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## Effectiveness of Spirulina Supplement and Selected Yogasanas On Biophysiological Parameters of Children with HIV infection.

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### ABSTRACT

The present study was aimed to evaluate the effectiveness of spirulina supplement and selected yogasanas on bio physiological parameters of children with HIV infection. Two hundred children with HIV infection aged between 5 and 18 years belong to both sexes participated in the study hundred children were chosen for both experimental and control groups. Commercially available and ISO certified spirulina food supplement was used in the study. Selected yogasanas such as tadasana (standing pose), trikonasana (triangle pose), padmasana (lotus pose), vajrasana, yogamudra and shavasana (corpse pose) were practiced by the participants under supervision of experts. We have observed significant difference in the comparison of physiological parameters such as weight, height, haemoglobin of pretest and posttests of experimental group with the control group and between the experimental and control group except CD4 count. The interventions that the spirulina supplement and selected yogasanas had positive impact on the physiological parameters of children with HIV infection or AIDS.

**Keywords:** Spirulina supplement, yogasanas, HIV infection, Bio-Physiological parameters.

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## INTRODUCTION

Pediatric AIDS suspected in a child presenting with at least 2 major signs associated with two minor signs in the absence of known causes of immune suppression, such as cancer, malnutrition or other recognized etiologies. The major signs included weight loss or abnormally slow growth, chronic diarrhoea of more than one month duration, prolonged fever of more than one month duration. The minor signs included generalized lymphadenopathy, oropharyngeal candidiasis, repeated common infections, persistent cough, generalized dermatitis, confirmed maternal HIV infection (WHO). The mortality of children because of AIDS globally in the year 2004 was 320,000. The rate has been reduced to 260,000 in the year 2009 [1]. The progression of HIV infection in children is very aggressive and many children die during their young age [2]. In India the estimated number of children under 15 years is 4%. A collaborative study on the growth patterns of HIV infected (184) and uninfected (1403) children. The study revealed that during infancy period the uninfected grows 1.6% faster in height and 6.2% heavier in weight than infected children. After 2 years the growth velocity also found high among uninfected children. By 10 years the mean difference found in height was 7.5 cm and in weight was 7 kg. It was also had a significant association with socio economic status and severity of illness. The study highlighted the adverse effects on physical health as they enter into the adolescent period [3]. A retrospective analysis of 248 HIV infected children in India aimed to find out the prevalence of anemia and growth failure. The study revealed that 66% of the children had anemia and 8% of them had severe anemia, 55% of were underweight and 46 % of the children were found to have stunted growth. The risk factors for anemia was identified as age of illness especially children younger than 6 years, rural residence, HIV staging, and presence of stunting, presence of pulmonary tuberculosis. Intake of ART found to reduce the risk of anemia but it was not related to the gender, intake of co- trimoxazole or the type of ART. The study concluded that the need to implement national level nutritional interventions since there was high prevalence and strong interrelationship between anemia and poor nutrition among HIV infected children in India [4].

The micronutrient supplementation such as Vitamin D, B, C, E, delays the progression of the disease, reduced oxidative distress and improves the immunity. Supplementation of whey protein elevated erythrocyte glutathione concentration and lowered co-infections [5]. Oral Iron supplementation elevated CD4 cell counts [6]. Supplementation of spirulina improves several symptoms and has antihistamine, anticancer, antiviral and enhancing immune function [7]. Spirulina supplementation with regular meals improved their nutritional status of HIV undernourished children by elevating their weight and reduction in the level of anemia. The positive status makes them at risk for physical disabilities in general and specific, [8]. 50% of infected school aged children had some physical limitations mainly on energy demanding activities. They also suggested the need for comprehensive interventions to maximize their potentials as they grow. The present study was aimed to evaluate the effectiveness of spirulina supplement and selected yogasanas on bio physiological parameters of children with HIV infection.

## MATERIALS AND METHODS

### Participants:

Two hundred children with HIV infection aged between 5 and 18 years belong to both sexes participated in the study. Hundred children were chosen for both experimental and control group from Vocational Training and Rehabilitation centre and Russ foundation Dindigul district for the experimental group and control group respectively. A written permission was obtained from the authorities of the organizations after submitting a copy of research proposal, ethical clearance (ethical clearance from sacred heart nursing college, Madurai (UT:SHNC:Ph D (N): 2012 dated 22.11.1012), information materials on the benefits of the proposed interventions. An informed consent provided information regarding the purpose of selecting the children for the study, nature of the study, to the parents / guardian and from the children the same particulars explanation was provided and obtained assent they were assured regarding maintenance of anonymity and confidentiality of the information throughout the study.

### Inclusion and exclusion criteria

Children aged between 5 to 18 years, Available during the study period, Residing in Dindigul Districts, able to understand Tamil or English were included. Children who are in the severe stage of illness CD4 cell count less than 200 were excluded.

## Research methodology

On the day of pretest assessment the nongovernment organizations were visited. The parents / guardian and children were gathered in a meeting hall and rapport was developed with them. The field coordinators of NGO cooperated to collect the demographic profile through structured interview. The physiologic parameters such as weight, height, were assessed using electronic standing weighing scale and stadiometer respectively. The Hemoglobin estimation was done using drabkins method. The CD4 count was obtained from their health record they were informed already by the field coordinators. On the same day a commercially available and ISO certified spirulina food supplement 2gram per day in capsule form as 400mg capsules to be consumed three capsules at 8am and two capsules at 8pm and they were instructed to consume before food and lemon juice if possible to enhance the absorption and palatability of spirulina. A sealed container with 150 capsules for 30 days duration was distributed for each child to. The same day the yogasanas such as tadasana (standing pose), trikonasana (triangle pose), padmasana (lotus pose), vajrasana, yogamudra and shavasana (corpse pose) were demonstrated by the researcher with a child model, it was observed that almost all six asanas chosen were already taught in their schools as part of physical exercises but not much familiar with the names the and they were able to redemonstrate it without any difficulties. An individual pamphlet on the yoga poses and steps were distributed to the parent or guardian and to the field coordinators, for one week they were performing under direct observation of the field co-coordinators. Further, they were instructed to maintain a daily record of spirulina intake and the performance of yogasanas. After 1<sup>st</sup> week later the pretest assessment were done at Russ Foundation with the co – operation of the field co-ordinators the demographic profile, physiologic parameters were assessed for 100 children. Post test I,II,III on 30<sup>th</sup> day 60<sup>th</sup> day & 90<sup>th</sup> day using the same instruments, and spirulina supplement was distributed and performance of yogasana were observed and their physiologic parameters life were assessed. During their visit to the centre food arrangement and the transport fare was provided.

## Statistical analysis

Anova for repeated measures was carried out for the comparison of means between the experimental and control group for the physiological parameters. Unpaired test was used for the comparison of means between experimental and control group was carried out between the physiological parameters. Frequency and percentage distribution of the growth standards analysis was done using the SPSS Macros available in WHO website. The analysis and plotting of diagrams and graphs were done using SPSS software version 22. Probability value less than 0.05 ( $P < 0.05$ ) was considered significant.

## RESULTS

The comparison of Physiological parameters (Weight and Height) between the Control group and Experimental group with Pre- test and Post-test I, II and III. A statistical measure called Repeated measures ANOVA was used for the overall comparison, there was no statistical significant difference in the weight of the control group ( $F=0.471$ ,  $P > 0.05$ ) and it was significant in the experimental group ( $F=1011.82$ ,  $P < 0.05$ ). (Table 1). Regarding the height there was no significant change in both control and experimental groups. The comparison of Hemoglobin within the Control group ( $F=0.623$ ,  $P = 0.602$ ) was not significant whereas it was significant in the Experimental group ( $F=369.1$ ,  $P = 0.01$ ). The comparison of CD4 counts in the Pre-test and Post-tests of Control group ( $F=0.33$ ,  $P=0.617$ ) was not significant whereas in the Experimental group it was found significant ( $F=5.6$ ,  $P=0.013$ ) (Table 1). The growth standards analysis showed that the number of underweight male. Similarly the number of underweight children in the experimental group was reduced from 95% to 90%, the BMI among male children 98% of the children were subnormal in the posttest III from 97.67% to 90.47% children was reduced from 98% to 94.8 % (Table 2). Similarly the number of children with anemia was 86% whereas it was reduced to 81% in the experimental group. The presenting complaints were found have reduced the anemia, immune suppression and presenting complaints were improved significantly the experimental group comparing to the control group. The Comparison of physiological parameters between the control and experimental group showed no significant change was observed when the weight (Fig No 1 ), Height (Fig No 2 ) and CD4 counts (Fig No 4 ) were compared between the control and experimental group (unpaired 't' test) in the pretest and post test I,II,III. Whereas the Comparison of haemoglobin (Fig No 3) between the control and experimental group (unpaired 't' test) showed significant changes in the pretest and post tests I, II, III.

Table 1 : Physiological parameters of control group and experimental groups in the Pre-test and Post-test I,II&III					
S.No	Parameter	Group	Mean $\pm$ SE	Significance Repeated measure ANOVA	
				Control group	Experimental group
1	WEIGHT	Con – Pre test	32.89 $\pm$ 0.97	F=0.471(3df) P=0.702(<0.05)NS	F=1011.82(3df) P=0.001(<0.05)S
		Con – 1 <sup>st</sup> Post test	32.94 $\pm$ 0.97		
		Con – 2 <sup>nd</sup> Post test	32.91 $\pm$ 0.97		
		Con – 3 <sup>rd</sup> Post test	32.84 $\pm$ 0.96		
		Exp – Pre testtest	31.26 $\pm$ 1.02		
		Exp – 1 <sup>st</sup> Post test	31.82 $\pm$ 1.01		
		Exp – 2 <sup>nd</sup> Post test	33.05 $\pm$ 1.02		
		Exp – 3 <sup>rd</sup> Post test	34.44 $\pm$ 1.01		
2	HEIGHT	Con – Pre test	131.45 $\pm$ 1.46	F=1.796(3df) P=0.174(>0.05)NS	F=2.142(3df) P=0.095(>0.05)NS
		Con – 1 <sup>st</sup> Post test	131.47 $\pm$ 1.46		
		Con – 2 <sup>nd</sup> Post test	131.57 $\pm$ 1.45		
		Con – 3 <sup>rd</sup> Post test	131.71 $\pm$ 1.42		
		Exp – Pre test	130.88 $\pm$ 2.11		
		Exp – 1 <sup>st</sup> Post test	131.69 $\pm$ 2.24		
		Exp – 2 <sup>nd</sup> Post test	131.73 $\pm$ 2.28		
		Exp – 3 <sup>rd</sup> Post test	131.97 $\pm$ 2.27		
3	HEMOGLOBIN	Con – Pre test	8.78 $\pm$ 0.17	F=0.623(3df) P=0.602(>0.05)NS	F=369.1(3df) P=0.01(<0.05)S
		Con – 1 <sup>st</sup> Post test	8.84 $\pm$ 0.16		
		Con – 2 <sup>nd</sup> Post test	8.84 $\pm$ 0.16		
		Con – 3 <sup>rd</sup> Post test	8.85 $\pm$ 0.16		
		Exp – Pre test	9.49 $\pm$ 0.16		
		Exp – 1 <sup>st</sup> Post test	9.53 $\pm$ 0.16		
		Exp – 2 <sup>nd</sup> Post test	9.92 $\pm$ 0.16		
		Exp – 3 <sup>rd</sup> Post test	10.40 $\pm$ 0.16		
4	CD4 COUNTS	Con – Pre test	822.53 $\pm$ 21.74	F=0.33(3df) P=0.617(>0.05)NS	F=5.6(99df) P=0.013(<0.05)S
		Con – 1 <sup>st</sup> Post test	821.99 $\pm$ 21.7		
		Con – 3 <sup>rd</sup> Post test	822.46 $\pm$ 21.7		
		Exp – Pre test	881.01 $\pm$ 38.2		
		Exp – 1 <sup>st</sup> Post test	882.94 $\pm$ 38.23		
		Exp – 2 <sup>nd</sup> Post test	883.79 $\pm$ 38.1		
		Exp – 3 <sup>rd</sup> Post test	884.2 $\pm$ 3787		
			N=100	N=100	N=100

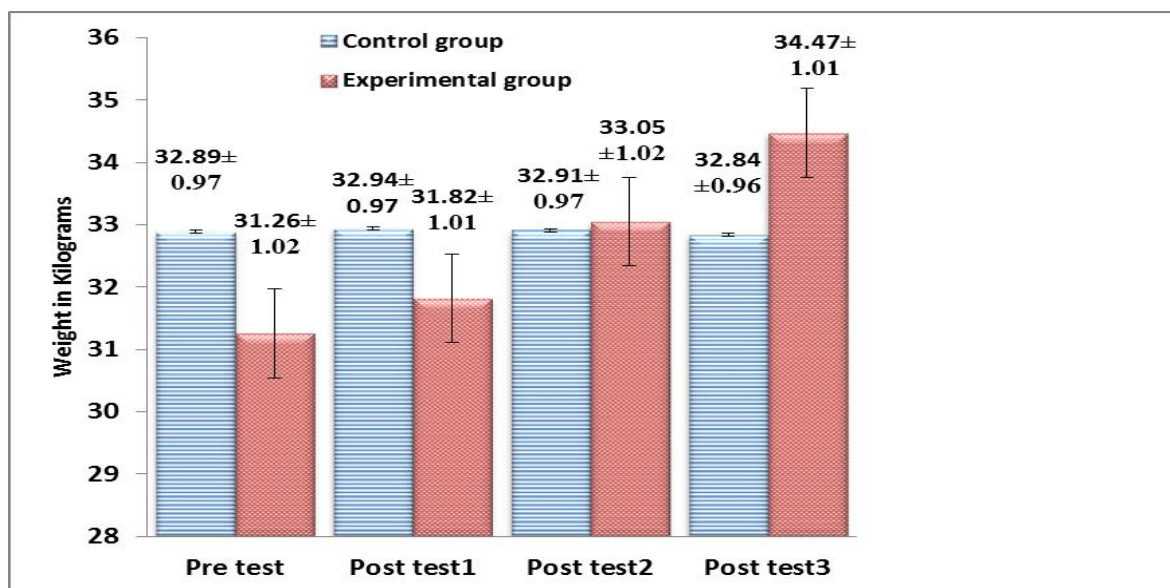
Table 2: Frequency and percentage distribution of growth standards in pretest,posttest,I,II,III.

S. No	GROWTH PARAMETERS		Control group --F(%) n=100				Experimental n=100			
			Pre-test	Post test I	Post test II	Post-test III	Pre test	Post-test I	Post-test II	Post-test III
1	Weight – Male (49)	AA	1(2)	1(2)	1(2)	2(4.1)	1(1.7)	2(3.4)	2(3.4)	3(5.1)
		UW	48(97)	48(97)	48(97)	47(95.9)	57(98)	56(96)	56(96)	55(94.8)
	Weight - Female (51)	AA	2(3.9)	2(3.9)	3(5.8)	3(5.8)	2(4.7)	2(4.7)	4(9.5)	4(9.5)
		UW	49(96)	49(96)	48(94)	48(94)	40(95)	40(95)	38(90)	38(90)
2	Height – Male (49)	AA	1(2)	1(2)	1(2)	1(2)	1(1.7)	2(3.4)	2(3.4)	2(3.4)
		S	48(98)	48(98)	48(98)	48(98)	57(98)	56(96)	56(96)	56(96)
	Height – Female (51)	AA	1(1.9)	1(1.9)	1(1.9)	1(1.9)	1(2.3)	1(2.3)	2(4.7)	2(4.7)
		S	50(98)	50(98)	50(98)	50(98)	41(97)	41(97)	40(95)	40(95)
3	BMI – Male (49)	N	1(2)	1(2)	1(2)	2(4.08)	1(1.7)	2(3.4)	3(5.2)	4(6.8)
		S N	48(98)	48(98)	48(98)	47(95.9)	57(98)	56(96)	55(94)	54(93)
	BMI – Female (51)	N	0(0)	0(0)	1(1.9)	2(3.9)	1(2.3)	2(4.7)	2(4.7)	4(9.5)
		S N	51(100)	51(100)	50(98)	49(96)	41(97.6)	40(95.2)	40(95.2)	38(90.47)

AA – Appropriate to the age, UV – Under weight, S – Stunted, N – Normal, SN - Subnormal

**Table 3: Frequency distribution of anemia,immunesuppression and presenting complaints in pretest,posttestI,II,III.**

Sl no	Variables	Control group(n=100)				Experimental group(n=100)			
1.	Anemia	87	87	88	91	86	86	83	81
	Anemia								
	Not anemic	13	13	12	91	14	14	17	19
	Not significant								
2.	CD4 count	0	0	0	0	6	6	6	4
	Not significant	6	6	6	5	7	7	7	9
	Mild	94	94	94	95	87	87	87	87
	advanced								
Sl.no	Presenting complaints	Control group (n=100)				Experimental group (n=100)			
		Pre test	Post test I	Post test II	Post test III	Pre test	Post test I	Post test II	Post test III
1.	Fever	12	12	18	12	12	10	4	0
2.	Diarrhea	35	33	29	9	7	6	1	0
3.	Fatigue	30	33	31	32	35	30	22	14
4.	Tuberculosis	4	4	2	2	1	0	0	0
5.	lymphadenopathy	10	10	12	9	11	10	10	10
6.	Skin problems	8	8	6	4	6	6	6	2
7.	Oral lesions	12	12	11	13	10	8	8	8
8.	Respiratory tract infection	6	6	0	1	9	9	4	1
9.	Irregular periods	10	10	9	10	12	8	6	2
10.	No complaints	30	30	29	27	60	72	81	95



**Figure 1 : Comparison of weight ( in Kilograms with Mean ± SE) between control group AND experimental group of pretest & post test I,II,III**

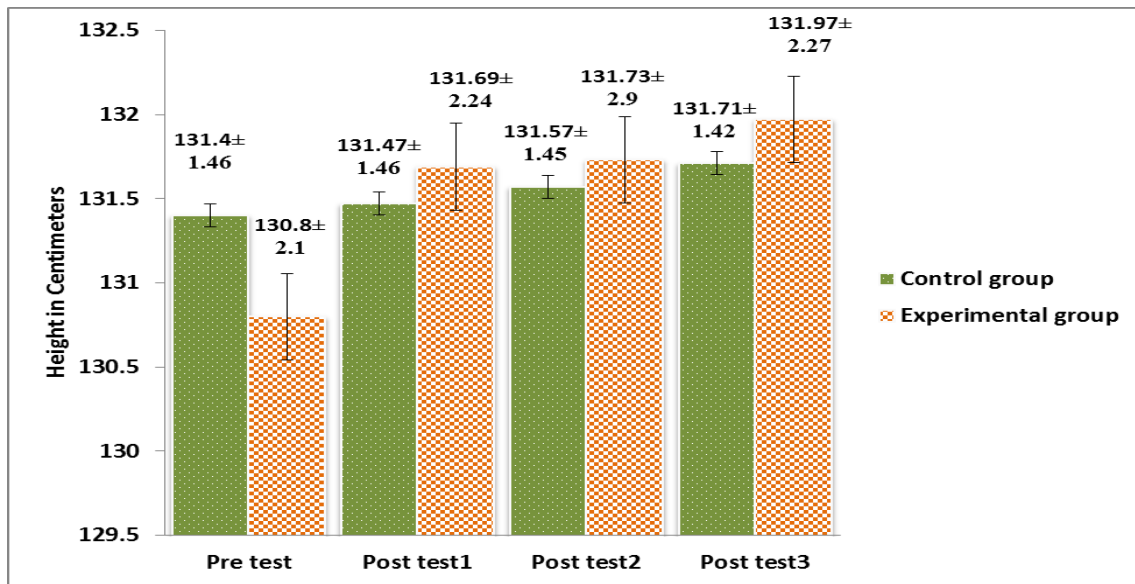


Figure 2 : Comparison of Height in Centimeters with Mean  $\pm$  SE between control group & experimental group of pretest & post test I,II,III

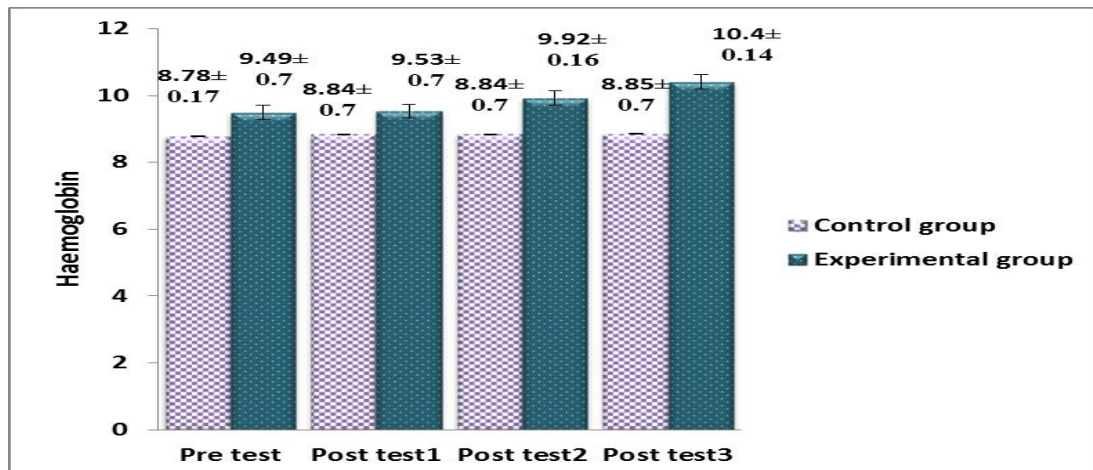


Figure 3: Comparison of Hemoglobin with Mean  $\pm$  SE between control group & experimental group of pretest & post test I,II,III

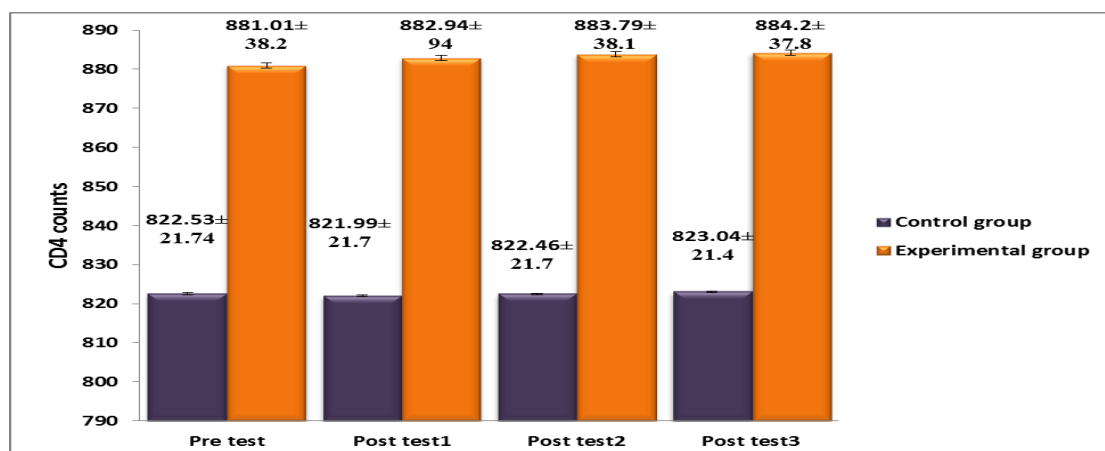


Figure 4: Comparison of the CD4 counts with Mean  $\pm$  SE between control group & experimental group of pretest & post test I,II,III



## DISCUSSION

In this present study the physiologic parameters assessed were weight, height, hemoglobin and CD4 counts the mean observed weight in children in control group was 32.89kg, 32.91kg, 32.92kg and 32.84 kg pretest, post test I, II and post test III respectively. There was no significant change found within the control group pretest & post test I, II, III. When the mean weight within the experimental group were 31.26kg, 31.82kg, 33.05kg and 34.44kg in the pretest, post test I, II and post test III respectively. There was a significant improvement in the experimental group ( $P=0.001$  ( $<0.05$ )  $F=1011.82(3df)$ ). Supplementation of spirulina for HIV infected children showed an average weight gain of 15g per day comparing to HIV negative undernourished children [9]. There was no significant change in the mean height of children in the experimental and control group. The mean hemoglobin level observed in the control group pretest was  $8.78 \pm 0.17$  and in experimental group  $9.49 \pm 0.16$  the post test III assessment of mean hemoglobin level of  $8.85 \pm 0.16$  and  $10.40 \pm 0.16$  in control group and experimental group respectively showed a significant elevation in experimental group. The dietary intake of Iron and micro nutrients supplementation of iron elevates the hemoglobin level significantly [10]. The CD4 counts of the control group did not show any significant elevation in the post tests comparing to the pretest mean. The CD4 count showed a significant elevation in the mean values of the experimental group post tests I, II and III as 882.94, 883.79 and  $884.22 \pm 37.87$  respectively with the mean pretest score of  $881.01 \pm 38.22$ . A comparative study on the prevalence of HIV and the type of food consumption found that Africa In Africa 1/10 but a tribal group called Kanimba in Chad 2-4/100 & 10 and chad habituated to consume 3-13g / day and the study concluded that the regular consumption of algae helps to prevent and to suppress the viral load among the infected.

In this present study the analysis of scores of physiological parameters of Weight, Height, Hemoglobin, and CD4 counts of control group assessments were compared with the respective assessments of experimental groups (unpaired t test). The hemoglobin value was found significantly changing between the control and experimental group. whereas there was no significant change found in the CD4 counts in pre test, post I, II, and post test III. Six month practice of yogasanas and pranayama significantly elevated the CD4 counts compared to the control group. yoga intervention among aged 8-16 years children with hemoglobin reduced their bleeding episodes referrals to hemoglobin clinics and school absence. Therapeutic yoga for 5 session on Quality of life of children with cancer positively affected their gross motor functioning. A randomized control trial among HIV positive two adolescent group received 10 week yoga programme & peer supported showed a short term well being physically and emotionally than the group received only peer support.

Though the yoga practice was originated from India, the studies on the efficacy of yoga on HIV/AIDS among adults or children were very limited. Similarly the studies on food supplements for HIV children were shown to have a limited scope hence supplementing spirulina on human participants was not addressed in many health problems especially in children with HIV infection. So this present study is undertaken by a nurse to recognize the potential effect of spirulina supplement and yogasanas among children with HIV infection.

## CONCLUSION

We have observed significant difference in the comparison of physiological parameters such as weight, height, haemoglobin of pretest and posttests of experimental group with the control group and between the experimental and control group except CD4 count. The interventions that the spirulina supplement and selected yogasanas had positive impact on the physiological parameters of children with HIV infection or AIDS.

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