

A STUDY ON PREVALENCE OF ANEMIA AND GROWTH PATTERN AMONG HIV-INFECTED CHILDREN FROM RURAL AREAS ATTENDING GOVT. GENERAL HOSPITAL, VIJAYAWADA, ANDHRA PRADESH, INDIA

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ABSTRACT

The present communication deals with the profile of HIV infected children belonging to pre-HAART (pre-Highly Active Anti Retroviral Therapy) era and HAART era to know the status of anemia and growth pattern who attended the ART centre, Govt. General Hospital, Vijayawada, Andhra Pradesh, India. A cross-sectional record based study was carried out in 125 HIV infected children in ART centre from 2009 to 2011. Hemoglobin, height, weight, BMI, waist and hip ratio were calculated according to the standard protocols. The CD4 count was estimated using BD FACS caliber flow cytometer and results were statistically analyzed. According to the present study 125 subjects of age group 1-20 years were chosen. The subjects in pre-HAART era (75 subjects) showed low level of Hb content 6.9 gm/dL in male and 6.3 gm/dL in female subjects; the mean BMI level was 20.43 in male and 18.47 in female subjects and showed a significant increase ($p < 0.05$) in mean CD4 counts from 592 to 790 cells/cmm from baseline count to follow up count after 18 months. The study patients in HAART era (45 subjects) significant decrease ($p < 0.001$) in Hb content from 7.3 to 6.5 gm/dL and significant increase ($p < 0.05$) in BMI level from 18.1 to 22.6 and showed a significant increase ($p < 0.001$) in CD4 counts from 174 to 902 cells/cmm from baseline to follow up treatments. Our study reinforces the finding that anemia, growth pattern of HIV infection in Indian children with prognostic significance.

Key words : HAART era; Pre –HAART era; Hemoglobin level; BMI; CD4 count.

INTRODUCTION

To date, the HIV/AIDS epidemic has not been overcome anywhere in the world, making this disease a serious health challenge for the new millennium. Even more disturbing, is the fact that the vast majority of infected people are

unaware of the fact that they have acquired HIV (UNAIDS, 2009). India is on the threshold of a generalized epidemic as even a small increase in prevalence would lead to an exponential increase in the number of people living with HIV due to the large population base. The adult prevalence of HIV infection in India is 0.91 (UNAIDS,

2004; CDC, 2004) but the prevalence of pediatric HIV infection in India is unknown.

The adverse experiences of HIV-infected children often begin before the death of their parents. After parental death, these infected children are vulnerable to abandonment by the extended family, depression, abuse, malnutrition, lack of health care and schooling, and early entry into child labor (Kumarasamy et al., 2003). Some of the common complications encountered in HIV-infected people are weight loss, wasting, derangement in biochemical parameters, opportunistic infections like TB, oral candidiasis, bacterial infection, ulcerations, and fungal infections to name a few (Kumarasamy et al., 2005). Studies have explicitly demonstrated that anemia is associated with decreased survival and increased disease progression in adults with HIV infection (Volberding et al., 2004).

Independent of other factors, anemia is also associated with a diminished quality of life (Calis et al., 2008). In children with HIV infection, the high prevalence of anemia is well known. Given that the negative impact of anemia is magnified on account of its close relation to overall nutrition and growth, there is limited data from Asian countries where HIV infection, malnutrition and nutritional deficiencies co-exist. In HIV-infected children, wasting (i.e., low weight for height/length) has been associated with reduced length of survival, while weight loss has resulted in increased infectious complications in children with AIDS. Conversely, HIV has been associated with immune status, level of viral replication and nutritional disorders may be important in predicting growth outcomes (Sahlis, 1968). Hence, the present study is aimed to study the status of hemoglobin levels, BMI and CD4 counts in the HIV infected children attending ART centre, Vijayawada of Andhra Pradesh state, India.

MATERIALS AND METHODS

The study was carried out in 125 HIV infected children in ART centre, Government General Hospital, Vijayawada from 2009 to 2011 which

was a retrospective cross-sectional record based study. Permission from the authorities was taken and the data is highly reliable. The clinical profile of children during the study period was noted. Basically the subjects were divided into two groups HAART era and pre HAART era. HAART medication included SLN, ZLN, SLE and ZLE (S-stavudine, L-lamuvudine, N-nevirapine and E-ephavirenz) combinations.

Hemoglobin was estimated according to Sahli's hemoglobinometric method (1968). The height and weight of the subjects was measured using the method described by Jellife (1966). The weight was expressed in kilograms (kg) up to the nearest 0.1 kg. Height was measured to the nearest 0.1 cm using a standard metal tape. The body mass index (BMI) is calculated for human body fat based on an individual's weight and height. Waist and hip ratio calculated according to the World Health Organization's data gathering protocol. The CD4 count was estimated using BD FACS caliber flow cytometer. The data collected from the records was analyzed using MINITAB 11.12, 32 Bit and the differences were considered statistically significant at a p value < 0.05 and < 0.001.

RESULTS

Out of 125 HIV positive children, 75 (60%) subjects were in pre-HAART era, 45 (36%) subjects were in HAART era and 5 (4%) subjects were mortal cases (Table-1). Out of 75 patients in pre-HAART era; 37 (49%) subjects were male and 38 (51%) subjects were female (Table-1). Out of 45 patients in HAART era; 26 (58%) subjects were male and 19 (42%) subjects were female (Table-1). And out of 5 death cases; 2 (40%) children were male subjects and 3 (60%) children were female subjects.

Table-1 reveals that children not taking HAART medication are progressing with the disease and not reaching the adolescent stage and they either become mortal or go for antiretroviral therapy. There is an age wise significant difference between two groups with $p < 0.001$ ($\chi^2 = 44.314$). Also reveals that, children who are under HAART reached from childhood to

adolescence. Thus after initiation of HAART, children reaching adolescent stage indicated that HAART is effective in them.

Table-2 shows the anthropometric measurements of the study patients in pre-HAART group. There is a significant difference in mean height, mean weight and mean BMI between male and female children with $p < 0.05$. The mean value for waist-hip ratio for males is 0.93 and for females is 0.92. The waist-hip ratio (WHR) is normal with no significant change between male

and female subjects. The mean Hb value for males is 6.9 gm/dL and for females is 6.3 gm/dL. This reveals that children who are progressing with HIV infection had usually low levels of Hb content. Thus HIV infected children and adults are associated with poor clinical outcomes, anemia is associated with more rapid progression to AIDS (Gautam et al., 2008).

Table-3, represents the percentage of the subjects in pre-HAART era distributed in different categories of BMI. Among male subjects only

Table 1: Distribution of HAART era and pre-HAART era children according to age and gender

Age Group (Years)	HAART era						pre-HAART era					
	Male		Female		Total		Male		Female		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
1 – 5	1	4	0	0	1	2	0	0	2	5	2	3
6-10	6	23	5	26	11	24	30	81	32	84	62	82.5
11-15	14	54	12	63	26	58	7	19	4	11	11	14.5
16-20	5	19	2	11	7	16	0	0	0	0	0	0
Total	26	100	19	100	45	100	37	100	38	100	75	100

$\chi^2 = 44.314, p < 0.001$

Table 2: Anthropometric measurements of Study Patients in pre-HAART era

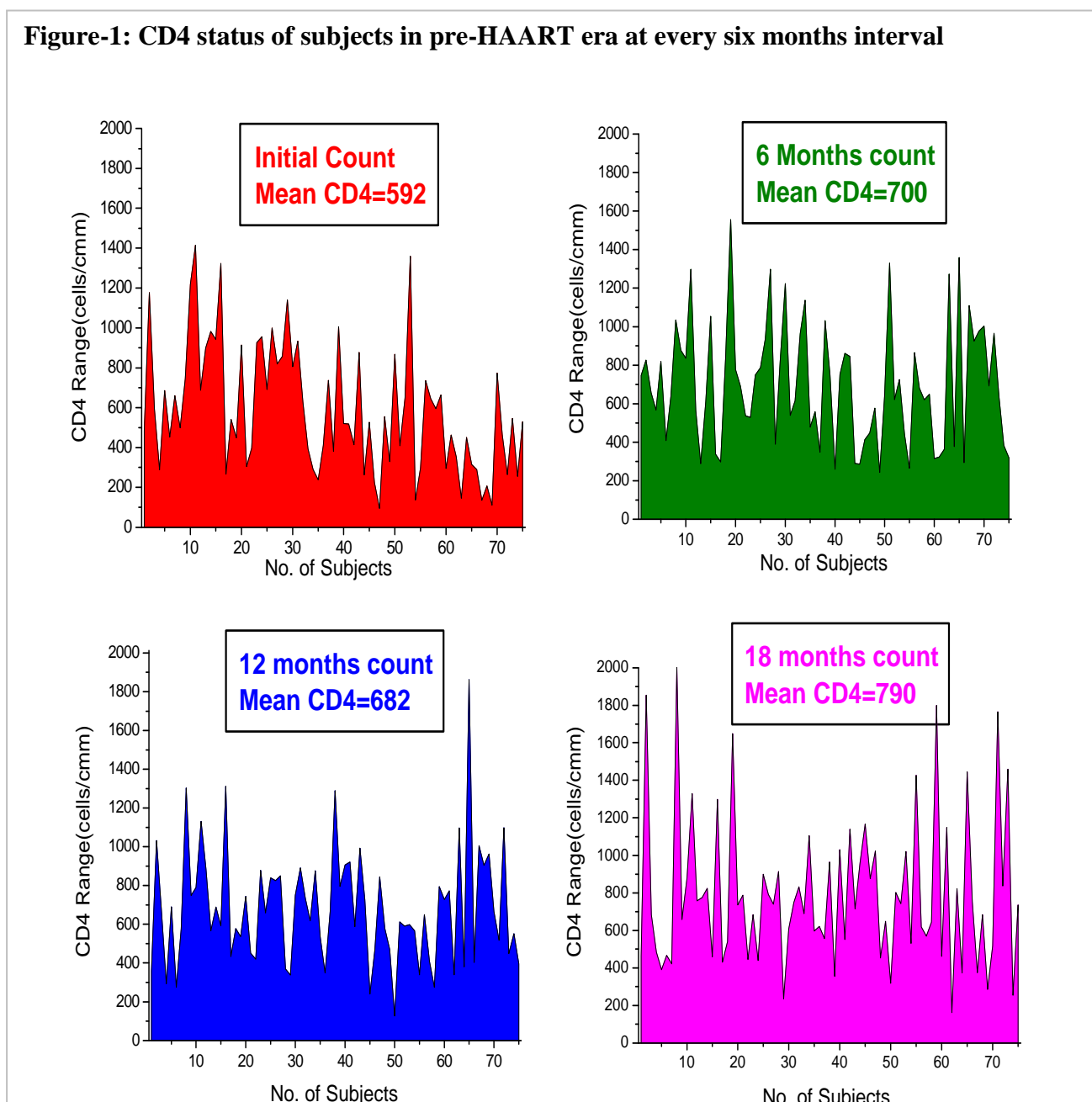
Parameter	Male (N = 37) Mean ± S.D.	Female (N = 38) Mean ± S.D.	P – value
Height (cm)	127 ± 0.125	118 ± 0.142	<0.05*
Weight (Kg)	26.23 ± 7.52	22.37 ± 6.66	<0.05*
Body Mass Index (Kg/m ²)	20.43 ± 4.61	18.47 ± 4.18	<0.05*
Waist (cm)	60 ± 5.67	60.2 ± 11.0	>0.05
Hip (cm)	63.89 ± 7.11	64.8 ± 11.7	>0.05
Waist-Hip Ratio (WHR)	0.93 ± 0.0469	0.92 ± 0.0565	>0.05
Haemoglobin (gm/dL)	6.959 ± 0.811	6.316 ± 0.976	<0.05*

$p < 0.05^*$ represents significant change.

Table 3: Distribution of study patients according to BMI categories in pre-HAART era [According to US Department of Health and Human Services (USDHHS) weight status categories]

Body Mass Index (kg/m ²)	Male (37) N (%)	Female (38) N (%)
<18.5 (Underweight)	9 (24.3)	20 (52.6)
18.5 – 24.9 (Normal weight)	25 (67.5)	15 (39.4)
25 – 29.9 (Overweight)	2 (5.4)	2 (5.2)
>30 (Obesity)	1 (2.7)	1 (2.6)
Total	37 (100)	38 (100)

Figure-1: CD4 status of subjects in pre-HAART era at every six months interval



24.3% shown underweight condition, but 67.5% of males shown normal weight and 52.6% females shown underweight condition. But low percentage of male and female subjects shown overweight and obesity condition. This reveals that due to HIV infection, majority of the children have normal weight or underweight.

As shown in Figure-1, among 75 subjects who were included in pre-HAART era; majority of the children had no or mild symptoms of HIV infection i.e., 5.3 – 13.3% were in clinical stage-1, 49.3 – 61.4% in clinical-2, 24 – 38.8% of the subjects were in clinical stage-3 with moderate

clinical symptoms. Advanced disease was presented in 1.3 – 6.7% of children falling in clinical stage-4. The children in clinical stage 3 and 4 shall be suggested to take anti - retroviral therapy (ART) immediately. With reference to individual observation of the study, over 95% HIV – positive people should need treatment, some people should need within 1-2 years and others could wait for many years. HIV infection progresses in different people at very different rates (Figure-1).

Figure-1, represents the values of pair difference of mean CD4 counts of study subjects in pre-

ART era at every 6 months interval. There was a significant increase ($p < 0.05$) in mean CD4 counts of the patients by 108 cells/cmm from initial count to CD4 count after 6 months. But there was a decrease in mean CD4 count from 6

months to 12 months by 18 cells/cmm and no significant increase ($p > 0.05$) in mean CD4 counts of the patients from 12 months to 18 months of HIV infection.

Figure-2: Distribution of HIV patients basing on Baseline and Follow up Haemoglobin levels in gm/dL

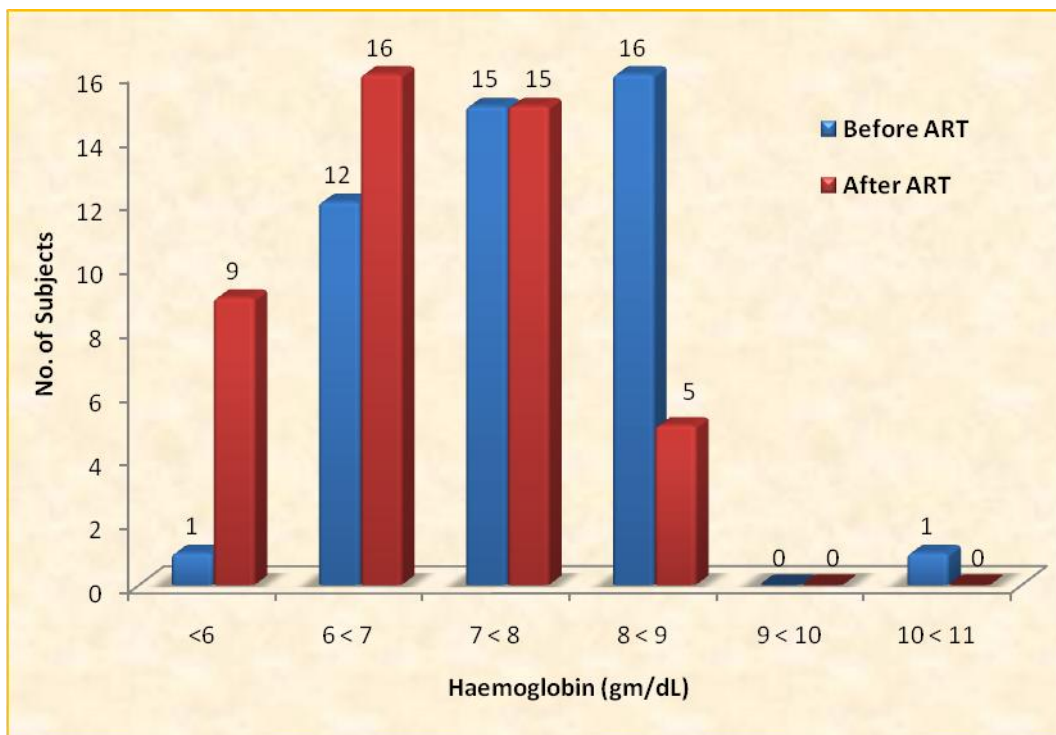


Figure-3: Distribution of HIV patients basing on Baseline and Follow up Body Mass Index (BMI) levels in kg/m²

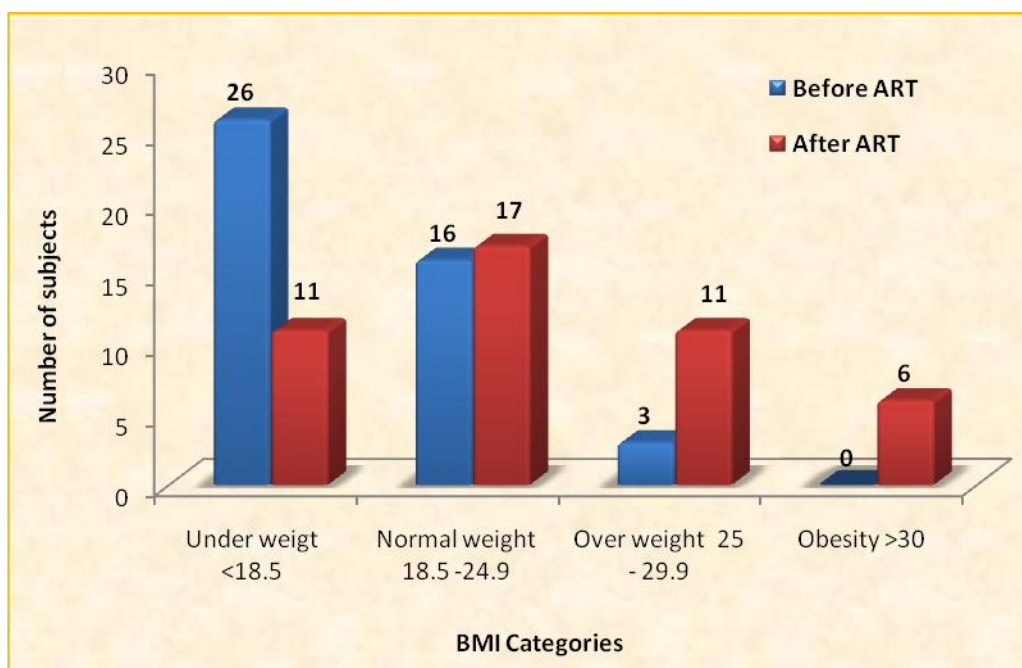
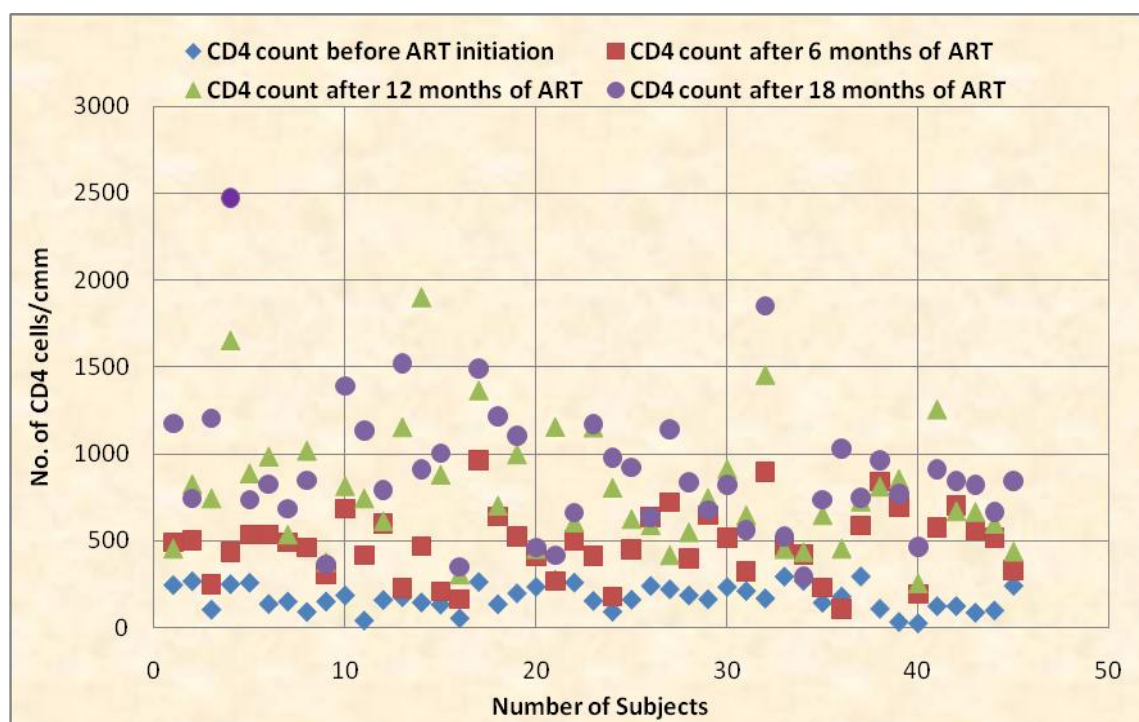


Figure-4: Initial & Follow up CD4 Counts of subjects in ART Group

In HAART era, the Hb content in the study subjects decreased significantly ($p < 0.001$) after HAART initiation. The present study clearly indicates that the majority of the patients after taking HAART decreased their hemoglobin content than before initiation of HAART. Hence because of HAART many patients became anemic in the present study (Figure-2). As per the Figure-3, 26 (57.8%) subjects show underweight before initiation of HAART but only 11 (24.4%) subjects shown underweight condition after taking HAART. 16 (35.5%) subjects were having normal weight before HAART but 17 (37.8%) subjects had normal weight after HAART. Only 3 (6.7%) subjects shown overweight before HAART but after HAART medication the number of subjects increased to eleven members (24.4%) after HAART. None was found to be obese before HAART but after HAART medication 6 (13.3%) subjects found to be obese.

The CD4 counts for all the patients were enumerated for 45 subjects in HAART era, at every six months for three times (i.e., at 6 months, 12 months and 18 months) after initiation of HAART (Figure-4). Table 6 reveals that, the study patients in HAART era showed a

significant increase ($p < 0.001$) in CD4 counts from 174 to 902 cells/cmm, significant decrease ($p < 0.001$) in Hb content from 7.3 to 6.5 gm/dL and significant increase ($p < 0.05$) in BMI level from 18.1 to 22.6 with reference to baseline and follow up treatments after 18 months.

DISCUSSION

The present study reveals that children, who initiated HAART, gradually reached to adolescence whereas those children not initiated HAART, progressing with the disease and subjected to AIDS defining illness. Our study correlates with the study of Weiner et al. (1998), where thirty-nine caregivers of HIV-infected youth (ages 10–18yrs) and twelve youth over the age of 18 years were interviewed at two time points. Barriers associated with transition were identified and addressed between visits. Transition readiness improved and state anxiety decreased significantly from the first time point to the last visit (approximately 7 months later). Thus, as the treatment options for HIV/AIDS have improved, many HIV-infected children who are not expected to survive childhood are entering into adolescence and young adulthood (Fewer than 300 children annually are born

infected with HIV in the United States while >8500 previously infected children and youth <19 years old living with HIV/AIDS continue to age up in the health care system (Kotylo et al., 1993).

A decade ago, there was a dismal direction to the illness. Almost all children died before their young adult years. Today, the outcome is much more favorable. A significant number of children are expected to live well into their adolescent years and hopefully beyond. Despite the many stresses inherent in living with HIV/AIDS, these young adults need to be given the opportunity to develop and pursue individual aspirations and goals. If recognized and nurtured, they have the potential to significantly contribute to the society (Embree et al., 2001).

Hemoglobin content of the study subjects was lower than the normal value and all were anemic at the time of initiation of ART and few subjects show stunted growth according to BMI. The above finding is supported by Anita Shet et al. (2009), that there is a high prevalence anemia and growth failure among children living with HIV infection in India. In a meticulously conducted review on global prevalence of HIV-associated anemia, Calis et al. (2008) reported that anemia was a common complication occurring in 50-90% of children living with HIV in both resource-limited and resource-rich settings and that anemia prevalence was over three times higher among these children when compared with those without HIV infection. National reports also indicate that the rural population has higher HIV prevalence than the urban population (Williamson et al., 1997), which supports our results where most of the children in the present study hailed from the rural background. Also, it is reported that decline of CD4 count to below 200 cells/mm³ increases the risk of incidence of anemia (Jelliffe, 1966).

According to World Health Organization (WHO, 2012) HIV-infected children on or off ART who are symptomatic, have conditions requiring increased energy (e.g., TB, chronic lung disease, chronic OIs or malignancies) or have weight loss or have evidence of poor growth, should be provided with 25 – 30% additional energy. HIV-

infected children who are severely malnourished should be managed as per the guidelines for uninfected children and provided with 50 – 100% additional energy.

As per the present results, the study subjects in pre-HAART group are progressing with HIV infection with low levels of hemoglobin but the waist-hip ratio of the subjects is normal. The body mass index (BMI) reveals that most of the male children have normal weight but female children fall in underweight category. But majority of the subjects show normal weight and underweight condition. According to the study made by Newell et al. (2003) illustrates that neither height nor weight was associated significantly with the main effects of HIV infection status at birth, but differences between infected and uninfected children increased with age. Between 6 and 12 months, uninfected children grew an estimated 1.6% faster in height and 6.2% in weight than infected children; between ages 8 and 10 years, these figures were 16% and 44%, respectively. By 10 years, uninfected children were on average an estimated 7 kg heavier 7.5 cm taller than infected children.

In pre-HAART group, there is a significant increase ($p < 0.05$) in mean CD4 counts by 108 cells/cmm of the patients from initial count to CD4 count after 6 months. But there is decrease in CD4 count from 6 months to 12 months by 18 cells/cmm. This is supported by the earlier studies (CDC, 2004; Calis et al., 2008; Kumar et al., 2006) that there was a progressive depletion of CD4+ T cells is associated with progression of HIV disease and an increased likelihood of opportunistic infections and other clinical events associated with HIV, including wasting and death. But there is no significant increase ($p > 0.05$) in mean CD4 counts of the patients from 12 months to 18 months of HIV infection.

The study patients in HAART era, initiated ART when their CD4 counts were below 300 cells/cmm. It is also recommended by WHO (2010) to initiate ART for all HIV-infected children between 12 and 24 months of age irrespective of CD4 count or WHO clinical

stage, to initiate ART for all HIV-infected children more than 5 years of age with a CD4 count of ≤ 350 cells/mm³ (as in adults), irrespective of WHO clinical stage and initiate ART for all HIV-infected children with WHO clinical stages 3 and 4, irrespective of CD4 count. In the present study, baseline mean CD4 cell count was 174 ± 72.2 cells/ μ l which is supported by the study of Gautam et al. (2008), where the mean baseline CD4 cell count was 112.1 ± 60.29 cells/ μ l. Also supported by studies among similar patient groups from other parts of India (Mellors et al., 1997; Vajpayee et al., 2005).

The CD4+ T cell counts are normally higher in children compared to adult population. With increasing age the CD4+ T cell counts decrease to attain adult levels at about three to six years of age. A study conducted by Kotylo et al. (1993), has shown that the relative and absolute numbers of CD4+ T cells are high at birth, decrease during early childhood, and closely approximate adult reference values after the age of 3 years.

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