

Dietary adequacy of HIV infected individuals in north India - A cross-sectional analysis

Ravinder Kaur Sachdeva, Aman Sharma, Ajay Wanchu, Vandana Dogra, Surjit Singh & Subhash Varma

Department of Internal Medicine, Postgraduate Institute of Medical Education & Research, Chandigarh, India

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Background & objectives: Dietary inadequacy is common in developing countries and so is in immune-deficient HIV infected individuals. Hence, an assessment of dietary patterns was done among a group of HIV infected individuals and compared with recommended dietary allowances.

Methods: One hundred consecutive HIV infected individuals were interviewed from the Immunodeficiency Clinic of a tertiary care center at Chandigarh. Dietary intake was assessed by 24 h recall method. Mean carbohydrate, protein and fat intakes were evaluated. Mean difference in the calorie intake from recommended dietary intake was then calculated. Mean absolute CD4 cell count was calculated and correlated with BMI and mean calorie intake.

Results: Mean weight and BMI of the individuals participated in the study was 58.6 ± 11.7 (range, 34 - 94) kg and 21.5 ± 3.7 (range, 13.6 - 36.7) kg/m², respectively. Mean total calories intake was 1713 ± 292.8 (860 - 2525) calories/day and mean difference in the calories taken from the standard values was 249.5 ± 190.7 (10.6 - 967.5) calories/day. There was no significant correlation between CD4 cell count and total calories taken.

Interpretation & conclusions: In HIV-infected individuals the energy intake was significantly lower than the recommended average intake. Hence, efforts should be taken to ensure that HIV-infected individuals have access to high-quality, nutritious food choices that promote optimal dietary patterns.

Key words Antiretroviral - calories - dietary - HIV

Research evaluating the role of nutrition in HIV infection initially focused on weight loss or lean body mass and wasting¹. Each of these variables was found to be associated with increased risk of opportunistic infections and death². Unintentional weight loss is associated with increased mortality. Highly active antiretroviral therapy (HAART) has significantly improved life expectancy, changed the nutritional profile, and presented new challenges for HIV infected individuals. Dyslipidaemia, insulin resistance,

metabolic syndrome and obesity are now frequently seen among individuals living with HIV. Thus nutritional priorities vary, and dietary recommendations may be less straightforward in HIV-infected individuals as HIV treatment and outcomes continue to evolve. Although body composition and biochemical measures of metabolic risk were extensively investigated in HIV, the role of diet has received less attention. Traditionally dietary analysis was used to describe nutrient deficiencies and to examine outcomes in relation

to dietary intake of individual macronutrient and micronutrients³. Although important, the association of individual nutrient intakes with disease outcomes can be difficult to detect, because nutrients are not consumed in isolation and act synergistically in the body. To address the limitations of studying individual nutrient intakes, dietary pattern analysis has emerged as a method of assessing total food consumption⁴. Such analysis allows for the effects of many dietary components, considered in aggregate, on the outcome of interest. Inherent subjectivity occurs throughout the pattern analysis because investigators must decide how to collapse the data (typically into food groups) and how to quantify the variables (as weight, frequency or percentage or variables)⁵. This study was undertaken to evaluate the dietary intake of HIV infected individuals in north India and compare it with the recommended dietary allowances (RDA), and to assess the interplay of various HIV-related factors with dietary intake.

Material & Methods

This was a cross-sectional study of 100 consecutive HIV infected individuals attending the Immunodeficiency Clinic of a tertiary care teaching and research institute, Postgraduate Institute of Medical Education & Research (PGIMER), Chandigarh, from July 2009 to October 2009. Patients with co-morbid diseases including diabetes mellitus, thyroid disease, malignancy, and co-infections were excluded. Pregnant females were also excluded. Patients' data including age, sex, weight, height, CD4 count, type of antiretroviral therapy and duration were noted. Important socio-economic variables were obtained. Dietary intake was assessed by 24 h recall method⁶. Patients were administered with a standard questionnaire which was followed by interview session to obtain their dietary pattern over the last 24 h. The subjects were asked both open-ended and closed-ended questions. The questionnaire was pre-tested by administering it to 10 subjects selected randomly. In order to decide the sample size, a pilot study was conducted and the proportion was about 32 per cent. In order to achieve a power of 80 per cent, the computed sample size was 97 and, therefore, 100 HIV-infected individuals were enrolled. A day's menu obtained from each subject was converted into raw ingredients using the standards of conversion of food materials to raw ingredients formulated by the dietician of the department. The nutritive value of raw ingredient was computed from nutrient composition data given by the Indian Council of Medical Research (ICMR). All dietary intake was

compared with the ICMR RDA values^{7,8}, taking the energy needed by a sedentary person to sustain minimal physical activity for comparison. Calibrated floor scale used to calculate weight was kilogram (kg) and for height was square meter (m²). Each measurement was taken thrice and the average value was then taken as the final reading. Body mass index (BMI) was calculated for each individual. Basal metabolic rate (BMR) was calculated using Harris Benedict equation⁹. A written informed consent was taken from all participants. The study was conducted after obtaining ethical clearance from the institution's ethics committee.

Statistical analysis: Comparison of patients' intake with RDA was made using one sample t-test. A correlation analysis was performed between CD4 cell count and BMI, dietary intake and socio-economic status. $P < 0.05$ was taken as statistical significant.

Results

Mean age of participants was 36.1 ± 8.3 (range 23 - 62) yr. Sixty eight men and 32 women participated in the study. Seventy seven patients were literate whereas 23 were illiterate, and 61 were employed, and 68 per cent individuals belonged to rural area. Mean CD4 cell count at the time of study was 427 ± 274 (range, 86 - 1363) cells/ μ l. Forty one individuals received AZT (zidovudine)+3TC (lamivudine)+NVP (nevirapine), 23 received d4T (stavudine)+3TC+NVP, 22 received d4T+3TC+EFV (efavirenz), 9 received AZT+3TC+EFV and 5 individuals were receiving TDF (tenofovir)+3TC+LPV (lopinavir) boosted with r (ritonavir) as per recommended guidelines¹⁰. All individuals enrolled in the study were asymptomatic at the time of HIV diagnosis. None of the enrolled participants had any side effect with antiretrovirals. Mean weight and BMI of the individuals participated was 58.6 ± 11.7 kg (range, 34-94) and 21.5 ± 3.7 kg/m² (range, 13.6 - 36.7) respectively. Mean BMR of the individuals participated was 1430.5 ± 186.9 kcal/day (range 1007 - 1915). Ninety per cent of the participants ate three times a day based on the 24 h recall method. Mean carbohydrate, protein and fat intakes were 246.7 ± 39.7 (130 - 389) g/day, 48.6 ± 10.3 (21 - 77) g/kg/day and 41.3 ± 10.5 (20 - 65) g/day, respectively. The Table shows the comparison of measured mean energy, carbohydrate, protein and fat intake per day with RDA in males and females. Mean total calories intake was 1713 ± 292.8 (860 - 2525) calories/day and mean difference in the calories taken from the standard values was 249.5 ± 190.7 (10.6 - 967.5) calories/day.

Table. Comparison of measured daily nutrient values with recommended dietary allowances (RDA)

| | Male (n = 68) | | | Female (n = 32) | | |
|-------------------|---------------|---------------------|----------------------|-----------------|-------------------|----------------------|
| | RDA | Mean ± SD | (95% CI) | RDA | Mean ± SD | (9% CI) |
| Energy (kcal) | 2425 | 1783.68 ± 251.193** | (-702.13 to -580.52) | 1875 | 1564.38 ± 322.1** | (-426.76 to -194.49) |
| Carbohydrates (g) | 330 | 258.67 ± 41.681** | (-81.58 to -61.09) | 230 | 225.75 ± 47.27* | (-21.29 to 12.79) |
| Protein (g) | 60 | 51.00 ± 11.83** | (-11.91 to -6.09) | 50 | 43.75 ± 10.5* | (-10.04 to -2.46) |
| Total fat (g) | 20 | 42.77 ± 11.627** | (19.89 to 25.65) | 20 | 38.44 ± 12.73** | (13.85 to 23.03) |

*P** < 0.002; ** < 0.001 compared to RDA

There was significant difference in the mean calories taken with the standard calories required ($P < 0.001$). There was no significant correlation between absolute CD4 cell count and BMI (Pearson's correlation $\rho = 0.45$, $P = 0.661$). There was also no significant correlation noted between CD4 cell count and total calories taken (Pearson's correlation $\rho = 0.09$, $P = 0.37$). There was no statistically significant relationship between the socio-economic status and the dietary intake. No statistical significant correlation was noted between marital status and the dietary intake, mode of transmission and the dietary intake, education and the dietary intake occupation and the dietary intake.

Discussion

HIV affects nutritional status from the onset of infection and in all stages of the disease^{11,12}. Most patients with HIV tend to lose weight due to a variety of causes like nausea, anorexia, opportunistic diseases and inadequate dietary intake. One study linked time of death to a point in time when the body weight reaches two-thirds of the ideal value². A major goal of nutritional management is to intervene early and preserve lean body weight to prevent wasting. Increasingly, data suggest that depletion of nutrients affects the ability of the body to mount and sustain an immune response^{11,13}. Early nutritional intervention in patients infected with HIV improves immune function. Of the various causes of undernutrition in these individuals, dietary inadequacy is an often-neglected but important cause. As HIV infection becomes a more chronic disease and the management of HIV becomes increasingly sophisticated, the ability to ensure HIV-infected individuals have access to high-quality, nutritious food choices that promote optimal dietary patterns, rather than just sufficient quantities of food, will also be increasingly important.

In this study, almost all food consumed by the participants was considered in the analysis, capturing total diet. Standard calibrated instruments were used to

calculate weight and height of each participant. There was no statistically significant correlation between BMI and CD4 cell count. Although 24 h analysis may not reflect the dietary habits over a longer period of time but shows the dietary intake over previous 24 h. Nutritional status amongst the study participants was generally below the normal standards. This justifies a need for nutritional intervention among HIV individuals for improved quality of life. Nutritional management is an essential but often neglected element in HIV care. AIDS patients experience a myriad of disease-related nutritional complications, including weight loss, lipodystrophy, malabsorption and micronutrient deficiencies¹⁴. Anorexia and other gastrointestinal symptoms such as nausea, vomiting, diarrhoea and malabsorption may occur due to HIV, opportunistic infections or drugs, and may prevent adequate nutritional intake or absorption leading to continued weight loss, vitamin deficiencies and poor nutritional status. Low socio-economic status and poor income can limit access to adequate dietary intake. Opportunistic infections are associated with increased resting energy expenditure¹⁵. However, one large study by Macallan *et al*¹⁶ concluded that reduced energy intake, rather than elevated energy expenditure, is the prime determinant of HIV-associated weight loss. The resulting malnutrition can itself contribute to an increased immunocompromised state¹⁷. Malnutrition and wasting should be treated as grave complications in the course of HIV infection because the timing of death in these patients may be related more closely to the extent of wasting than to any secondary infection¹⁸. Any HIV-infected person should be considered at risk for malnutrition, with nutritional assessment focused on factors that may promote or contribute to the potential for malnutrition. Focus on improving nutrition in HIV-infected patients is important because it optimizes existing immune system function, can help alleviate the burden of HIV-related complications, might reduce the overall cost of medical care and improves the patient's quality of life. Dworkin *et al*¹⁸ assessed the potential role

of dietary intake in the development and persistence of malnutrition in patients with HIV and AIDS and found that 88 per cent patients were ingesting less than 50 per cent of the RDA for at least one nutrient. Kim *et al*¹⁹ performed a cross-sectional study of 633 subjects in Boston and Rhode Island to determine the correlates of inadequate dietary intake among HIV-infected adults, and found that inadequate energy intake occurred in 38 per cent of this population and that female sex was independently associated with less energy and protein intake. Protein intake was also less in those without a caregiver adult in the family²⁰.

It is pertinent to note that all these studies have been conducted in populations that have reasonable access to food, unlike our study, which was performed in an already impoverished population. In our study the energy intake was less than RDA values. Similar pattern of a significantly low protein intake by patients was also noted. On the contrary, the fat intake for both males and females was significantly higher than the daily recommendations. Studies indicate that diets consumed by lower socio-economic groups contain cheap, concentrated energy derived mostly from fat, sugar, cereals, potatoes and low-cost meat products^{20,21}. Increased fat intake and obesity have been seen to occur disproportionately in patients with limited resources. People on the lower end of the income scale, in an attempt to cut food cost, have been seen to consume less expensive but more energy- and fat-dense foods. The recommended dietary intake of nutrients is different in various countries. This might make interpretation of findings dependent on reference range used. However, the fact that the recommended nutrient intake for most nutrients is lower in India than in developed countries makes the findings of the study all the more pertinent.

Dietary food records collected prospectively may provide a more accurate assessment of dietary behaviour than do patients' recollection of the preceding day. However, 24-hour and multiple-day dietary recall have been found to be comparable²². Generally, at least three days of diet data are required for the most stable macronutrients and for the percentage of calories from fat. Micronutrients, such as vitamin C, require many more days. Also, recent changes may have been made by patients in their dietary habits in response to changes in body composition and economic constraints brought on by the onset of HIV-related expenses. The proportion of females was smaller in this study, probably due to the socio-cultural milieu in India, with lack of access to healthcare facilities for females seen across a spectrum

of diseases. However, this could also make the results more significant in view of the generally higher nutrient intake amongst males compared to females.

In conclusion, our study showed that energy intake was significantly lower than the recommended intake in HIV infected individuals. With malnutrition imposing additional immunosuppressive burden on an already immunocompromised patient, it is imperative that more efforts are directed at tackling food insecurity, and all HIV-infected persons be considered at risk for malnutrition and nutritional counselling should play a major role in management of HIV disease.

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Reprint requests: Dr Aman Sharma, Assistant Professor, Department of Internal Medicine, Postgraduate Institute of Medical Education & Research, Chandigarh 160 012, India
e-mail: amansharma74@yahoo.com, coe_pgi_chandigarh@yahoo.com