Original Article

The effect of nurse initiated nutritional counselling with hatha yoga on nutritional status of HIV infected adolescents: Randomized controlled trial

Rajathi Sakthivel, Shankar Shanmugam Rajendran[1]

Head of Child Health Department, Hindu Mission College of Nursing, [1]Department of Research and Education, College of Nursing, Madras Medical College, Affiliated to The Tamil Nadu Dr. M. G. R. Medical University, Chennai, Tamil Nadu, India

ORCID:
Rajathi Sakthivel: 0000-0003-1191-0109;
Shankar Shanmugam Rajendran: 0000-0002-1369-0990

Abstract

Context: The adolescence is a period of fabulous changes made in growth as physically, emotionally, and socially; because of deprived nutrition, these changes become declined and more complicated for an adolescent diagnosed with HIV.

Aim: The study aims to evaluate the effectiveness of nurse-initiated nutritional counseling with *Hatha yoga* on nutritional status of HIV-infected adolescents.

Setting and Design: This was randomized controlled trial research with a wait-list control group design adopted in selected antiretroviral therapy centers in Chennai, Tamil Nadu.

Materials and Methods: Through simple random technique, a total of 388 HIV-infected adolescents were divided into experimental (195) and control (193) groups. The data were collected from samples/caregivers through a structured nutritional assessment questionnaire, and anthropometric measurements were also noted. The nutritional counseling was given to experimental group alone and *asanas* were demonstrated by a researcher. The data were collected from both groups at 0, 3rd, and 6th month intervals.

Statistical Analysis Used: Data were analyzed using descriptive statistics of mean and standard deviation and inferential statistics such as Chi-square, ANOVA "*F*"-test, and Bonferroni *t*-test.

Results: According to the "Z" score, the baseline assessment showed that 28% in the experimental and 29% in the control group of HIV-infected adolescents were malnourished, and the remaining percentage was within normal. However, on 6th month evaluation, it reduced to 19% and 28%, respectively. Hence, nutritional gain score was increased to 9.3% in the experimental and 1.5% in the control group with 95% confidence interval.

Conclusion: The motivational counseling along with *Hatha yoga* has effectiveness to increase nutritional status of HIV-infected adolescents in the experimental group than in the control group.

Keywords: Adolescents, Antiretroviral therapy, Counseling, HIV, Yoga, Nutrition

Address for correspondence: Dr. Rajathi Sakthivel, Hindu Mission College of Nursing, Chennai, Tamil Nadu, India.
E-mail: rajathisakthi80@gmail.com

Received: 10 June 2021; **Revised:** 28 May 2022; **Accepted:** 30 May 2022; **Published:** 05 September 2022

Access this article online	
Quick Response Code:	Website: www.jnmsjournal.org
	DOI: 10.4103/jnms.jnms_94_21

How to cite this article: Sakthivel R, Rajendran SS. The effect of nurse initiated nutritional counselling with hatha yoga on nutritional status of HIV infected adolescents: Randomized controlled trial. J Nurs Midwifery Sci 2022;9:180-90.

INTRODUCTION

Nutrition and HIV are interrelated; the relationships between these two are multifaceted and multidirectional.[1] The combination of antioxidants in the diet and antiretroviral therapy (ART) lowers the viral loads and generation of reactive oxygen species (ROS) from antiretroviral treatment. HIV is associated with substantial oxidative stress and ROS; consequently, decreasing the body's battle with HIV results in the decline of antioxidants that cause the progression of HIV to AIDS. The antioxidants are substances that restrain oxidation and sentinel the body from the detrimental effects of free radicals, which play a vital role in scavenging excess ROS to sustain normal physiological conditions.[2] The nourishment plays a vital role in the immune system of HIV/AIDS patients; on a global scale, it is presumed that nutrients and antioxidant management may offer a cost-effective therapeutic approach for people living with HIV (PLHIV).[3]

According to the stages of HIV, the progression to AIDS causes distorted body functions, reduction in food intake, difficulties interrelated to digestion and absorption, alters the metabolism of nutrients, improper utilization of fats, and inability to produce saliva and other juices..[4,5] The weight and height growth impairment is one of the most common manifestations in HIV-infected children and may be the first sign of disease and considered an indicator of disease progression.[6] Early initiation of ART across all age groups regardless of immunological status is essential for restoring growth. Coordination of ART initiation, nutritional supplementation programs, and concurrent prophylaxis is required to ameliorate growth deficits and pubertal delays.[7] Coovadia and Bobat revealed that zinc deficiency may boost HIV replication, harm cellular immunity, and accelerate apoptosis of cells concerned in the immune responses.[8] Chatterjee *et al.* found that malnutrition in children increased the risk of mortality.[9] Francis *et al.* reported that, among 205 participants, the prevalence of stunting was 36.2% (72/199); among this, 11.1% (22/199) of adolescents were severely stunted, 18% thin, and 8% severely thin.[10] Another study conducted among 7–17-year-old HIV-infected adolescents in Brazil found that 86% of participants had a nutritional deficiency and low body mass index (BMI) for age was significant in poor immune function, growth, and control of chronic diseases.[11]

The well-nourished adolescents infected with HIV are better able to offer some resistance to opportunistic infections (OIs) and tolerate side effects of ART management, but the malnourished adolescents with AIDS have minimal internal resources to fight OIs. There are many practical and unique considerations and challenges to combination ART (cART) utilize in perinatally infected adolescents even in weight shunting, delayed puberty, candidiasis, poor dentition, poor palatability, and gastrointestinal (GI) intolerance.[1,2,4] Tang *et al.* in their systematic review on 21 studies suggested that nutritional assessment and counseling are needed to improve good clinical outcomes.[12] Carmo *et al.*, conducted a study on 58 children/adolescents aged between 5 to 20 years and identified that PLHIV is at increased risk for bone mineral density changes and lower serum levels of Vitamin D, especially in HIV-infected children.[13] Hence, these adolescents have needed to enhance nutritional requirements demanding diet rich in protein, vitamins, and minerals due to rapid growth spurt and better physical activity. These concerns can be declined by periodical screening and nutritional education for all adolescents living with HIV (ALHIV).

Millen reported that "The Complementary and Alternative Medicine" of *Yoga* is superb tool for the stress decline when done appropriately." It can help relieve various symptoms, as well as the ART medication side effects, including digestive problems and joints pain. "A regular yoga practice is a simple way to achieve good strength, boost immune system, and enhance circulation in all over the body."[14] Oka and Lkhagvasuren stated that yoga may be associated with more beneficial effects for people with functional somatic symptoms and chronic diseases, as well as healthy participants. The asanas, pranayama, meditation, and isometric yoga have reductions in perceived stress and uncomfortable symptoms as well as improved mood and quality of life in chronic illness.[15] Yoga seems to be as safe when related to other exercise types.[16] In Asia, among the ART experienced perinatally HIV-infected adolescents, 16% had a deficient bone mass, which was linked to low BMI, height, and weight Z-scores.[7] Hence, the researchers felt that nutritional counseling and education with Hatha yoga would be beneficial to reduce the nutritional issues, as well as increase quality and span of life in all ALHIV. This research was conducted with the aim to assess the level of nutritional status both in experimental and control groups, to evaluate the effectiveness of nutritional counseling with Hatha yoga among HIV-infected adolescents, and to find an association between the posttest nutritional gain score with selected demographic variables among HIV-infected adolescents in both groups.

MATERIALS AND METHODS

The experimental design of randomized controlled trial was adopted. The sample size was calculated through power analysis, fixed as 200 per each group (with 10% attrition rates: 191 + 19 = 210) for statistical significance.

Through a simple random lottery method, a total of 400 participants from four ART centers were selected, and samples coming on odd days were considered as control group and even days were experimental group. The both genders of adolescents aged between 10 and 17 years, who were in stage I–III, on cART more than 3 months, and willing to enroll were included in the study. The adolescents who are all in clinical stage IV and hospitalized during the study period were excluded from the study.

Ethical considerations

The proposal of the study was approved by the Institutional Ethics Committee and Clinical Trial Registry of India. Ethical code number: 30102013. Clinical Trial Registry of India: CTRI/2015/02/005521. The purpose of the study was explained in selected ART centers, Chennai, and permission was obtained from the National AIDS Control Organization and Tamil Nadu State AIDS | Control Society. Informed consent was taken from caregivers/parents, and assent form was obtained from adolescents who are all known about their disclosure status. The anonymity of the subjects and confidentiality of data were ensured.

Instruments

The literature review and expert's opinion were carried out in preparing the three different questionnaires to collect data. The first tool was sociodemographic pro forma of adolescents and its caregivers of HIV-infected adolescents. The second tool consisting of structured format for clinical information of adolescents includes diagnosis of HIV in years, probable route of transmission, HIV stage, on ART, and history of antituberculosis therapy. The third tool was nutritional assessment questionnaire consisting of two sections – Section A: It includes anthropometric assessments of height, weight, BMI, Mid Upper Arm Circumference (MAC), waist circumference (WC), and skin fold thickness (triceps). All the anthropometric measurements were taken according to standard procedures of the National Institute of Health. Section B: It covers the structured questionnaire of clinical assessments such as history of nutritional deficiency and head-to-foot assessments.

Scoring key of nutritional status

The anthropometric measurements of height, weight, and BMI were compared with National Centre of Health Statistics (NCHS, 1970s). The reference value for mid arm circumference (MAC), WC, and skin fold thickness (triceps) for adolescents is still in controversial view, the investigator took a "0" month assessment as a baseline value, and further assessment on the 3rd and 6th month was considered as an improvement. According to the NCHS, the "Z" score was interpreted as normal $-2.0 < Z$ score, moderately malnourished $-3.0 < Z$ score <-2.0, and severely malnourished – Z score <-3. The reliability was assessed by using Cronbach's alpha and inter-rater method. It shows that the correlation of coefficient value is very high, i.e., 0.90, and internal consistency of the tool was reliable to execute the main study.

Data collection procedure

After the formal approval obtained from the all concerned departments, the researcher selected 400 adolescents based on the eligibility criteria [Figure 1]. The data were collected from the caregivers/adolescents through in-depth structured interview method and observation of hospital records. The assessment of nutritional status was taken by anthropometric measurements. The initial assessment score was taken as pretest at "0" month. On the same day, 20–25 min of nutritional counseling using flash cards was given to an experimental group of adolescents/caregivers regarding antioxidants rich in diet, the importance of nutrition for managing minor ailments. The selected asanas of Padmasana, Vajrasana, Trikonsana, Ushtrasana/Ardha matsyendrasana Bhujangasana, Shavasana, and Pranayama were demonstrated by a researcher within the duration of 15–30 min and instructed to do redemonstration by the study subjects. The researcher had given special attention to a few adolescents who had learning difficulties in practicing the asana. For these adolescents, the researcher was given extra time of 10–15 min for maximum to learn the asana on the same day itself, i.e., the total time taken for each sample was 45 min to 1 h at "0" assessment. The intervention was given to the study group for up to 6 months. Every month, the reinforcement counseling with a duration of 10–15 min and follow-up of yoga practice was monitored with a minimum duration of 30–45 min. They were also given pamphlets for practicing the selected asana every day for minimum duration of 15–20 min on their own at home and continue antioxidants diet in their daily meal. The researcher had been given a diary for an interventional aid and instructed to maintain daily after the daily yoga practice. However, in control group, subjects were in routine care as conventional management. The data were assessed at 3rd and 6th month intervals by both groups. At the end of the 6th month, the cursory instructions were given to the control group. The Statistical Package for the Social Sciences (SPSS) version 16 (IBM) was used to analyze the present study data.

RESULTS

Among 388 participants, in the experimental and control groups, nearly half of the participants (47% and 40%,

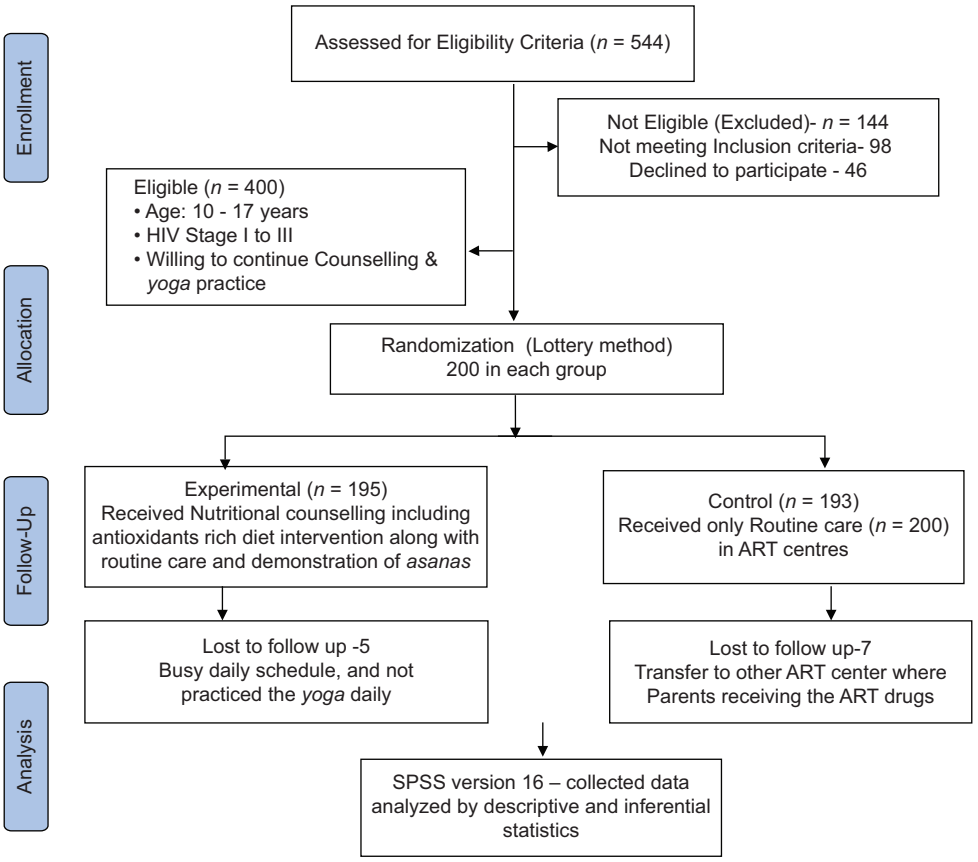

Figure 1: Consort diagram. ART: Antiretroviral therapy

respectively) were in the age group of 13–15 years, and in gender-wise, 50% and 57% were males, respectively. Regarding educational status, 40% and 44% were in middle level of education, respectively, and majority, i.e., 85% and 77%, belonged to Hindu in both groups. Regarding demographic variables of adolescents' caregivers, majority, i.e., 70% and 69%, were in the age group of 36–50 years, and in gender-wise, 70% and 66% were females. In regard to relationship of adolescents, 61% and 66% of children were taken care by caregivers and 27% and 22% by mothers. Regarding educational status, nearly 50% of adolescents completed the school level of education and 30% and 24% completed college level education, respectively, in both groups. In consider with occupational status, 44% and 49%, respectively, in both groups were employed and 55% and 53% resided in urban areas, respectively, in both groups.

In regard to clinical assessment, respectively, in both groups [Table 1], 5% and 6% had previous history of nutritional deficiency and nearly 46% in the experimental and 53% in the control group of adolescents had not followed deworming regularly. In regard to clinical signs and symptoms in both groups, the presence of dry skin were seen in 4% and 6%, respectively, at baseline assessment; however, in subsequent evaluation, it was reduced to 1% in the experimental and remaining same in the control group. Regarding oral issues, 6% and 8% in respective groups had problems in the baseline assessment. At 6th month evaluation, there is marked improvement in the experimental group, and no one is found with dryness of lips, bleeding gums, and aphthous ulcers, but still 5% had oral issues in the control group. In GI system, at baseline assessment, 25%–28% of respective group of adolescents had various GI problems. However, at the 6th month evaluation, it was reduced in experimental group, whereas in control group, there were no significant changes found at 6th month evaluation. In regard to musculoskeletal system, the presence of muscle wasting and lipodystrophy was seen in 13% and 11% in the experimental group, whereas in control group, 10% and 7%, respectively, in both the groups.

Among 388 participants, all the nutritional variables except height had significance in repeated measures of the ANOVA 'F' test at $P = 0.001$ *** [Table 2]. It shows that except for height, there is a marked improvement in all other nutritional variables of HIV-infected adolescents. However, the Bonferroni t-test revealed that all the variables had significance from baseline to 6th-month evaluation at $P < 0.01$ ** and 3rd to 6th-month evaluation had significance at $P < 0.05$* except height.. However, in control group, all

Table 1: Information related to clinical histories of sign and symptoms in both groups of HIV-infected adolescents

Clinical history assessment	Group		Chi-square test (χ^2, *P*)
	Experimental, *n* (%)	Control, *n* (%)	
Previous history nutritional deficiency			
Yes	9 (4.6)	11 (5.7)	0.23, 0.63 (NS)
No	186 (95.4)	182 (94.3)	
De wormed of subject regularly			
Yes	105 (53.8)	91 (47.2)	1.73, 0.19 (NS)
No	90 (46.2)	102 (52.8)	
Dry skin			
"0" month			
Yes	8 (4.1)	12 (6.2)	0.88, 0.34 (NS)
No	187 (95.9)	181 (93.8)	
3rd month			
Yes	5 (2.6)	10 (5.2)	1.78, 0.18 (NS)
No	190 (97.4)	183 (94.8)	
6th month			
Yes	2 (1.0)	13 (6.7)	8.50, 0.01** (S)
No	193 (99.0)	180 (93.3)	
Oral			
"0" month			
Yes	17 (8.7)	13 (6.7)	0.53, 0.46 (NS)
No	178 (91.3)	180 (92.3)	
3rd month			
Yes	9 (4.6)	11 (5.6)	0.23, 0.62 (NS)
No	186 (95.4)	182 (93.3)	
6th month			
Yes	0	10 (5.1)	15.39, 0.01** (S)
No	195 (100.0)	183 (94.9)	
GI system			
Yes	56 (28.7)	49 (25.3)	0.54, 0.46 (NS)
No	139 (71.3)	144 (74.7)	
If yes "0" month			
Appetite	38 (67.9)	32 (65.3)	1.58, 0.66 (NS)
Nausea	14 (25.0)	10 (20.4)	
Vomiting	2 (3.6)	4 (8.2)	
Diarrhea	2 (3.5)	3 (6.1)	
3rd month			
Appetite	21 (2.4)	28 (51.9)	5.89, 0.05* (S)
Nausea	8 (27.6)	18 (33.3)	
Vomiting	0	8 (14.8)	
Diarrhea	0	0	
6th month			
Appetite	7 (87.5)	25 (55.5)	6.00, 0.05* (S)
Nausea	1 (12.5)	15 (33.3)	
Vomiting	0	3 (6.7)	
Diarrhea	0	2 (4.5)	
Extremities			
Muscle wasting			
Yes	25 (2.8)	19 (9.8)	0.85, 0.35 (NS)
No	170 (87.2)	174 (90.2)	
Edema			
No	195 (100.0)	193 (100.0)	0.00, 1.00 (NS)
Lipodystrophy			
Yes	22 (11.2)	13 (6.7)	2.44, 0.11 (NS)

GI: Gastrointestinal, NS: Not significant, S: Significant

nutritional variables of HIV-infected adolescents did not have significance in ANOVA *F*-test and Bonferroni *t*-test [Table 3].

The pre-and post-test "Z" score interpretation of HIV-infected adolescents [Table 4], in the experimental group, the chi-square value of 20.7 is significant in the $P = 0.05$*. However, in control group, there would not be any progress seen in nutritional status and Chi-square value of 1.22 is not significant at $P > 0.05$ [Table 3]. It depicts that there is gradual increase in nutritional status of HIV-infected adolescents in the experimental group than in the control group.

Regarding percentage-wise distribution of nutritional status gain score in experimental group, 72% were only in normal built and 28% were malnourished. However,

Table 2: Anthropometric variables of HIV-infected adolescents in experimental group

Nutritional variables	Experimental (mean±SD)			Repeated measure ANOVA *F*-test (*F*, *P*)	Bonferrni *t*-test
	"0" month	3rd month	6th month		
Height	141.36±12.7	142.26±14.63	142.57±12.36	4.40, 0.04	Base versus 6th month (*P*<0.01)
Weight	34.39±8.91	35.00±8.86	37.01±17.47	15.32, 0.001	Base versus 6th month (*P*<0.01) 3rd versus 6th month (*P*<0.05)
BMI	16.82±2.31	17.08±2.29	17.43±2.28	28.22, 0.001	Base versus 6th month (*P*<0.01) 3rd versus 6th month (*P*<0.05)
WC	52.31±7.55	52.90±7.62	54.02±7.57	63.88, 0.001	Base versus 6th month (*P*<0.01) 3rd versus 6th month (*P*<0.05)
MAC	17.85±1.83	17.98±1.87	18.15±1.85	35.13, 0.001	Base versus 6th month (*P*<0.01) 3rd versus 6th month (*P*<0.05)
Skin fold thickness	3.75±0.86	3.88±0.87	4.20±0.76	33.44, 0.001	Base versus 6th month (*P*<0.01) 3rd versus 6th month (*P*<0.05)

WC: Waist circumference, MAC: Mid arm circumference, BMI: Body mass index, SD: Standard deviation

Table 3: Anthropometric variables of HIV-infected adolescents in control group

Nutritional variables	Control group (mean±SD)			Repeated measure ANOVA *F*-test (*F*, *P*)	Bonferroni *t*-test
	"0" month	3rd month	6th month		
Height	139.84±11.82	139.92±11.80	140.21±11.71	0.95, 0.33	-
Weight	33.62±9.28	33.70±9.30	34.16±9.20	1.02, 0.30	-
BMI	16.80±2.37	16.83±2.37	16.98±2.33	1.11, 0.27	-
WC	52.36±5.77	52.42±5.79	52.68±5.75	0.88, 0.34	-
MAC	17.62±1.19	17.73±1.18	17.74±1.18	0.86, 0.35	-
Skin fold thickness	3.67±0.65	3.77±0.65	3.87±0.64	1.40, 0.24	-

WC: Waist circumference, MAC: Mid arm circumference, BMI: Body mass index, SD: Standard deviation

Table 4: "Z" score of interpretation of HIV-infected adolescents in both groups

Z score	Experimental			Control		
	Baseline, *n* (%)	3rd month, *n* (%)	6th month, *n* (%)	Baseline, *n* (%)	3rd month, *n* (%)	6th month, *n* (%)
−4.00–−3.00	13 (6.7)	9 (4.6)	2 (1.0)	11 (5.6)	10 (5.1)	9 (4.7)
−3.00–−2.00	42 (21.5)	38 (19.5)	35 (17.9)	45 (23.1)	44 (22.6)	44 (22.8)
−2.00–−1.00	37 (19.0)	32 (16.4)	29 (14.9)	27 (13.8)	24 (12.3)	25 (12.8)
−1.00–0.00	22 (11.3)	25 (12.8)	29 (14.9)	30 (15.4)	29 (14.9)	29 (14.9)
0.00–1.00	23 (11.8)	25 (12.8)	30 (15.4)	28 (14.4)	35 (17.9)	32 (16.4)
1.00–2.00	58 (29.7)	58 (29.7)	60 (30.8)	52 (26.7)	53 (27.2)	54 (27.7)
2.00–3.00	0	8 (4.1)	10 (5.1)	0	0	0
Total	195 (100)	195 (100)	195 (100)	193 (100)	193 (100)	193 (100)
Chi-square test	χ^2=20.74, *P*=0.05 (significant)			χ^2=1.22, *P*=0.97 (not significant)		

in the 6th month, normal level was increased to 81% and malnourished adolescents were reduced to 19%. The percentage-wise nutritional gain score is 9.3%. However, in control group, 71% were only in normal level and 29% were malnourished. However, in the 6th month, the normal level was increased to only 72% and malnourished adolescents are reduced to 28% [Figure 2]. The percentage-wise nutritional gain score was only 1.5%. It depicts that the experimental group has gained more score than control group.

In the experimental group, the association between nutritional status with demographic variables of HIV-infected adolescents was evaluated by the Chi-square test [Table 5]. 92% were normal in the younger age of 10–12 years and only 8% were in malnourished when compared to other age categories. In consideration with education, 93% and 87% were normal in primary and middle level educated adolescents, and both was significant at $P = 0.001$***. In regard to caregiver's age, majority of 94% in younger age

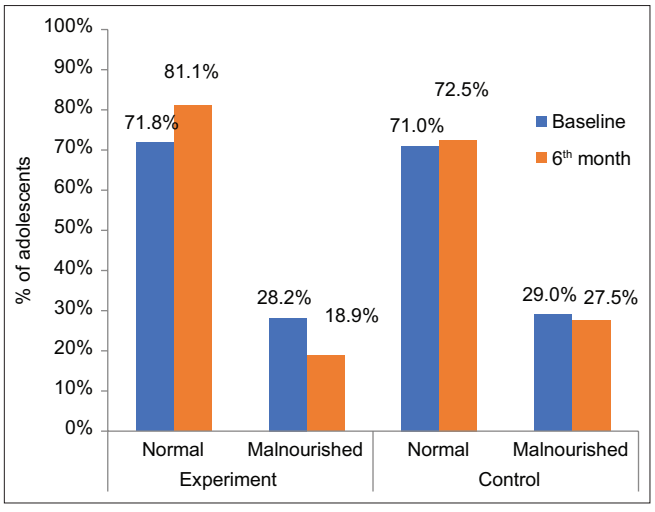

Figure 2: Percentage-wise distribution of nutritional gain score in both groups of HIV-infected adolescents

of 20–35 years were significant at $P = 0.03$*. In relationship with adolescents, highest percentage of 92% were associated

Table 5: Association between nutritional status with demographic variables of HIV-infected adolescents/caregivers in experimental group

Demographic variables	Normal, *n* (%)	Malnourished, *n* (%)	Total	Chi-square test (χ^2, *P*)
Age of adolescents (years)				
10–12	55 (91.7)	5 (8.3)	60	15.85, 0.001*** (S)
13–15	76 (83.5)	15 (16.5)	91	
16–18	27 (61.4)	17 (38.6)	44	
Sex				
Male	78 (80.4)	19 (19.6)	97	0.05, 0.82 (NS)
Female	80 (81.6)	18 (18.4)	98	
Education				
Primary	41 (93.2)	3 (6.8)	44	15.44, 0.001*** (S)
Middle	67 (87.0)	10 (13.0)	77	
Secondary	41 (69.5)	18 (30.5)	59	
Higher secondary	9 (60.0)	6 (40.0)	15	
Religion				
Hindu	129 (78.2)	36 (21.8)	165	5.68, 0.06 (NS)
Muslim	25 (96.2)	1 (3.8)	26	
Christian	4 (100.0)		4	
Age of caregivers (years)				
20–35	46 (93.9)	3 (6.1)	49	7.10, 0.03* (S)
36–50	105 (77.2)	32 (22.8)	136	
>50	8 (80.0)	2 (20.0)	10	
Sex				
Male	41 (69.4)	18 (30.6)	59	7.32, 0.01** (S)
Female	117 (86.0)	19 (14.0)	136	
Relationship with adolescents				
Father	20 (83.3)	4 (16.7)	24	6.64, 0.04* (S)
Mother	48 (92.3)	4 (7.7)	52	
Caregivers	90 (75.6)	29 (24.4)	119	
Education				
No formal education	30 (78.9)	8 (21.1)	38	0.33, 0.84 (NS)
Scholl level	78 (80.4)	19 (19.6)	97	
college level	50 (83.3)	10 (16.7)	60	
Occupation				
Employed	70 (82.4)	15 (17.6)	85	3.43, 0.17 (NS)
Not employed	20 (71.4)	8 (28.6)	28	
Not applicable	72 (87.8)	11 (12.2)	82	
Annual income (Rs.)				
<12,000	24 (77.4)	7 (22.6)	31	0.54, 0.90 (NS)
12,000–24,000	56 (80.0)	14 (20.0)	70	
>24,000	10 (83.3)	2 (16.7)	12	
Not applicable	68 (82.9)	14 (17.1)	82	
Residence				
Rural	77 (87.5)	11 (12.5)	88	4.37, 0.05* (S)
Urban	81 (75.7)	26 (24.3)	107	

*Significant at $P \leq 0.05$, ***Very high significant at $P \leq 0.001$, Not significant $P > 0.05$

with mothers when compared to the other categories with significant at 0.04*. In regard to residence, 88% are associated with rural and it is significant at $P = 0.05$*. The remaining other demographic variables are not associated with nutritional status of HIV-infected adolescents. It depicts that there is a significant association between the nutritional status of HIV-infected adolescents with specific demographic variables in the experimental group and no association found in the control group [Table 6].

DISCUSSION

There is no medicine to cure HIV infection. However, with increasing access to effective ART treatment and care including for OIs, it has become a manageable chronic health condition, enabling them to lead long and healthy lives. Improving and maintaining good nutrition along with physical activity may also prolong health and delay the progression of HIV to AIDS especially in ALHIV (UNICEF 2019).[17] Since good nutrition is challenging for children and adolescents, in the present study, majority of parents, i.e., nearly 97%–98%, were positive, only 39% and 38% of participants were living with their biological parents and remaining in both groups were living in nongovernmental organizations. Apart from this, 50%–60% of mothers were alive more when compared to fathers (40%–49%) in respective of both groups because fathers had the additional behaviors of alcohol, smoking, and continue to acquiring repeated infection of HIV makes to decline their life span.

Table 6: Association between the nutritional status with demographic variables of HIV-infected adolescents/caregivers in control group

Demographic variables	Normal, *n* (%)	Malnourished, *n* (%)	Total	Chi-square test (χ^2, *P*)
Age of adolescents (years)				
10–12	54 (79.4)	14 (20.6)	68	3.42, 0.18 (NS)
13–15	56 (71.8)	22 (28.2)	78	
16–18	30 (63.8)	17 (36.2)	47	
Sex				
Male	85 (78.0)	24 (22.0)	109	3.72, 0.6 (NS)
Female	55 (65.5)	29 (34.5)	84	
Education				
Primary	35 (81.4)	8 (18.6)	43	6.55, 0.08 (NS)
Middle	65 (76.5)	20 (23.5)	85	
Secondary	30 (60.0)	20 (40.0)	50	
Higher secondary	10 (66.7)	5 (33.3)	15	
Religion				
Hindu	108 (73.0)	40 (27.0)	148	4.77, 0.09 (NS)
Muslim	23 (63.9)	13 (36.1)	36	
Christian	9 (100.0)		9	
Age of caregivers (years)				
20–35	39 (79.6)	10 (20.4)	49	3.81, 0.15 (NS)
36–50	85 (68.0)	40 (32.0)	125	
>50	16 (84.2)	3 (15.8)	19	
Sex				
Male	45 (69.2)	20 (30.8)	65	0.53, 0.46 (NS)
Female	95 (74.2)	33 (25.8)	128	
Relationship with adolescents				
Father	18 (81.8)	4 (18.2)	22	3.98, 0.13 (NS)
Mother	35 (81.4)	8 (18.6)	43	
Caregivers	87 (67.9)	41 (32.1)	128	
Education				
No formal education	45 (84.9)	8 (15.1)	53	0.33, 0.84 (NS)
School level	69 (73.4)	25 (26.6)	94	
College level	26 (56.5)	20 (43.5)	46	
Occupation				
Employed	69 (73.4)	25 (26.6)	94	5.07, 0.08 (NS)
Not Employed	11 (52.4)	10 (47.6)	21	
Not applicable	60 (76.9)	18 (23.1)	78	
Annual income (Rs.)				
<12,000	19 (76.0)	6 (24.0)	25	7.36, 0.06 (NS)
12,000–24,000	67 (80.7)	16 (19.3)	83	
>24,000	4 (57.1)	3 (42.9)	7	
Not applicable	49 (62.8)	29 (37.2)	78	
Residence				
Rural	68 (75.6)	22 (24.4)	90	0.77, 0.38 (NS)
Urban	72 (69.9)	31 (30.1)	103	

NS $P>0.05$. NS: Not significant

In the present study, in clinical histories, 5%–6% participants had previous history of nutritional deficiency, especially iron deficiency anemia (<8–10 g/dL) and Vitamin D deficiency for the past 2–4 years. At present, 2% in experimental and 1% in control group participants having iron deficiency anemia. It is supported by review article findings stated that the overall prevalence of anemia was 66%, and 8% had severe anemia with the proportion of underweight and stunted children in the population being 55% and 46%, respectively.[18] The similar findings were reported that 25% of 12–20 years of perinatally HIV-infected adolescents had Vitamin D and iron deficiency.[19] The burden of undernutrition among ALHIV is alarmingly high. The prevention of OIs, promoting social support, and depressing practice of meal skipping may help reduce the problems.[20]

In clinical signs and symptoms, the presence of dry skin was reduced in experimental group and no changes in control group after 6th months' intervention period. In regard to oral problems, there was marked improvement in experimental group and no one was found with dryness of lips, bleeding gums, and aphthous ulcers, but still 5% present in control group had oral issues and continuing conservative management. Next, at baseline assessment, 25%–28% of adolescents had various GI problems of loss of appetite, nausea, vomiting, and diarrhea in both groups. However, at 6th month evaluation, signs and symptoms were reduced in the experimental group, whereas in the control group, there were no significant changes found. In regard to extremities, the presence of muscle wasting and lipodystrophy were seen in both groups, with an average

rate of 7%–13%. Similar study reported that adverse events of ART drugs such as nausea and vomiting (14.3%) and loss of appetite are more frequent when compared to skin rashes, nail discoloration, and lipodystrophy (5%–10%).[21]

Regarding the anthropometric measurements, all variables in experimental group showed a significant improvement from baseline to 6th month evaluation at the $P = 0.05$*, except the height. Because height is more influenced by hereditary background, whereas in the control group, there were no significant changes in all variables. Similar findings evidenced in Uganda stated that the beginning of ART resulted in significant improvement in mean standardized weight for age Z score ($P = 0.001$) and height for age and Z score ($P < 0.05$).[22] The similar findings were also found in Nigeria; after 6 months of nutritional counseling and monitoring, the mean BMI was significant among the females (24.9 kg/m^2 intervention vs. 21.8 kg/m^2 control group at $P = 0.0005$).[23] The study done in Tanzania also suggested that better dietary counseling and prerequisite of macro and micro-nutrient supplements will be necessary to attain optimal nutrition for most of HIV-infected children in resource-limited regions.[24] The ART-experienced ALHIV experiencing an increase in incidence of fractures because 16% had deficient in bone mass, which were linked to low BMI, height, and weight *Z* scores.[25]

In the present study, at baseline assessment, 72% of adolescents were only in normal built; after the intervention, it was increased to 81%, in experimental group. However, in control group, no significant changes were found. In cross-sectional study, identified that among 307 HIV-infected adolescents, 33.2% were stunted, and 3.3% were wasted their muscles because of disease progression.[26] In another intervention-based study reported that, HIV-infected orphan children had the mean weight gain (0.99 ± 0.43 kg) was significantly improved after the 1 month of study period.[27] In the present study, the experimental group gained a higher (9.3%) nutritional score when compared to the control group (1.5%). The findings revealed that the motivation of nutritional counseling and selected Hatha yoga has effectiveness in increasing the nutritional level of HIV-infected adolescents in the experimental group rather than the control group. The review article also stated that the reinforcement counseling regarding nutritional intervention trial and exercise program can be successful in promoting the health outcomes of PLHIV increase CD4 count, improve the body compositions, and reduce risk of cardiovascular diseases and diabetes.[28]

The alternative therapy of Yoga/mindfulness activities may facilitate stress management among elementary school students and may be added as a complement to social and emotional learning activities.[29] In similar study, yoga intervention including asanas, pranayama, and meditation showed positive effects on adolescents in terms of lowering stress, increased alertness, and having a better disposition Hatha yoga component.[30] Another study found that within-group effects of yoga participants were found to have reduced depression and improved QOL immediately following yoga programs when compared to baseline. In contrast, within-group effects for controls did not reveal improvements.[31] In other study, Menon *et al.* (2014) found that after 12-week yoga training program enhanced micronutrient adsorption and increased physical fitness among rural schoolchildren and adolescents than the control group.[32] In another study, it stated that 12 weeks of yoga practices had significant micronutrient absorption in urban residential schoolchildren (11–15 years) as compared to control group.[33]

Regarding the association in the present study, regarding the age of the adolescents, the younger age of 10–12 years were gained high score and significant at $P < 0.05$ because the younger age of 10–12 years were under the supervision of caregivers. The early adolescents with middle education gained high nutritional status when compared to the other categories. Because late adolescents with higher education misinterpret the correct information and perceive it in the wrong way to adopt the worst lifestyle. The changes made the adolescents get lower scores and the early adolescents are mostly under the control of caregivers/parents. In regard to caregiver's age, the younger age of 20–35 years having relationship of mothers and residing in rural areas were had significant at $P = 0.05$%. Since the younger ages, female caregivers such as mothers have played a major role in attaining high scores and showed great attention to the adolescent's health and followed interventions in a disciplined manner, adopting diet modifications makes it easy to gain more score than the other types of caregivers. The remaining other demographic variables were not associated with nutritional status of HIV-infected adolescents.

In similar study, in children above 12 years of age, the muscle wasting was higher, i.e., more than 5 times higher in adolescents (7.7%) compared to younger children (1.4%).[26] Takarinda stated that there is a high proportion of adolescents with HIV who are malnourished associated with low level of education and having no parent are important risk factors to malnutrition in this population. There is need for optimizing nutrition care for adolescents on HIV treatment.[34] Thapa *et al.* identified the association between the literacy status of caregivers with poor nutrition

was significant, i.e., caregivers who were not educated through formal education 2–3 times got undernourished with adjusted odds ratio of 2.31 with 95% confidence interval 1.10%–4.82%.[35] Regarding the limitations of this study, the biochemical markers evaluation is not done for this study findings and the intervention strategies include of diary and yoga practices mainly rely on the adolescents/caregiver's subjective reports.

CONCLUSION

The gain score difference of 7.8% showed the effectiveness of nutritional counseling with Hatha yoga in the improvement of nutritional status of HIV-infected adolescents in the experimental group. This study can abet to ensure that tomorrow's adults will be healthy and lead productive life with fewer burdens to the society. Considering the facts about the prevalence of HIV among adolescents, the professional experience of the researcher makes the present study to finds the importance. There is a need to protect the HIV-infected adolescents from OIs and for HIV. The nursing professionals must play a vital role in making the community aware of AIDS and maintain healthy nutritional status for ALHIV.

Conflicts of interest

There are no conflicts of interest.

Authors' contributions

S. Rajathi: Concept, design, intellectual content, literature search, experimental studies, data acquisition, data analysis, manuscript preparation; S. R. Shankar: Final manuscript editing and critical review.

Financial support and sponsorship

Nil.

Acknowledgments

I honestly concede my gratefulness to Dr. N. Usman, Rtd, Director Institute of Venerology- MMC, Co-guide Dr. R. Somasekar, Professor, ICH and Advisory Committee Member Mrs. Thahira Begum, Principal, College of Nursing, MMC, Chennai, for their unremitting guidance, motivation, and support to complete this study. Our thanks also go to all ART Nodal officers, staffs, and the patients who actively cooperated in the research process.

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