

Anthropometric and Nutritional Profile of People Living with HIV and AIDS in India: An Assessment

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ABSTRACT

Background: Importance of nutrition in human immunodeficiency virus (HIV) is well-established; however, the information regarding the diet quality of people living with HIV (PLHIV) especially in India is lacking. **Objectives:** The objective of this study is to assess the anthropometric and nutritional profile of Indian PLHIV. **Material and Methods:** The study was performed on 400 adult PLHIV registered at the Antiretroviral Center (ART) center in New Delhi, India. Anthropometric data including height, weight, waist, hip, mid arm, and calf circumferences, were collected; 1-day 24-h dietary recall was done to gather nutrient intake from which nutrient adequacy ratios were computed. Mini Nutritional Assessment (MNA) was also conducted. **Results:** The mean body mass index (BMI) of the sample was 19.73 ± 3.55 kg/m² with around 40% having BMI <18.5 kg/m². All anthropometric measurements were found to correlate positively and significantly with CD4 count ($P < 0.05$). The sample consumed poor quality of diet as they could not meet even the 2/3rd of the Indian Council of Medical Research (2010) requirements for energy, protein, calcium, iron, riboflavin, niacin, folic acid, B12, copper, and zinc. Classification of subjects according to MNA indicated that more than 50% of the sample was at-risk of malnutrition and 34% were malnourished. With 40% of sample having BMI less than normal, 50% at risk of malnutrition together with poor nutrient intakes over a long period of time could contribute to further worsening of the nutritional status. **Conclusion:** There is a need to develop a database on nutritional profile of PLHIV in India which reinforces the need for development of effective strategies to improve their nutritional status.

Keywords: Anthropometry, diet record, HIV/acquired immunodeficiency syndrome, MNA, nutrition

Introduction

According to the National AIDS Control Organization (NACO) (2010) recent estimates, the total number of people living with human immunodeficiency virus (HIV)/acquired immunodeficiency syndrome (AIDS) in

India [people living with HIV (PLHIV)] is estimated at 23.9 lakh (19.3-30.4 lakh) in 2009.⁽¹⁾ Of all HIV infections, 39% (9.3 lakhs) are among women. The four high prevalence states of South India (Andhra Pradesh-5 lakhs, Maharashtra-4.2 lakhs, Karnataka-2.5 lakhs, and Tamil Nadu-1.5 lakhs) account for 55% of all HIV infections in the country. West Bengal, Gujarat, Bihar, and Uttar Pradesh are estimated to have more than 1 lakh PLHIV each and together account for another 22% of HIV infections in India.

Nutritional intake is often an overlooked factor in the progression of HIV disease, although the relation between nutrition and immune function is well-

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established.⁽²⁾ In HIV-infected individuals, poor nutritional status is a strong predictor of survival, even after controlling for CD4+ cell counts: A weight loss of >66% of ideal body weight was linked to the timing of death in AIDS patients.⁽³⁻⁵⁾ 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.⁽⁶⁾

Padmapriyadarsini and Swaminathan⁽⁷⁾ reported that a nutritional assessment should be conducted for all patients irrespective of the stage of HIV disease in order to assess status and identify potential problems promptly. Shevitz and Knox⁽⁸⁾ have coined nutritional assessment for PLHIV in the mnemonic "ABCD" which stands for anthropometric, biochemical, clinical and dietary parameters. The present paper, therefore, aims to assess the anthropometric, and dietary parameters of PLHIV. It also conducts nutritional assessment of PLHIV.

Materials and Methods

A total of 400 PLHIV (245 males; 144 females and 11 transgender), registered at the Anti-retroviral Center (ART) of Guru Teg Bahadur Hospital, Shahadra, Delhi, India were enrolled for the present study. All PLHIV who attended the ART center over a period of 3 months, were more than 21 years of age, had the record of CD4 estimations within last 30 days from the date of data collection, those receiving ART for not longer than 6 months and agreed to answer the questions related to nutrition, were enrolled in the study. Infants, children, adolescents, and pregnant and lactating mothers; those not registered at the center and those who refused to participate in the study were excluded from the study.

Ethical approval was obtained from the Institutional Ethics Committee of Institute of Home Economics, University of Delhi, India. Details of the study procedures were given on the volunteer's information sheet (in English and Hindi language). The benefits, confidentiality, and voluntary participation features of the study were explained and written informed consent was obtained from all the subjects.

Sociodemographic information and dietary patterns were gathered using a questionnaire. CD4 estimations were taken from the hospital records and anthropometric measurements (Height, weight, midupper arm circumference-MUAC, waist, hip, and calf circumferences) were taken with standard procedures and body mass index (BMI) and waist-to-hip ratio (WHR) was calculated. One day 24-h dietary recall was taken for measuring the nutrient intakes. The nutrient intakes were compared to recommended dietary allowances (RDAs) for Indian Population laid down by Indian

Council of Medical Research (ICMR) (2010).⁽⁹⁾ Based on the information obtained by 24-h recall method, the cooked foods were converted to raw amounts and the nutrients were calculated. The nutrients were calculated using software called DietSoft version 1.1.6. The software has been developed by the Department of Dietetics, All India Institute of Medical Sciences (AIIMS). The nutrients in the software are based on the values published in the "Nutritive value of Indian Foods" by ICMR (1999). The concept of nutrient adequacy ratio (NAR) was introduced by Madden and Yoder,⁽¹⁰⁾ which is defined as the ratio of intake of particular nutrient to its recommended dietary intake or RDA. It is calculated for each nutrient by using the following formula:

$$NAR = \text{Nutrient intake/RDA of the nutrient}$$

The subjects were classified according to the following NAR categories:

1. >1-excess intake of nutrient
2. 0.66-1-adequate intake of nutrient
3. <0.66-deficient intake of nutrient

NAR of 0.66 for a particular nutrient reflects dietary adequacy of that nutrient since the intake meets at least two-thirds of the recommended dietary allowances.⁽¹¹⁾

Since, there is no specific tool developed for PLHIV to assess their nutritional status, therefore, in the present study, Mini Nutritional Assessment (MNA) Scale developed by Nestle which is a screening and assessment tool used to identify elderly patients at risk of malnutrition was used.⁽¹²⁾ The tool is divided into two parts-Screening and Assessment. If the respondent score 11 or less in the screening part, then the assessment questions are asked and if the respondent score 12 or more in screening, he/she is said to be in normal nutrition state and the assessment part is omitted. The screening and assessment scores are added to obtain the total malnutrition indicator score (maximum 30 points). If the final score is greater than 23.5 points, the patient is in normal state of nutrition. If the score ranges from 17 to 23.5 points, the patient is at risk of malnutrition and if score is below 17 points, the patient is said to be malnourished.

Results

Table 1 shows the sociodemographic profile of the sample. The age range for the sample was 21-59 years (mean-33.3 ± 8.3 years). It comprised people in the age group of 21-30 (46.3%) years the most followed by 31-40 years (36.5%). Hence, the most affected were the people from younger age groups. Heterosexual route and the unsafe sexual practices was the major route for HIV transmission (76.5%). Average family size for the present study sample was two adults (1-20) and

Table 1: Sociodemographic profile of the sample

	Male (N = 245)		Female (N = 144)		Transgender (N = 11)		Total (N = 400)	
Age range (years)								
21-30	113 (46.1)		69 (47.9)		3 (27.3)		185 (46.3)	
31-40	90 (36.7)		51 (35.4)		5 (45.4)		146 (36.5)	
41-50	37 (15.2)		17 (11.8)		2 (18.2)		56 (14)	
>=51	5 (2.0)		7 (4.9)		1 (9.1)		13 (3.2)	
Education								
Illiterate	52 (21.2)		62 (43.1)		9 (81.8)		123 (30.8)	
Primary	42 (17.1)		18 (12.5)		1 (9.1)		61 (15.2)	
Secondary	128 (52.2)		47 (32.6)		1 (9.1)		176 (44)	
College and above	23 (9.4)		17 (11.8)		0		40 (10)	
Marital status								
Single	39 (15.9)		5 (3.5)		8 (72.7)		52 (13)	
Married	191 (78.0)		89 (61.8)		3 (27.3)		283 (70.8)	
Divorcee/separated	3 (1.2)		0		0		3 (0.7)	
Widow	12 (4.9)		50 (34.7)		0		62 (15.5)	
Religion								
Hindu	208 (85.2)		126 (87.5)		5 (45.5)		339 (84.8)	
Muslim	30 (12.3)		13 (9.0)		6 (54.5)		49 (12.4)	
Others	6 (2.5)		5 (3.5)		0		11 (2.8)	
Family type								
Nuclear	162 (66.2)		90 (62.5)		0		252 (63)	
Joint	77 (31.4)		49 (34.0)		1 (9.1)		127 (31.8)	
Other	6 (2.4)		5 (3.5)		10 (90.9)		21 (5.2)	
Occupation	Present	Past	Present	Past	Present	Past	Present	Past
Heavy	31 (12.6)	37 (15.1)	5 (3.5)	4 (2.8)	0	0	36 (9)	41 (10.3)
Salaried	67 (27.3)	73 (29.8)	15 (10.4)	12 (8.3)	0	0	82 (20.5)	85 (21.2)
Business	108 (44.1)	118 (48.2)	7 (4.9)	6 (4.2)	1 (9.1)	1 (9.1)	116 (29)	125 (31.2)
Other	2 (0.8)	2 (0.8)	2 (1.4)	2 (1.4)	10 (90.9)	10 (90.9)	14 (3.5)	14 (3.5)
Unemployed	37 (15.1)	15 (6.1)	115 (79.9)	120 (83.3)	0	0	152 (38)	135 (33.8)
Annual income (Rs.)								
<=20,000	41 (16.7)		50 (34.7)		0		91 (22.8)	
20,001-30,000	65 (26.6)		35 (24.4)		2 (18.2)		102 (25.5)	
30,001-41,000	52 (21.2)		29 (20.1)		5 (45.4)		86 (21.5)	
41,001-84,000	56 (22.9)		19 (13.2)		2 (18.2)		77 (19.2)	
>=84,001	31 (12.6)		11 (7.6)		2 (18.2)		44 (11)	

Figures in parentheses indicates percentage within group

two children (0-10). At the time of interview, 38% of the sample was unemployed, 29% was into some kind of business, 20.5% was salaried population, 9% was involved in of heavy work like cultivation or construction work and 3.5% reported to be students or domestic help. An increase of 12.6% in the rate of unemployment from the time of detection of virus to the time of interview was seen in the present sample. The major reasons reported for the same were ill health and their HIV status.

The mean CD4 count for the sample was 291.68 ± 183.81 (259.5 median; 12-1211 range) [Table 2] cells/cumm. Classification indicates that 30% of the sample had irreversible condition known as AIDS (indicated by CD4 count <200 cells/cumm); 60% had damaged immune system as indicated by CD4 count between 200 and 500 cells/cumm and only around 10% of the sample had CD4 count above 500 cells/cumm. No significant

differences were found between the gender as tested by chi-square test ($P > 0.05$).

The anthropometric profile is shown in Table 3. The mean height of the sample was 160.8 ± 5.8 cm. The mean weight of the sample was recorded as 51.5 ± 9.7 kg ranging from 27 to 87.3 kg. The mean BMI of the sample was 19.73 ± 3.55 kg/m² ranging from 10.2 to 39.5 kg/m². No significant differences were found between the groups ($P > 0.05$). Since there was a wide range in the BMI, the subjects were also classified according to the standard cut-off values for BMI as given by World Health Organization (2004) for Asians.⁽¹³⁾ The classification shows that 45.6% of the sample had BMI within the normal range of 18.5-22.9 kg/m², while around 40% of the sample was underweight with BMI <18.5 kg/m². Only around 15% of the sample fell in to the category of overweight and obese (>23 kg/m²).

Table 2: Human immunodeficiency virus-related information of the sample

Treatment status				
On ART	166 (67.8)	89 (61.8)	7 (63.6)	262 (65.5)
Not on ART	79 (32.2)	55 (38.2)	4 (36.4)	138 (34.5)
Mode of Transmission				
Sexual Route	187 (76.3)	114 (79.2)	5 (45.4)	306 (76.5)
Injection drug users	8 (3.3)	1 (0.6)	5 (45.4)	14 (3.5)
Blood Transfusion	13 (5.3)	15 (10.4)	0	28 (7)
MTCT	2 (0.8)	0	0	2 (0.5)
Probable unsafe injection	14 (5.7)	1 (0.7)	1 (9.2)	16 (4)
Unknown	21 (8.6)	13 (9.0)	0	34 (8.5)
Infected member in the family				
Yes	80 (32.6)	69 (47.9)	8 (72.7)	157 (39.3)
No	165 (67.4)	75 (52.1)	3 (27.3)	243 (60.7)
CD4 (cells/cumm)	294.1±202.5 (250, 22-1211)	287.9±152 (271, 12-890)	286.2±129.3 (275, 131-584)	291.68±183.81 (259.5, 12-1211)

ART: Antiretroviral center, MTCT: Mother to child transmission

Table 3: Anthropometric profile of the sample

Parameter	Male (n = 245)		Female (n = 144)		Transgender (n = 11)	
	Mean ± SD	Range	Mean ± SD	Range	Mean ± SD	Range
Height (cm)	164.9±5.8 ^a	149-180	153.5±7.1 ^b	135.4-174	165.2±6.8 ^a	-179
Weight (kg)	53±8.8 ^a	29.9-84	47.3±10.1 ^b	27-87.3	56.6±8.4 ^a	45.4-70.4
BMI (kg/m ²)	19.5±3.1	11.3-30.6	20.1±4.3	10.2-39.5	20.7±2.1	18.1-24.2
WC (cm)	75.2±9.5 ^a	52-110	70.3±9.5 ^b	54.6-101.5	79.4±11.5 ^a	65-95.5
HC (cm)	84.2±5.9	68-106	83.6±9.3	65.1-123.4	86.3±6.3	78-95.3
WHR	0.89±0.08 ^a	0.73-1.16	0.84±0.06 ^b	0.7-0.98	0.92±0.09 ^a	0.81-1.1
MUAC (cm)	23.3±2.9	14.5-32	23±3.3	14.7-34.5	24±2.8	19.3-29
Calf Cir (cm)	30±2.7 ^a	20-37.2	28.6±3.4 ^b	21.6-40.4	30.9±1.9 ^a	28.3-33.5

*Different superscripts indicate significant difference ($P < 0.05$). BMI: Body mass index, HC: Hip circumference, MUAC: Midupper arm circumference, SD: Standard deviation, WC: Waist circumference, WHR: Waist-to-hip ratio

The mean waist circumference (WC) of the sample was 73.6 ± 9.8 cm (52-110 cm). The mean hip circumference (HC) of the sample was 84 ± 7.3 cm (65.1-123.4 cm). The mean MUAC of the study sample was found to be 23.2 ± 3.06 cm. No significant differences were found between the genders. The mean calf circumference (CC) of the sample was 29.5 ± 3.1 cm. The mean CC of men and triglycerides (TG) was significantly greater than that of females ($P < 0.05$). The mean WHR of the sample was 0.87 ± 0.07 , the WHR of males and TG being significantly higher than that of females ($P < 0.05$).

All anthropometric measurements were found to correlate positively and significantly with CD4 count [weight, BMI, WC, MUAC, and CC ($P < 0.01$) and HC ($P < 0.05$) by spearman rank correlation. This gives an indication that improvement in the physical health (as indicated by anthropometric measurements) may lead to the increase in CD4 levels of PLHIV.

Dietary profile

The mean nutrient intakes and NAR for each nutrient is shown in [Table 4]. The sample could not meet the requirements for energy, protein, calcium, iron, riboflavin, niacin, folic acid, B12, copper, and zinc. The

intakes for fat, vitamin C, thiamine, and magnesium met the requirements laid down by ICMR (2010).⁽⁹⁾ Contribution of protein, carbohydrate, and fat to the day's energy intake was also calculated. It was found that for the entire sample 60% of day's energy was furnished by carbohydrate, 11-12% by protein and 24-25% by fat. This corresponds to the ideal contribution of 60% by carbohydrate, 20-30% by fat and 10-15% by protein.

NAR was calculated for each nutrient wherein NAR of 0.66-1.00 depicts the adequate intake of the nutrient (2/3rd of the RDA) [Table 4].

The intake for micronutrients like calcium, riboflavin, folic acid, vitamin B12, copper, and zinc was much below the recommendations as indicated by majority of the subjects having NAR for these nutrients below 0.66.

Mini nutritional assessment

Figure 1 shows the distribution of sample according to MNA classification. Nearly 50% of the sample was at-risk of malnutrition; 34% was malnourished, and only around 15% fell in the category of normal. Gender wise no significant differences were seen ($P > 0.05$); however, there were more percentage of

Table 4: Mean nutrient intake and nutrient adequacy ratio

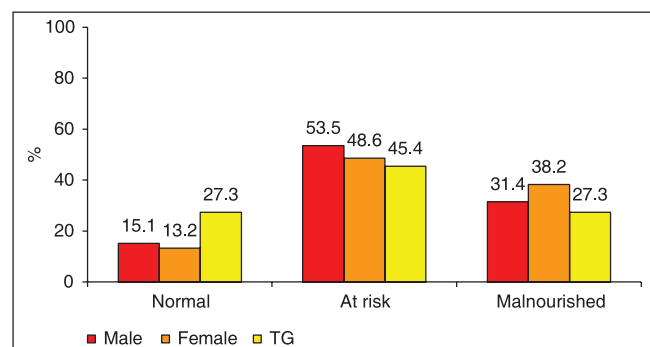
Nutrient [RDA]	Male (n = 245) [n (%)]	Female (n = 144) [n (%)]	Transgender (n = 11) [n (%)]
Energy [2320 (M); 1900 (F)] (kcal)			
Mean±SD	1649.1±556.2	1380.7±540.5	1507.2±354.6
<0.66	92 (37.6)	54 (37.5)	4 (36.4)
0.66-1.00	131 (53.5)	69 (47.9)	7 (63.6)
>1.00	22 (9.0)	21 (14.6)	0
Protein [60 (M); 55 (F)] (g)			
Mean±SD	47.3±18.4 (11.5)	36.8±16.7 (10.7)	45.2±21.5 (12)
<0.66	85 (34.7)	75 (52.1)	5 (45.4)
0.66-1.00	113 (46.1)	53 (36.8)	2 (18.2)
>1.00	47 (19.2)	16 (11.1)	4 (36.4)
Carbohydrate (60%) (g)	249.7±87.2 (60.6)	204.2±78.5 (59.2)	229.6±53.8 (60.9)
Fat [25 (M); 20 (F)] (20-30%) (g)			
Mean±SD	44.4±18.1 (24.2)	38.9±19.1 (25.4)	42.4±16.1 (25.3)
<0.66	11 (4.5)	16 (11.1)	1 (9.1)
0.66-1.00	15 (6.1)	5 (3.5)	00
>1.00	219 (89.4)	123 (85.4)	10 (90.9)
Calcium [600 mg (M&F)] (mg)			
Mean±SD	528.8±417.2	445.6±321.1	501.3±259.3
<0.66	112 (45.7)	71 (49.3)	3 (27.3)
0.66-1.00	61 (24.9)	37 (25.7)	5 (45.4)
>1.00	72 (29.4)	36 (25)	3 (27.3)
Iron [17 (M);21 (F)] (mg)			
Mean±SD	13.5±7	10.3±6.8	9.1±4.4
<0.66	94 (38.4)	1 (0.7)	7 (63.6)
0.66-1.00	86 (35.1)	2 (1.4)	4 (36.4)
>1.00	65 (26.5)	141 (97.9)	0
Vitamin C [40 mg (M&F)] (mg)			
Mean±SD	75.4±95.4	63±78	82.8±90.1
<0.66	53 (21.6)	44 (30.6)	1 (9.1)
0.66-1.00	37 (15.1)	28 (19.4)	2 (18.2)
>1.00	155 (63.3)	72 (50)	8 (72.7)
Thiamine [1.2 (M); 1.1 (F)] (mg)			
Mean±SD	1.23±0.56	0.93±0.48	0.92±0.42
<0.66	60 (24.5)	43 (29.9)	5 (45.4)
0.66-1.00	63 (25.7)	38 (26.4)	2 (18.2)
>1.00	122 (49.8)	63 (43.7)	4 (36.4)
Riboflavin [1.4 (M); 1.1 (F)] (mg)			
Mean±SD	0.8±0.39	0.65±0.39	0.74±0.38
<0.66	163 (66.5)	91 (63.2)	10 (90.9)
0.66-1.00	64 (26.1)	40 (27.8)	0
>1.00	18 (7.4)	13 (9.0)	1 (9.1)
Niacin [16 (M); 12 (F)] (mg)			
Mean±SD	10.7±4.7	8±3.8	8.1±3.3
<0.66	110 (44.9)	67 (46.5)	8 (72.7)
0.66-1.00	102 (41.6)	57 (39.6)	3 (27.3)
>1.00	33 (13.5)	20 (13.9)	0
Folic Acid [200 (M&F)] (mcg)			
Mean±SD	55.3±32.1	42.9±30.1	43.2±28
<0.66	235 (95.9)	141 (97.9)	11 (100)
0.66-1.00	10 (4.1)	2 (1.4)	0
>1.00	0	1 (0.7)	0
B12 [1 (M&F)] (mcg)			
Mean±SD	0.87±1.4	0.51±0.95	1.7±2.2
<0.66	178 (72.7)	121 (84.0)	7 (63.6)
0.66-1.00	14 (5.7)	7 (4.9)	0
>1.00	53 (21.6)	16 (11.1)	4 (36.4)

(Continued)

Table 4: Mean nutrient intake and nutrient adequacy ratio (Continued)

Nutrient [RDA]	Male (n = 245) [n (%)]	Female (n = 144) [n (%)]	Transgender (n = 11) [n (%)]
Copper [2.2 (M&F)] (mg)			
Mean±SD	1.55±0.69	1.15±0.57	1.23±0.64
<0.66	109 (44.5)	101 (70.1)	7 (63.6)
0.66-1.00	96 (39.2)	38 (26.4)	2 (18.2)
>1.00	40 (16.3)	5 (3.5)	2 (18.2)
Magnesium [340 (M); 310 (F)] (mg)			
Mean±SD	347.5±145.9	264.4±122.5	300±105.7
<0.66	45 (18.4)	43 (29.9)	3 (27.3)
0.66-1.00	72 (29.4)	49 (34.0)	4 (36.4)
>1.00	128 (52.2)	52 (36.1)	4 (36.4)
Zinc [12 (M); 10 (F)] (mg)			
Mean±SD	5.8±2.5	4.5±2.2	4.4±2
<0.66	194 (79.2)	116 (80.6)	10 (90.9)
0.66-1.00	51 (20.8)	27 (18.7)	1 (9.1)
>1.00	0	1 (0.7)	0

<0.66, 0.66-1.0, and >1.0 are nutrient adequacy ratio categories. RDA: Recommended dietary allowance, SD: Standard deviation

**Figure 1:** Classification of subjects according to MNA scale

males in at-risk category, while more percentage of females fell in the malnourished category. Further analysis of MNA score along with the anthropometric measurements indicate that in males and females, there was a significant decline ($P < 0.05$) in the values for weight, BMI, WC, hip circumference, MUAC and CCas the stage changed from "normal" to "at risk" to "malnourished." This indicates that as the subject's malnutrition risk increases, their physical health declines [Figure 1].

Discussion

The present study determined the anthropometric and nutritional profile of PLHIV in Delhi, India. It comprised of majority of individuals from younger age-group, that is, 21-30 years. NACO also reports that in India people in the age group of 15-29 years comprise almost 25% of the country's population and they account for 31% of AIDS burden.⁽¹⁴⁾ Chakraborty *et al.*,⁽¹⁵⁾ reported heterosexual transmission as the major route of HIV transmission among PLHIV from Eastern India. The results of the present study are also in line with the National level data indicates that unprotected sex (87.4% heterosexual and

1.3% homosexual) is the major route of HIV transmission. Also, an increase in the rate of unemployment among the subjects after detection of HIV due to poor health conditions and HIV infection per se elicits the importance of counseling of PLHIV at the time of detection of the HIV positive status. The interview sessions with the subjects brought forward issues like hibernation, shock, loss of interest in life after the detection of positive status.

In our study the mean BMI of the sample was 19.7 ± 3.6 kg/m² (19.5 ± 3.1 for males; 20.1 ± 4.3 for females and 20.7 ± 2.1 for TG) which is quite similar to the BMI of PLHIV from Kenya 20.5 kg/m² in male and 21.7 kg/m² in female.⁽⁶⁾ Measurement of body circumferences is necessary in PLHIV in order to assess the extent of wasting and the redistribution of body fat (lipodystrophy) in these individuals. Abnormal accumulations of intraabdominal fat,⁽¹⁶⁻²⁰⁾ enlarged dorsocervical fat masses,⁽²¹⁻²³⁾ and fat loss from the arms and legs, face, and buttocks are the most visible signs of metabolic disturbance in PLHIV. As compared with normal HIV-negative population,⁽²⁴⁻²⁸⁾ PLHIV have been found to have greater WCs, greater WHRs but smaller hip circumferences have been reported by various studies.^(29,30) There are no recommendations for waist and hip circumferences and WHR for PLHIV. However, comparing with the general recommendations reveals that both WC and WHR for both males and females was below the ideal cut-offs.⁽³¹⁾ As truncal visceral fat deposition is considered as a long-term consequence of ART medications,^(25,32) the present sample was either not on ART or was consuming ART medications for not more than 6 months. This can be a reason for not having high WCs among the present study population. However, low WC indicates the prevalence of malnutrition among the sample.

As no nutritional screening tool developed for PLHIV, MNA tool was used and it indicated a large percentage of PLHIV subjects in “at risk” category of malnutrition. Similar studies conducted on PLHIV from Nigeria and Uganda using other scales (Subjective Global Assessment tool) concluded that a large percentage of HIV population was in mild-moderate malnutrition category.^(33,34)

With regard to dietary intake, the sample had deficient intakes for all the nutrients except fat, vitamin C, thiamine, and magnesium. In our study population, poor dietary energy intake is prevalent indicating a direction towards declining nutritional health. With majority of PLHIV having NAR between 0.66 and 1.00 for protein and >1.00 for fat indicates high fat-low protein diet. The mean contribution of carbohydrate was 60%, protein 15%, and fat 25% to the day’s total energy intake. Though, the contribution was within the prescribed limits but ideally as cited in the literature the diets of PLHIV should be less in fat and more in protein for overall better quality of diet. Therefore, the diets of Indian PLHIV may require alteration in terms of reducing the quantity of fat. Decreased dietary intake of certain micronutrients is associated with faster HIV disease progression, altered immune function, and mortality.⁽⁶⁾ The present study also reports poor micronutrient intake by Indian PLHIV with 40% having NAR <0.66 for calcium, 73% for riboflavin, 55% for niacin, 95% for folic acid, 73% for B12, 59% for copper, and 84% for zinc. Interview session with the subjects revealed that the consumption of fresh fruits was low and diets majorly comprised of staples (wheat/ rice and pulses). Pulses were the major source of protein and among nonvegetarians chicken was the major source of protein.

A number of national and international studies have documented compromised nutritional status of PLHIV in terms of low BMI and belonging to mild to moderate category of malnutrition, but data regarding the actual intakes of nutrients and complete nutritional profile are lacking. The present study, therefore, assessed the actual intake of nutrients by PLHIV in India, their comparisons with the national RDA which indicated poor dietary intake and need of nutritional intervention which may be in the form of supplementation of BCC. Poor nutrient intake over a long period of time could contribute to further worsening of the nutritional status not only physically but in terms of biochemical derangement as well. Thus, there is a need to develop a database on actual nutrient intakes by PLHIV in India which would pave way for the development of necessary interventions to improve the nutrient intakes for better nutritional status.

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