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# Anthropometric and Dietary Profile of HIV Sero-positive Patients in Chulaimbo Sub-District Hospital, Kenya.

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**ABSTRACT**:

**Background:** There is lacking information on changes in body composition along with dietary pattern among People Living with HIV/AIDS (PLWHA) attending clinic at Chulaimbo Sub-district hospital, Kenya. In most HIV clinics in Kisumu, patients are weighed almost at every visit; however this practice alone does not distinguish between fat and lean mass. Hence making it difficult to understand clearly the effectiveness of treatment or other interventions.

**Objective:** To assess the body composition changes and nutrient intake of HIV sero-positive patients.

**Methodology:** A prospective cohort study was conducted on 497 PLWHA attending clinic at Chulaimbo Sub-district hospital, Kenya. Body Mass Index (BMI) was used to assess body composition and a 24-hour dietary recall survey to capture the average macronutrient and micronutrient intake of the patients. The mean probability of adequacy across 9 nutrients was calculated using the Dietary Reference Intakes. Anthropometric data including current weight, height and BMI were collected. Nutrient intake was estimated using a diet history in combination with a standardised food frequency questionnaire.

**Setting:** Academic Model for Prevention and Treatment of HIV/AIDS (AMPATH) clinic at Chulaimbo Sub-district hospital, Kisumu West District, Kenya.

**Subjects:** 497 adults aged 18–60 years.

**Results:** After 6 months, it was found that the percentage of under weights (BMI <18.5) was 20.3%. The men were leaner (BMI = 20.5 ±3.67) than the women (BMI = 21.7 ±3.87) and patients with a CD4+ T cell count < 200 tended to have the lowest median values for all anthropometric measurements. The mean energy intake of the patients was 1574 ±578 (male) and 1636 ±621 (female), a protein 42 ±16 (male) and 39 ±12 (female). No significant correlation was found between the macronutrient intake and body composition at the baseline. More than half the patients had a low intake (< 90% of the recommended dietary allowances) of energy, protein, calcium, iron (female), vitamin A, vitamin C, riboflavin and niacin.

**Conclusion and recommendation**: The results confirm that majority of the HIV/AIDS patients from this population are malnourished. Nutritional supplementation of HIV/AIDS patients should be considered, as this might lead to improved immune function in these patients.

**Key words:** BMI, nutrient adequacy, food group, Dietary Reference Intakes, HIV

## INTRODUCTION

Nutrients that play big role in immune function include: protein, total energy, lipids, amino acids, vitamins and minerals, (Baum and Shor-posner, 1998). Optimal nutrition, involving protein, energy, minerals and essential micronutrients, serves to strengthen and protect the immune system as well as the many generalized aspects of host defense. Proteins play roles as structural components of tissues and also antibodies, cytokines, acute-phase proteins, components of the complement pathways, transcription factors and

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enzymes. Alterations in proteins could therefore lead to immunologically important changes in enzyme-dependent activation, antioxidant protection, complement activation, antibody-mediated virus neutralization and intercellular communication via cytokines, (Gershwin *et al.,* 2000).

Nutrients affect immune system function directly via processes like protein synthesis or indirectly via their roles in various enzyme systems (B vitamins). When macronutrient intake is insufficient to meet metabolic needs, protein-calorie malnutrition (PCM) and deficiencies of micronutrients develop (Baum and Shor-posner, 1998). These deficiencies impair the synthesis of molecules necessary for the immune response and impair the function of immune-related enzyme systems. In HIV disease, the presence of malnutrition strongly predicts patient survival independent of $CD4^+$ T-lymphocyte counts. Clinical deficiencies of some nutrients occur rapidly in response to dietary deficiencies, malabsorption, or altered metabolism, while those having a storage form in the body may take longer. The presenting symptoms of malnutrition typically include weight loss, a change in body habitus, or a change in functional status (Baum and Shor-posner, 1998; Beisel, 2000; Friis, 2005).

Infections may affect the nutritional status of an individual suffering from HIV/AIDS in various ways such as a reduction in food intake and nutrient absorption and by increasing the utilization and excretion of proteins and micronutrients (Semba and Tang, 1999). HIV infection accelerates the release of pro-oxidants, cytokines and other reactive oxygen species, leading to the increased utilization of antioxidants such as vitamin E, C, beta-carotene and micronutrients such as iron, zinc, selenium, manganese and copper (Friis and Michaelsen, 1998). An imbalance between these pro-oxidants and antioxidants causes oxidative stress which further damages the immune cells, proteins and enzymes, thus accelerating HIV replication (Schwartz, 1996).

Nutrition is a fundamental intervention in the early and ongoing treatment of HIV disease. Nutrition therapy, in coordination with other medical interventions, can extend and improve the quality and quantity of life in individuals infected with HIV and living with AIDS (Elbein, 1995). Usable energy and the structural components required to build an immune system are derived through food intake. Without adequate nutrition, the immune system is clearly deprived of components needed to generate an effective immune response (Gershwin *et al.,* 2000). At all times during HIV infections, proper nutrition and aggressive nutritional support play essential role.

Assessing the probability of nutrient adequacy adds value to the food and nutrition monitoring systems in developing countries, where energy intake is the most important indicator of food security (Haddad *et al.,* 1994). In developing countries, methods for evaluating nutrient adequacy should be simple and practical (Ghaffarpour *et al.,* 2000). Hatloy *et al.,* 1998 showed that the food diversity scores could give a fairly good assessment of the nutritional adequacy of the diet (Shimbo *et al.,* 1994). The study assesses body composition and nutrient intake in HIV sero-positive patients at Chulaimbo Sub-district hospital, Kenya. The choice of Chulaimbo Sub-district hospital, Kisumu West District was based on the fact that HIV/AIDS prevention and control remains a serious social challenge in the area, with a prevalence rate of 11.2% far above the national prevalence rate of 7.4% (Kenya National Bureau of Statistics KNBS *et al*., 2010) but slightly below the Nyanza prevalence rate of 15.3% (KNBS *et al.,* 2010).

## MATERIALS AND METHODS

### Subjects

This study was conducted within the framework of AMPATH (Academic Model for Prevention and Treatment of HIV/AIDS) clinic at Chulaimbo Sub-district hospital, Kenya. The study adopted a prospective cohort research design among the study population, with the aim of determining the nutritional status of PLWHA and developing strategies to promote healthy lifestyles to reduce faster progression form HIV to AIDS. (Azizi *et al.*, 2000).

A sample size of 497 was randomly chosen from a sample frame of 9100 patients aged 18 to 60 years, this was done with the use of random table numbers. Patients whose ages fell outside 18 – 60 years age bracket, inpatient, PMTCT mothers and those who had not been enrolled in the AMPATH clinic for the last six (6) months that preceded the study did not participate in the study. Of the 497 patients, 392 female and 105 male were included in the study. The proposal of this study was approved by Institutional Review Ethics Committee of School of Medicine, Moi University, (FAN: IREC 000470) and informed written consent was obtained from all the patients.

**Dietary Assessment**

Dietary intake assessment was undertaken using a 24-hour recall survey form by expert nutritionists, with at least five years of experience in the nationwide food consumption survey project (Kimiagar *et al.,* 1998). The 24-hour recalls was administered once on every visit to the clinic for six months. The 24-hour recall was based on actual intake and used to estimate absolute rather than relative intake (Willet, 1998). The 24-hour recall method is susceptible to recall bias, both for identification of foods eaten and for quantification of portion sizes. Collecting dietary data by highly trained interviewers in this study reduced this type of error. The 24-hour dietary recall described the reported intakes from midnight to midnight, meal after meal. Individuals were questioned as to whether the day of recalls was a usual day or not, hence showed the usual intake of patients. Standard reference tables were used to convert household portions to grams for computerization (Ghaffarpour *et al.,* 1999). After coding, the 24 hour dietary recall survey form was linked to a nutrient database (Nutritionist III) and nutrient intakes. The data related to Nutritionist III was modified according to the Food Composition Tables by Shemi (1993).

**Anthropometric Data**

A calibrated scale was used to obtain height and weight with patients in light clothing and without shoes, to 0.5 cm and 0.5 kg, respectively. Height (H) was measured with the patient standing erect and weight (W) measured on a standing scale. These measurements were used to calculate the body mass index (BMI) using the formula kilograms/height in meters$^2$. Self-reports of usual body weight (UBW) and weight measurements taken during the physical examination were used to define body weight loss (BWL). CD4 cell count was used to assess the disease progression. These BMI indices were categorized using the WHO (World Health Organization), 2005 reference standards to classify the patients into their nutritional status. Patients were categorized into four classes according to the body mass index (BMI), calculated by reference to the weight (kg) and height (m$^2$), as follows:

(1) < 18.5 (underweight)
(2) 18.5 – 24.9 (normal range)
(3) 25.0 – 29.0 (overweight)
(4) > 30 (obese)

**Administration of data collection instruments**

Socio-demographic details such as age, gender and residential area were obtained from each patient using a standardized interview schedule. Information concerning financial and employment status, level of education, marital status, monthly income, and number of persons living in the house were obtained and recorded. The interview schedule elicited demographic information in either English or Kiswahili. When necessary, translation of the interview schedule into local dialects was provided by the research assistants. The socio-demographic interview schedule was completed only at the first visit.

**Statistical Analysis**

Data were entered in Microsoft excel 2007 then imported to SPSS version 15.0 and the alpha level (α) was set at 0.05. Data was analysed quantitatively using descriptive and inferential statistics. Independent sample t-test was used to establish if there was any significant difference in the means between nutrient and HIV status and BMI and HIV status. Food composition tables were used to compute the nutrient intake of the patients.

## RESULTS

total of 497 patients from Chulaimbo Sub-district in Kisumu West District, Kenya were recruited in the study. Of the 497 patients, 493 completed the study (2 got transfers to other clinics, 1 declined to continue and 1 died). Mean and standard deviation of age and BMI was 39 years (± 10.5) years and 20.5 ± 3.67 (male), 21.7 ± 3.87 (female) kg/m$^2$, respectively. Of the 497 patients 105 (21.1%) were male and 392 (78.9%) female, There were 42 (8.5%) single, 221 (44.5%) married, 213 (42.9%) widowed 15 (3.0%) separated, and 6 (1.2%) divorced. Despite majority of the patients being in a union, the number widowed was also very high. Marital status can be an important risk factor when exploring patterns of HIV transmission in a population.

The level of education attained by the patients is shown in *Table 1*, 6.4% of the patients had no formal education, 322 (64.8%) primary education, 134 (27.0%) secondary education, 8 (1.6%) university education and 1 (0.2%) tertiary college education. The patients involved in the study were pagans 1 (0.2%), Christians 491 (98.8%) and Muslims 5 (5%). Majority of the patients had primary level education and below. This implies that prevalent HIV infections are now concentrating among those with the lowest levels of education. Descriptive characteristics of patients are shown in *Table 1*.

Table 1: Demographic Characteristics of the study group (n = 497)

| Characteristics | Male No (%) | Female No (%) | Total No (%) |
|---|---|---|---|
| ***Age*** | | | |
| 18 – 20 | 1 (1.0%) | 10 (2.6%) | 11 (2.2%) |
| 21 – 30 | 18 (17.1 %) | 85 (21.7%) | 103 (20.7%) |
| 31 – 40 | 33 (31.4%) | 153 (39.0%) | 186 (37.5%) |
| 41 – 50 | 27 (25.7%) | 95 (24.2%) | 122 (24.5%) |
| 51 – 60 | 26 (24.8%) | 49 (12.5%) | 75 (15.1%) |
| **Total** | **105 (100%)** | **392 (100%)** | **497 (100%)** |
| *Marital status* | | | |
| Single | 11 (10.5%) | 31 (7.9%) | 42 (8.5%) |
| Married | 51 (48.6%) | 170 (43.4%) | 221 (44.5%) |
| Widowed | 39 (37.1%) | 174 (44.3%) | 213 (42.8%) |
| Separated/Divorced | 4 (3.8%) | 17 (4.4%) | 21 (4.2%) |
| Total | **105 (100%)** | **392 (100%)** | **497 (100%)** |
| ***Education*** | | | |
| No education | 7 (6.7%) | 25 (6.3%) | 32 (6.4%) |
| Primary | 64 (60.9%) | 258 (65.8%) | 322 (64.8%) |
| Secondary | 31 (29.5%) | 103 (26.3%) | 134 (27.0%) |
| University | 2 (1.9%) | 6 (1.6%) | 8 (1.6%) |
| Other (Tertiary) | 1 (1.0%) | 0 (0%) | 1 (0.2%) |
| Total | **105 (100%)** | **392 (100%)** | **497 (100%)** |

In this study, the Body Mass Index (BMI) was used to define the patient's nutritional status. The BMI was determined by the weight in kilograms divided by the height measurement in meters squared (kg/m$^{2}$). The cut off BMI was = 18.5kg/m$^{2}$. These BMI indices were categorized using the WHO (World Health Organization), 2005 reference standards to classify the subjects into their nutritional status. The HIV patients BMI were assessed over a period of six months, *Table 2*. The BMI ranged between 20 and 22 kg/m$^{3}$. There were significant differences in the BMI between the male and female patients during the six months of the study.

Table 2: Anthropometric measurements of the study group

| BMI (kg/m$^{3}$) - Month | Sex | N | Mean (±SD) |
|---|---|---|---|
| n = 497 *BMI – February* | Male<br>Female | 105<br>392 | 20.39 (±3.65)<br>22.01 (±6.27) |
| **n = 495 *BMI - March*** | Male<br>Female | 105<br>390 | 21.02 (±3.54)<br>21.58 (±3.65) |
| **n = 493 *BMI - April*** | Male<br>Female | 105<br>388 | 20.32 (±3.86)<br>21.42 (±3.81) |
| ***BMI - May*** | Male<br>Female | 105<br>388 | 20.34 (±3.78)<br>21.41 (±3.77) |
| ***BMI - June*** | Male<br>Female | 105<br>388 | 20.39 (±3.65)<br>22.01 (±6.27) |
| ***BMI – July*** | Male<br>Female | 105<br>388 | 20.60 (± 3.54)<br>21.58 (±3.77) |

Results shown in *Table 3* revealed that in February 101 (20.3%) had a BMI of less than 18.4, followed by 318 (64.0%) between 18.5 – 24.9, 65 (13.1%) between 25.0 – 29.0 and 13 (2.6%) above 30. In March 86 (17.43%) had a BMI of less than 18.4, 336 (67.9%) between 18.5 – 24.9, 63 (12.7%) between 25.0 – 29.0 and 10 (2.0%) above 30. In April 110 (22.3%) had a BMI of less than 18.4, 311 (63.1%) between 18.5 – 24.9, 60 (12.2%) between 25.0 – 29.0 and 12 (2.4%) above 30. In May 115 (23.3%) had a BMI of less than 18.4, 307 (62.3%) between 18.5 – 24.9, 58 (11.8%) between 25.0 – 29.0 and 13 (2.6%) above 30. In June 108 (21.9%) had a BMI of less than 18.4, 309 (62.7%) between 18.5 – 24.9, 65 (13.2%) between 25.0 – 29.0 and 11 (2.2%) above 30. In July 100 (20.3%) had a BMI of less than 18.4, 312 (63.3% between 18.5 – 24.9, 67 (13.6%) between 25.0 – 29.0 and 14 (2.8%) above 30. This implies that majority of the patients were within the normal range for BMI cut off (18.5 – 24.9kg/m$^{3}$).

The foods were classified into the following groups: carbohydrate sources, protein sources, vegetable sources, fruit sources, fats/oils sources and beverages sources. Nutrient intake focused on diversity and variety of nutrient intake obtained from 24-hour dietary recall and food frequency checklist. There were variety of nutrients consumed from the different food groups *Table 4*, this included 2980 (60.0%) from carbohydrates sources was consumed daily, 769 (25.5%) weekly, 408 (8.2%) occasionally while 813 (16.3%) was not consumed. For the protein sources, 3622 (56.1%) daily, 536 (8.3%) weekly, 809 (12.5%)

occasionally while 1494 (23.1%) did not consume varied sources. For the vegetable sources 2690 (41.6%) daily, 1842 (28.5%) weekly, 966 (32.0%) occasionally while 963 (14.9%) not consumed. For the fruits sources 2239 (64.4%) daily, 358 (10.3%) weekly, 41 (11.8%) occasionally while 471 (13.5%) not consumed. For the fats/oils sources 200 (20.1%) daily, 493 (49.6%) weekly, 50 (5.0%) occasionally while 251 (25.3%) did not consume. For the beverages 1231 (49.5%) daily, 587 (23.6%) weekly, 159 (6.4%) occasionally and 508 (20.5%) did not consumed. This result suggests that majority of the patients consumed a variety of nutrients from the carbohydrates sources and this may be due to the source being available and affordable compared to the other sources like protein.

An examination of the mineral and vitamin intake as shown in *Table 5* revealed that the mean intake did not exceed the RDA, except for iron (male, 10.49± 3.49) and thiamine (in both male, 1.65 ± 0.66 and female, 1.72 ± 0.69). *Table 5* shows that the majority of the male and female patients and the whole group demonstrated mean dietary intake lower than the recommended daily allowance (RDA). Majority of the patients reported an inadequate intake of energy (1556 male and 1596 female), vitamin A (3874 male and 4535 female), vitamin C (49.5 male and 47 female), iron (female patients 10.3), calcium (415.1 male and 461.4 female), riboflavin (0.44 male and 0.42 female) and niacin (10.21 male and 10.86 female). As observed in *Table 5* even at the end of the sixth month, the mean average of all the nutrients except iron (male, 10.35) and thiamine (both male, 1.63 and female, 1.76) was inadequate.

The analysis of the nutrient value of the foods consumed within 24 hours was done by the use of the food composition tables by Sehmi (1993). A value of over 100% of the RDA were considered above RDA nutrient consumption, whereas those consuming 90% - 100% of the RDA were considered optimum nutrient consumption and those consuming below 90% of the RDA considered below RDA nutrient consumption. The patients who met the criteria for the food programme were enrolled until they attained the required nutritional status. There were 80 (16.1%) on the food programme given on a monthly basis and 417 (83.9%) were not.

Based on the recommended dietary allowance (RDA), the nutrient consumption among the patients included energy, (51.9% males and 76.0% females), proteins (72.1% males and 88.7% females), calcium (34.6% males and 38.5% females), iron (128.8% males and 58.3% females), vitamin A (22.8% males and 26.7% females), vitamin C (55.0% males and 62.7% females) thiamine (135.0% males and 160.0% females), riboflavin (33.8% males and 38.4% females) and niacin (63.8% males and 77.6% females), *Table 6*.

On average there were three meals served in a day. This included breakfast, lunch and supper. Foods commonly served for breakfast included porridge, strong tea and "*nyoyo"* (maize and beans), and sweet potatoes. For lunch the subjects served "*ugali*' and traditional vegetables, porridge, "*nyoyo*", "*ugali"* and "*omena"*, "*ugali*" and beef stew, strong tea and sweet potatoes. The foods served for supper were similar to that served for lunch. *Table 7* illustrates the number of meals taken by the patients according to sex from the first month to the sixth month.

Table 3: Nutritional status as measured by BMI over Six Months

| | BMI | | | |
|---|---|---|---|---|
| **Month** | **< 18.5 No (%)** | **18.5 – 24.9 No (%)** | **25.0 – 29.0 No (%)** | **> 30 No (%)** |
| **n = 497 *February*** | 101 (20.3%) | 318 (64.0%) | 65 (13.1%) | 13 (2.6%) |
| **n = 495 *March*** | 86 (17.4%) | 336 (76.9%) | 63 (12.7%) | 10 (2.0%) |
| **n= 493 *April*** | 110 (22.3%) | 311 (63.1%) | 60 (12.2%) | 12 (2.4%) |
| ***May*** | 115 (23.3%) | 307 (62.3%) | 58 (11.8%) | 13 (2.6%) |
| ***June*** | 108 (21.9%) | 309 (62.7%) | 65 (13.2%) | 11 (2.2%) |
| ***July*** | 100 (20.3%) | 312 (63.3%) | 67 (13.6%) | 14 (2.8%) |

Table 4: Diet diversity of the study group (n = 497)

| Food group | Daily No. (%) | Weekly No. (%) | Occasionally No. (%) | Never No. (%) |
|---|---|---|---|---|
| ***Carbohydrate Sources*** | 2980 (60.0%) | 769 (15.5%) | 408 (8.2%) | 813 (16.3%) |
| ***Protein sources*** | 3622 (56.1%) | 536 (8.3%) | 809 (12.5%) | 1494 (23.1%) |
| ***Vegetable sources*** | 2690 (41.6%) | 1842 (28.5%) | 966 (32.0%) | 963 (14.9%) |
| ***Fruit sources*** | 2239 (64.4%) | 358 (10.3%) | 41 (11.8%) | 471 (13.5%) |
| ***Fats/oils sources*** | 200 (20.1%) | 493 (49.6%) | 50 (5.0%) | 251 (25.3%) |
| ***Beverage sources*** | 1231 (49.5%) | 587 (23.6%) | 159 (6.4%) | 508 (20.5%) |

In the month of February 2 (0.4%) did not have any meal, 46 (9.2%) had one meal, 174 (35.0%) had two meals and 275 (55.4%) had three meals. In March 2

(0.4%) had no meal, 26 (5.3%) one meal, 217 (43.7%) two meals and 250 (50.6%) three meals. In April 0 (0.0%) had no meal, 39 (7.9%) one meal, 215 (43.6%) two meals and 239 (48.5%) three meals In May 0 (0.0%) had no meal, 39 (7.9%) one meal, 227 (46.5%) two meals and 227 (46.5%) three meals. In June 0 (0.0%) had no meal, 35 (7.1%) one meal, 245 (49.7%) two meals and 213 (43.2%) three meals In July 0 (0.0%) had no meal, 30 (6.1%) one meal, 239 (48.5%) two meals and 224 (45.4%) three meals as shown in *Table 7*. This implies that majority of the patients consumed the average number (3) of meals per day by the patients.

Table 5: Relationship between nutritional status and sex

| Nutrient | Sex | Mean SD (±) | February | March | April | May | June | July | Average |
|---|---|---|---|---|---|---|---|---|---|
| **Kcal** | Male | Mean | 1555.93 | 1575.92 | 1578.05 | 1575.7 | 1581.44 | 1577.62 | 1574.11 |
| | | SD | ± 549.02 | ± 629.74 | ± 580.70 | ± 579.09 | ± 575.47 | ± 579.18 | ± 578.29 |
| | Female | Mean | 1596.19 | 1686.22 | 1636.14 | 1630.47 | 1632.11 | 1633.65 | 1635.79 |
| | | SD | ± 536.74 | ± 536.74 | ± 621.52 | ± 617.744 | ± 606.16 | ± 620.14 | ± 620.97 |
| **Protein** | Male | Mean | 40.43 | 41.51 | 42.53 | 52.54 | 40.16 | 42 73 | 41 65 |
| | | SD | ± 11.41 | ± 15.19 | ± 15.42 | ± 14.93 | ± 12.48 | ± 14.76 | ± 15.67 |
| | Female | Mean | 40.83 | 39.02 | 39.93 | 38.89 | 37.88 | 38.81 | 39.23 |
| | | SD | ± 11.23 | ±11.90 | ± 11.86 | ± 10.97 | ± 9.96 | ± 10.93 | ± 11.89 |
| **Iron** | Male | Mean | 10.35 | 10.48 | 10.48 | 10.52 | 10.57 | 10.56 | 10.49* |
| | | SD | ± 3.40 | ± 3.17 | ± 3.45 | ± 3.06 | ± 2.97 | ± 3.01 | ± 3.49 |
| | Female | Mean | 10.54 | 10.46 | 10.43 | 10.41 | 10.50 | 10.44 | 10.47 |
| | | SD | ± 3.29 | ± 3.39 | ± 3.28 | ± 3.24 | ±3.10 | ± 3.21 | ± 3.40 |
| **Calcium** | Male | Mean | 415.10 | 500.20 | 499.98 | 499.96 | 507.59 | 507.71 | 487.57 |
| | | SD | ± 320.3 | ± 319.47 | ± 324.31 | ± 321.96 | ±310.48 | ± 317.74 | ± 320.59 |
| | Female | Mean | 561.41 | 541.40 | 538.58 | 534.66 | 542.89 | 534.33 | 542.21 |
| | | SD | ± 11.23 | ±11.90 | ± 11.86 | ± 10.97 | ± 9.96 | ± 10.93 | ± 11.89 |
| **Vitamin A** | Male | Mean | 3874.14 | 4039.83 | 3999.07 | 4245.36 | 4281.56 | 4265.56 | 4117.59 |
| | | SD | ± 4468.34 | ± 4390.48 | ± 4422.36 | ± 4370.88 | ± 4340.79 | ± 4353.56 | ± 4347.50 |
| | Female | Mean | 4535.39 | 5150.39 | 4935.38 | 5119.59 | 5157.73 | 5138.88 | 5006.23 |
| | | SD | ± 6510.64 | ± 6766.37 | ± 6662.64 | ± 6662.64 | 5157.73 | ± 6649.87 | ± 6660.74 |
| **Vitamin C** | Male | Mean | 49.54 | 52.05 | 51.78 | 50.38 | 49.97 | 51.01 | 52.10 |
| | | SD | ±28.38 | ± 27.22 | ± 26.84 | ± 27.69 | ± 24.48 | ± 27.25 | ± 28.28 |
| | Female | Mean | 47.06 | 54.66 | 52.79 | 53.08 | 52.70 | 52.92 | 52.20 |
| | | SD | ± 26.84 | ± 23.64 | ± 25.05 | ± 25.21 | ± 24.06 | ± 24.82 | ± 24.93 |
| **Thiamine** | Male | Mean | 1.63 | 1.68 | 1.68 | 1.66 | 1.58 | 1.68 | 1.65* |
| | | SD | ± 0.52 | ± 0.73 | ± 0.72 | ± 0.68 | ± 0.62 | ± 0.67 | ± 0.66 |
| | Female | Mean | 1.76 | 1.73 | 1.78 | 1.72 | 1.60 | 1.72 | 1.72* |
| | | SD | ± 0.72 | ± 0.71 | ± 0.81 | ± 0.68 | ± 0.1 | ± 0.67 | ± 0.69 |
| **Riboflavin** | Male | Mean | 0.44 | 0.44 | 0.42 | 0.46 | 0.46 | 0.47 | 0.45 |
| | | SD | ± 0.35 | ± 0.41 | ± 0.74 | ± 0.42 | ± 0.42 | ± 0.42 | ± 0.43 |
| | Female | Mean | 0.42 | 0.42 | 0.43 | 0.47 | 0.46 | 0.48 | 0.45 |
| | | SD | ± 0.38 | ± 0.39 | ± 0.42 | ± 0.43 | ± 0.43 | ± 0.43 | ± 0.43 |
| **Niacin** | Male | Mean | 10.21 | 10.49 | 10.63 | 10.08 | 10.08 | 10.05 | 10.38 |
| | | SD | ± 3.40 | ± 4.62 | ± 4.46 | ± 3.55 | ± 3.56 | ± 3.62 | ± 3.96 |
| | Female | Mean | 10.86 | 10.63 | 10.75 | 10.15 | 10.16 | 10.12 | 10.45 |
| | | SD | ± 4.47 | ± 4.49 | ± 4.56 | ± 3.99 | ± 3.97 | ± 4.03 | ± 4.52 |

* Above RDA

Table 6: Nutrient Intake as measured by sex and Recommended Dietary Intake (n = 497)

| Nutrient | Sex | No. (%) |
|---|---|---|
| Energy (Kilocalories) (kcal) | Male<br>Female | 51.9%<br>76.0% |
| **Proteins (grams)** | Male<br>Female | 72.1%<br>88.7% |
| **Calcium (milligrams)** | Male<br>Female | 34.6%<br>38.5% |
| **Iron (milligrams)** | Male<br>Female | 128.8%*<br>58.3% |
| **Vitamin A (IU)** | Male<br>Female | 22.8%<br>26.7% |
| **Vitamin C (milligrams)** | Male<br>Female | 55.0%<br>62.7% |
| **Thiamine (milligrams)** | Male<br>Female | 135.8%*<br>160.0%* |
| **Riboflavin (milligrams)** | Male<br>Female | 33.8%<br>38.4% |
| **Niacin (milligrams)** | Male<br>Female | 63.8%<br>77.6% |

* Above RDA

Table 7: Relationship between frequency of meals and sex

| Month | Sex | None No. (%) | One No. (%) | Two No. (%) | Three No. (%) |
|---|---|---|---|---|---|
| n = 497 February | Male<br>Female | 0 (0%)<br>2 (100%) | 9 (19.6%)<br>37 (80.4%) | 33 (19.0%)<br>141 (81.0%) | 63 (22.9%)<br>212 (77.1%) |
| n = 495 March | Male<br>Female | 1 (50%)<br>1 (50%) | 3 (11.5%)<br>23 (88.5%) | 43 (19.8%)<br>174 (80.2%) | 58 (23.2%)<br>192 (76.8%) |
| n = 493 April | Male<br>Female | 0 (0%)<br>0 (0%) | 9 (23.1%)<br>30 (76.9%) | 47 (21.8%)<br>168 (78.2%) | 49 (20.6%)<br>190 (79.4%) |
| May | Male<br>Female | 0 (0%)<br>0 (0%) | 9 (23.1%)<br>30 (76.9%) | 42 (18.5%)<br>185 (81.5%) | 63 (22.9%)<br>164 (77.1%) |
| June | Male<br>Female | 0 (0%)<br>0 (0%) | 4 (11.4%)<br>31 (88.6%) | 52 (21.2%)<br>193 (78.8%) | 49 (23.0%)<br>164 (77.0%) |
| July | Male<br>Female | 0 (0%)<br>0 (0%) | 5 (16.7%)<br>25 (83.3%) | 48 (20.1%)<br>191 (79.9%) | 52 (23.2%)<br>172 (76.8%) |

This was done by finding the difference between the means of the male and female patients based on the BMI of the patients. Independent sample *t*-test was used and the results on the difference in the means, *Table 9*. To shows if there is any significant

To show if there is any significant relationship between nutrient intake and HIV/AIDS status, independent sample *t*-test was used, *Table 8*. This *t*-test was based on the following nutrients energy (kilocalories), proteins, iron, vitamin $B_1$, niacin, vitamin C, calcium and vitamin A. *Table 8* shows that there was a significant difference on the mean of thiamine between male and female (t = -2.267, df = 205.178, p = 0.024). Though the female had a higher intake of the other nutrients there was no significant difference, Kcal (t = -0.670, df = 161.254, p = 0.504), protein (t = -0.323, df = 160.926, p = 0.747), iron (t = -0.526, df = 159.699, p = 0.599), calcium (t = -1.455, df = 183.227, p = 0.147), vitamin A (t = -1.211, df = 235.640, p = 0.227), vitamin C (t = 0.806, df = 157.390, p = 0.421), riboflavin (t = 0.451, df = 175.100, p = 0.652) and niacin(t = -1.615, df = 210.635, p = 0.108). It can be envisaged that both male and female patients consumed foods rich in minerals (vegetables) especially thiamine.

Table 8: Relationship between nutrient intake and sex

| Characteristics | t for equivalence of means | df | Sig |
|---|---|---|---|
| **Energy (Kcal)** | -0.670 | 161.254 | 0.504 |
| **Protein** | -0.323 | 160.926 | 0.747 |
| **Iron** | -0.526 | 159.699 | 0.599 |
| **Calcium** | -1.455 | 183.227 | 0.147 |
| **Vitamin A** | -1.211 | 235.640 | 0.227 |
| **Vitamin C** | 0.806 | 157.390 | 0.421 |
| **Thiamine** | -2.267 | 205.178 | 0.024* |
| **Riboflavin** | 0.451 | 175.100 | 0.652 |
| **Niacin** | -1.615 | 210.635 | 0.108 |

Table 9: Relationship between BMI and sex

| Characteristics | *t* for equivalence of means | *df* | Sig |
|---|---|---|---|
| **February** | -3.409 | 286.018 | 0.001* |
| **March** | -1.422 | 286.018 | 0.157 |
| **April** | -2.608 | 162.980 | 0.010* |
| May | -2.583 | 164.551 | 0.011* |
| **June** | -1.910 | 165.542 | 0.058 |
| **July** | -2.466 | 173.210 | 0.015* |

relationship between BMI and HIV/AIDS status, independent sample *t*-test was used and the results are displayed in *Table 9*. This *t*- test was based on the weight (kg) and height ($m^2$) measurements (BMI). There was a significant difference on the means in the months of February (t = -3.409, df = 286.018, p = 0.001), April, (t = -2.608, df = 162.980, p = 0.010) May (t = -02.583, df = 164.551, p = 0.011) and July (t = -2.466, df = 173.210, p = 0.015). There was no significant difference in March (t = -1.422, df = 286.018, p = 0.157) and June (t = -1.910, df = 165.542, p = 0.058). The significant difference in the BMI between the male and female patients may be attributed to the inadequate energy intake.

## DISCUSSION

The results of this study conducted in a representative group of patients from AMPATH clinic in Chulaimbo Sub-district hospital, showed the mean BMI of this population was 20.5kg/$m^2$ in male and 21.7kg/$m^2$ in female as shown in *Table 2*. This can be compared with population norms for the United States, where mean BMI has been estimated as 25.9kg/$m^2$ for adult males (Allison *et al.,* 2002) and 26.3 for adult females (Zhu *et al.,* 2003). The current WHO BMI cut-off point for underweight is 18.5kg/$m^2$ (WHO, 2005). Thus, the mean for the entire study population was only slightly above one known cutoff for malnutrition. This study of a representative sample of patients attending AMPATH outpatient clinic shows the moderate frequency of malnutrition (20.3% of the overall study population) as shown in *Table 3*. One originality of this study is the fact that patients were randomly selected, giving a more accurate evaluation of nutritional status than in most other studies, which involved non-random samples (Chelbowski *et al.*, 1989; Graham *et al.,* 1993; Ysseldyke, 1991). Weight loss is very common in HIV and AIDS (Wanke *et al.,* 2000; Gorbach *et al.,* 1993) and has been correlated with disease progression and mortality (Kotler, 1989; Wheeler *et al.,* 1998). Even at moderate levels, malnutrition has been shown to have a detrimental impact on HIV outcome (Chlebowski *et al.,* 1989; Sutmann *et al.,* 1995). This association has been related to survival independent of the CD4 cell count (Guenter *et al.,* 1993). However, this study established the 69.9% of the patients were underweight compared to other studies. It is important to note that although longitudinal data is not available, there is growing evidence that increased BMI is associated with an increased CD4 cell count and with lower rates of the events that characterize the progression of HIV disease (Forrester *et al.,* 2001). Weight and body composition, in relation to the CD4 cell counts, indicate that there is a significant trend towards lower weight and BMI with lower CD4 counts (Forrester *et al.,* 2001). This is in agreement with this study which shows that the patients whose BMI was lower than 18.5kg/$m^2$ had a lower CD4 cell count.

This study revealed that there was inadequate intake of all the nutrients with exception of iron in the male patients and thiamine in both female and male patients. Dietary quality as it contributes to the health benefits of dietary variety can be associated partly, but by no means exclusively, with nutrient content. Nutritional quality of the diet does improve with consumption of greater food diversity (Shimbo *et al.,* 1994; Hatloy *et al.,* 1998). Food frequency checklist was used as a food security indicator and the number of food items consumed by the patient provided a measure of the quality of diet. The percentages were calculated to show diversity in both micro and macronutrients in their diets. An increase in the average number of different foods consumed provides a quantifiable measure of improved household food security (Swindale, 2005). Diet Diversity is used synonymously with diet variety, which is defined by Wardlaw and Kessel (2002) as choosing different types of foods within each food group. Increased diversity of the diet has been assumed to improve the quality of the diet. Diet diversity is usually measured by summing the number of foods or food groups consumed over a reference period. The reference period usually ranges from one to three days. Seven days period is also often used; however periods up to fifteen days have been reported (Drain, 2007). Diet diversity has however widely been associated with high socio-economic status. This is because people with high income may have the economic ability to purchase different types of foods from different food groups whereas those with low income stick to the few cheaper foods available, and this limits diet diversification among the poor people (Friis and Michaelsen, 1998). This study reveals that majority of the patients consumed a variety of nutrient from carbohydrates sources, protein sources and fruit sources, *Table 4*. Monthly income can be a strong and significant predictor of diet diversity among PLWHA. This study established that the monthly income was below the average of one Dollar ($80) a day (UNDP, 2002). This may be one of the reasons for the patients for the patients not consuming foods in adequate amounts. Hatløy *et al.*, (1998) and Slattery *et al.,*

(1997) observed that nutritional quality of the diet does improve with consumption of greater food diversity. Stewart (2003) viewed daily servings of the same food from each food groups not being enough, but that one should choose variety within food groups because the characteristic nutrients in each group vary greatly for individual foods. Though studies have shown that diet diversity correlates with nutrient adequacy, the patients in this study had a variety but did not meet the RDA for most of the nutrients, *Table 5*.

The results of this study is also similar to that of Onyango *et al*., (1998) that linked diet diversity to improved anthropometry in children one to three years of age in Kenya. However it is generally understood that no food contains all necessary nutrients and that diversity in the diet is needed to ensure a balanced diet. This implies that diversified diets are likely to ensure nutrient adequacy, and individuals who diversify diets have a likelihood of having a good nutritional status. The most commonly consumed food group was carbohydrates (60.0%) and fruits (64.4%). The pattern of results is in agreement with the results of a research done in Tanzania (Watson, 1994), which stated that household members consumed mainly starchy food because their low farm income could not easily purchase nutritious food. Certain foods are preferentially utilized in specific African countries and communities (Watson, 1994). The important staple foods eaten by Africans and the protein-energy percentages of these staples are: wheat (11%), millet (12%), rice (8%), maize (10%), yam (6%), plantain (4%) and cassava (3%), (Watson, 1994). The major meals are bulky and the amount of staple food usually consumed per average person per day does not provide the recommended daily allowance (RDA) of energy, protein and other essential nutrients (Kotler, 2000). The food consumed and the frequency at which it is consumed determines an individual's food security status. Therefore if the food consumption and frequency is low the patient becomes more food insecure.

There were indications of low intake of vitamins energy, protein, vitamin, A, vitamin C iron (female), calcium, riboflavin and niacin by most of the patients as shown in *Table 5.* This is probably linked with their high consumption of maize meal, which contains only low levels of these nutrients. It is clear that HIV-infected patients are at increased nutritional risk due to the kind of food consumed. The results in this study agrees with findings reported by Onyango *et al.,* (2009), that there is a lower intake of energy as well as most of the other nutrients among HIV sero-positive persons. WHO (2001) suggests that energy requirements increase significantly as the HIV disease progresses, in this case then it might be viewed as a bad trend for patients with low energy intake as reported in this study. The higher energy intake assists to a certain degree in reducing wasting and improve the well-being of the patients. Both male and female patients reported a mean total protein intake of 41.65g (± 15.67) and 39.23g (± 11.89) lower than the RDA of 63g and 50g (*Table 5*). Watson, (1994), reports a mean total protein intake in HIV-positive patients that is higher than the RDA. According to Dannhauser *et al*., (1999) and Drain, (2007) studies carried out on HIV-infected patients in the Free State province of South Africa and in Boston (USA) respectively, reported that majority of the patients had a total protein intake that met at least 67% of the RDA. The low intake of total protein as observed in this study is suggested to be associated with the patient's economic ability. However we envisaged that the low total protein intake reported in this study may not compensate for the increased urinary nitrogen loss, increased protein utility, decreased skeletal protein synthesis and increased skeletal muscle breakdown that is reported in HIV-infected individuals. Observational studies have shown that low blood levels and decreased dietary intakes of some micronutrients are associated with faster HIV disease progression, altered immune function and mortality. In this study, the majority of patients demonstrated an inadequate or low intake of micronutrients that was < 90% or lower than the RDA. The study also revealed the percentage of some micronutrients with an intake of less than 90% of the RDA, such as calcium and iron (female), (*Table 5*) and vitamins, such as A, C, thiamine, riboflavin and niacin (*Table 6)* in the male patients. The female patients had higher intake than the males, although there was a wider range of inadequate intake (< 90% of the RDA) of calcium (34.6% male and 38.5% female), and iron (128.8% male and 58.3% female) and of vitamin (A (22.8% male and 26.7% female), vitamin C (55.0% male and 62.7% female), riboflavin (33.8% male and 38.4% female) and niacin (63.8% male and 77.6% female) as illustrated in *Table 6*.

## CONCLUSION

The results of this study provide survey data on the dietary/nutritional intakes of HIV-positive/AIDS patients; particularly those living in Kisumu West District, Kenya, and perhaps reflect the dietary intakes of HIV-positive/AIDS patients in the African community. Even though the study reveals that 20.3% of the patients were underweight, generally the dietary intakes were lower than the RDA. This low intake may be related to employment status and food insecurity. The low intake therefore may not help in correcting nutritional impairment and retard wasting to a certain extent and, in turn, in maintaining the nutritional level of the nutrients in the blood. The high percentage of patients with an inadequate intake of most of the nutrients is of great concern and therefore need for further research. It is envisaged that the high dietary intake of major macronutrients and micronutrients will help in maintaining the nutritional status and in reducing wasting in the patients. Irrespective of the availability of anti-retroviral therapy, an adequate, well balanced diet, providing required foods and consequently adequate nutrients to meet the increased requirements of HIV infection/AIDS, is an important measure in maintaining nutritional health in people living with HIV/AIDS. However, the relatively high percentage of the patients with an inadequate intake of energy, protein, iron (female) calcium, vitamin A, vitamin C, riboflavin and niacin is of great concern and calls for urgent attention, hence further in-depth research is recommended.

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