure VII depicts the percentage of patients who consume nutritional supplements. It can be inferred from the pie chart that more than half of the target population consumed nutritional supplements (81%) while only a smaller fraction (19%) did not.

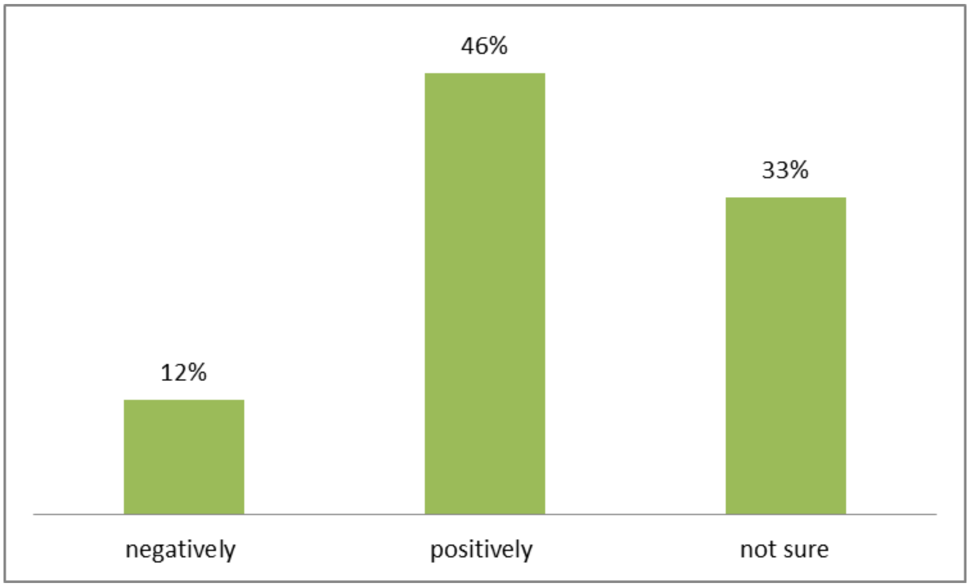

Figure VIII: Effects of HAART on Appetite of People Living with HIV/AIDS Infection in Barbados

Figure VIII depicts the percentage of patients who receive highly active anti-retro therapy (HAART) and the effects it has on their appetite. 46% reported that HAART had a positive effect on their appetite while 12% indicated that HAART had a reverse effect and affected their appetites negatively. The remaining patients infected with HIV/AIDS were unsure of the relationship HAART had on their appetites.

Discussion

This study sought to investigate the nutritional status of people living with HIV/AIDS by assessing their eating habits in relation to their anthropometric and clinic parameters. From the research findings it was established that there was a significant difference between male and female patients in respect to their anthropometric and clinical characteristics. Females predominantly had more adipose issue with higher BMIs while the males possessed more muscle mass. Research studies complying with these findings indicated that sexual dimorphism was apparent within genders and was denoted by naturally greater lean tissue mass with central fat patterns in males and peripheral distribution of fat in females (Taylor et al., 2009).

However given the current medical condition of these patients and catabolic nature of the HIV/AIDS virus, higher BMIs and fat composition can not only be attributed to gender differences alone and alternate factors such as early intervention of ARTs, drug adherence and compliance could be impacting on the BMIs and adiposity of some patients. A study conducted by Crum-Cianflone et al (2010) indicated that due to the long term use and exposure to ARTs, people living with HIV/AIDS were gaining weight during their infection rather than experiencing weight loss or becoming underweight. Within their study population, nearly two thirds of the HIV infected patients diagnosed within the era of HAARTs were overweight or obese. The aforementioned study is concurrent with the findings of this research paper as the mean BMI for female patients (27.654 ± 6.5478) allows them to be classified as overweight using the WHO guidelines.

Findings also revealed that males in comparison to females had significantly lower CD4 counts and significantly higher viral loads. Given that ART treatment in Barbados is free of cost, these significant findings can be deduced to the fact that males were probably less compliant with their

ART regimen than females or that dietary consumption was too poor to facilitate the mode of action of ARTs. The literature shows that in the absence or lack thereof food ART uptake and absorption was significantly reduced by 30% inhibiting its positive effects on the immune system. Moreover high viral load and low CD4 cell count have been independently associated with an increased risk of mortality (Mermin et al., 2011).

Analysis of the dietary consumption of the target population revealed that females consumed significantly higher amounts of protein and iron. The higher intake of protein consumption could be attributed to the larger amount of total calories consumed by females and the higher amounts of iron intake may be a directly associated with the protein source. The literature shows that protein consumption was necessary for normal body functioning and immunity in addition to preventing the reduction in lean body mass while iron was associated with cell mediated immunity and neutrophil action.

When dietary intake was compared to that of the nutritional status parameters in females, Pearson's Correlation revealed that dietary intake was not associated with nutritional status. These findings could be due to the fact that female patients were asymptomatic and had relatively stable body weights. A cross-sectional study conducted in India presenting with similar findings showed that total calories were not significantly associated with the nutritional and clinical parameters (Sachdeva et al 2010).

To further understand the cause of these results, another Pearson's Correlation was conducted controlling for several variables that may cause variance within the female population. Those findings revealed that protein, vitamin C and iron had small but significant correlations with body weight, body mass index, visceral fat and viral load. It can then be deduced that the eating habits of the female population did not place them at exacerbated risk for malnourishment and poor disease outcomes.

Dietary analysis for males in respect to their nutritional status revealed significant correlations between vitamin C, weight and body mass index. The relationship showed that as weight and body mass increased vitamin C consumption also increased. These results could be due to an increase in appetite stimulation which resulted in higher consumption of total calories and subsequently vitamin C. The literature shows that vitamin C is a powerful antioxidant necessary to reduce the incidences of oxidative stress. In addition an increase in vitamin C consumption and subsequent significant associations with body weight and muscle mass indicate increase resistance to infections.

Other significant correlations exhibited in the male population such as protein and selenium had positive association. These results showed that as protein and selenium increased viral load also increased. It is unclear why these nutrients were positively correlated and it can only be speculated that as the male population consumed more food or gain accessed to food with no experience of opportunistic infections they refrained from ART treatment. Controlled variables for the second Pearson's Correlation slightly differed in results.

Findings from the study also showed that 63% of the target population received nutritional counseling however out of this 63% only 15% received counseling on a frequent basis. In addition, nutritional supplement consumption among the target population was high as seen in figure VII. Suttajit (2007) indicated that there is a complex and synergistic relationship between malnutrition and HIV/AIDS and to therefore optimize nutritional status and maintain a healthy immune system food and nutrient interventions are paramount. Young (1997) also added that there is a substantial amount of evidence that indicates that medical nutrition therapy or nutrition counseling saves lives, reduces morbidity, improve health outcomes and overall quality of life.

The prevalence of low food security and the reliance on food assistance from the National HIV/AIDS Food Bank was exceptionally high in the target population. Studies have shown that high prevalence of food insecurity was responsible for the high mortality and morbidity rates experienced with people living with HIV/AIDS. In addition food insecurity was associated with increased HIV transmission risk behaviors and decreased access to HIV treatment and care.

Despite the fact that the female population exerted a higher BMI percentage and are presumably believed to have a better health outcome than the male population in this study, North American studies have indicated that food insecurity also exacerbated the rates of obesity, diabetes and hypertension. They further added that even in controlling for socio-economic factors, strong associations were seen.

A potential limitation of this study was the that fact a food frequency was used instead of a 24hour or 3day food record to analyze the dietary intakes of the patients. Though food frequency questionnaires can assist in determining the average amount of macro and micronutrient consumption, it is too highly dependent on the memory of individuals to estimate the quantity of a particular food item, thus over or under reporting could have affected the dietary analysis in this study.

Another limitation was the study design of this research project, though a cross-sectional study is effective in capturing the specific problem at the specific time, a cohort study would be better suited to accurately observe the nutritional status of people living with HIV/AIDS in Barbados.

Conclusion

Though there were no statistical significant associations between dietary intake and nutritional status among people living with HIV/AIDS infection in Barbados. However the study has nutritional significance in that it showed the potential risk of the female population for developing co-morbidities such as chronic non-communicable diseases. In addition it also revealed that the male population exhibited signs for potentially negative disease outcomes and the entire population could benefit from more nutritional counseling contact time.

The high prevalence of food insecurity and reliance on the food bank indicated a bigger problem that warrants immediate address. As the dynamics of HIV/AIDS continues to evolve and management becomes increasingly sophisticated, the ability to ensure adequate nutrition and optimal medical nutritional therapy also becomes increasingly important. This study therefore propagates the need for further research.

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Appendix

Dear Participant:

As part of my final year assessment I am required to produce a research project to meet the partial fulfillments of the University of the West Indies St. Augustine Campus. My topic of choice is ***"The Impact of Dietary Intake on the Nutritional Status of Persons Living with HIV/AIDS."*** This study seeks to evaluate your dietary consumption patterns and how this may impact on your overall health status.

The following procedures are required if you participate in the study:

1. Completion of a questionnaire

2. The measurement of weight, height and mid arm circumference

Explanation of Procedures:

1. The questionnaire comprises of the following three sections: demographics, food security and a food frequency. You are required only to place a tick next to your desired response. It is important to note that you **MUST NOT** write/sign/initial your names on the provided questionnaire.

2. Body measurements will be taken using you a bioelectrical impedance analyzer and a measuring tape. The bioelectrical analyzer resembles a home scale but it is more accurate for body composition measurements in a field setting. The analyzer uses a small electrical current that passes through the body and it is safe and painless. The measuring tape will be placed along the upper arm from the shoulder blade to the tip of the elbow to determine the length and mid arm. It will then be placed around the arm at the determined mid-point to obtain the mid arm circumference.

Please note that if you have a pacemaker or metal placements you will not be allowed to use the bioelectrical impedance analyzer.

All procedures will be demonstrated beforehand and will take approximately 15-20 minutes. You are free to withdraw your consent and discontinue participation at any time.

If you have any questions or concerns you may contact me at (246) 269-2325 or by email shanice.murray@sta.uwi.edu you may also address your concerns to Ms. Stacia Whittaker my on-site supervisor at (246) 467-9399.

Thank you for time and consideration.

Sincerely,
Shanice Murray
Bsc. Student Human Nutrition and Dietetics