WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
SJIF Impact Factor 6.805
Volume 5, Issue 4, 1392-1406. Case Study ISSN 2277– 7105

THE EFFECTIVENESS OF SELECTED YOGASANAS AND SPIRULINA IN CHILDREN WITH HIV INFECTION - A PILOT STUDY-

[1]Prof. Prabhavathi. S* and [2]Dr. Nalini Jayavanth Santha

[1]Research Scholar Saveetha University , Chennai, India.

[2]Principal, Sacred Heart Nursing College, Madurai, India.

Article Received on
15 Feb 2016,

Revised on 06 March 2016,
Accepted on 26 March 2016

DOI: 10.20959/wjpr20164-5971

***Correspondence for Author**
Prof. Prabhavathi. S
Research Scholar
Saveetha University ,
Chennai, India.

ABSTRACT

AIDS in children poses major challenges for the child, parents and the society. The aim of the pilot study to evaluate the effectiveness of spirulina supplement and yogasanas on physiological parameters and quality of life of children with HIV infection in Tamilnadu, India. An experimental and quantitative approach was used and 30 children were chosen using simple random sampling and allotted 15 children for both experimental and control group. Their weight, height, haemoglobin and CD4 counts were assessed and PaedQol inventory was administered for both groups at 30 days interval for four regular interval. The experimental group was assigned to attend yogasana sessions and 2g Spirulina Supplement for 90 days. The control group received routine interventions. The results revealed that there was a significant difference ($p<0.05$) in the level of haemoglobin, weight, and the domains of PaedQol such as physical functioning, emotional functioning, social functioning and school functioning of the child self report and parents report. There was no significant difference found in the CD 4 counts of the children.

KEYWORDS: HIV positive children, yogasanas, spirulina, physiologic parameters, quality of life.

INTRODUCTION

"**Children's health reflects the national health and wealth**" children are the most invaluable or incomparable resource of any country because the growing potentials of the children determines the global status or standard of the country. When children become the victims of poverty, malnutrition or some incurable diseases such as HIV/AIDS lead to grave

consequences to the individual child, parents, family, country, the continent and the entire globe ultimately. When this precious population is affected by HIV/AIDS means, it will adversely impact the health, economic growth and above all the morale of the nation.

AIDS in children poses major challenges for the child, parents/caregivers, community and the nation. WHO classified the challenges under three headings as mentioned below.[1]

1. Challenges related to the prevention of the infection from mother to child, which includes the need to develop interventions which are efficient, feasible, cost effective and globally affordable strategies.
2. Challenges related to the chronicity of the disease which includes the cost of care, adherence to the treatment, complications of the disease, counseling and support services to cope up with the emotional issues related to diagnosis, disclosure, stigma and fear of death.
3. Challenges related to the health system which includes the burden related to the increasing number of children infected with HIV, inadequate facilities in diagnosing HIV in children, lack resources to implement and monitor the services provided to children.
4. Societal challenges which includes the increasing number of orphans and vulnerable children, stigma, discrimination, cultural and societal barriers and loss of productive age group to the globe.

According to the UNAIDS 2012 global report 34 million people living with HIV/AIDS, around1.7 million people died because of AIDS related causes further, it was projected to rise up to 6.5 million in 2030 including children. The number of children infected with HIV reported globally was 3.4 million and the newly infected children in the year 2010 were 390000. The total number of death because of AIDS reported was 1.8 million and the mortality calculated among children account one out of seven deaths in general. 16.6 million Children have lost one or both parents to AIDS.[2,3]

The United Nations General Assembly reported that HIV/AIDS cause a loss of 58.5 million healthy life years annually and damaging 52.3 billion US dollars or 0.086% of global GDP per year. The UNGA committed to accelerate progress towards the elimination of new child infections by 2015, reducing the number of new HIV infections among children by 90% by the year 2015 and reducing mother to child transmission of HIV (MTCT) to 5 percent, redouble efforts to achieve, by 2015 universal access to HIV prevention, treatment, care and

support, accelerate efforts to achieve the goal of universal access to ART with the target of working towards having 15 million people living with HIV on ART by 2015, combat tuberculosis which is a common co-infection and leading cause of death among people living with HIV, and to work towards reducing tuberculosis deaths in people living with HIV by 50 percent, reduce the AIDS related deaths by 25 percentage as a goal including paediatric population.[3]

The Asian continent alone shares 4.8 million people after South Africa. Four countries that account for the major number of people living in the region are India, Myanmar, Papua New Guinea and Thailand. India is one of the largest and most populated countries in the world with over one billion inhabitants. According to NACO technical report 2010 the total number of people living in India is estimated at 2.4 million (23, 95,442) with 39% of infections among women that is 0.93 million women with HIV in India. The Children under the age of 15 years (1, 04450) accounts for 4.4% of all infections. Number of people died because of AIDS 1, 72,021.[4,5]

South India is considered to be high prevalent and shares 55% of the HIV infections in the country, since all four accounts more than 1% of prevalence among antenatal women with HIV infection. Tamilnadu with a population over 66 million the seventh most populous state in India as per NACO report Tamilnadu accounts 154742 HIV positive people. The number of children living with HIV infection was accounted as 6749 and number of deaths including children due AIDS related causes were 12459. In Tamilnadu the number of people receiving ART is 61473.[5]

Preidis GA, McCollum ED, Mwansambo C, Kazembe PN, Schutze GE, Kline MW. (2011) reported that the higher rates of mortality is associated with malnutrituin and pneumonia ampong HIV infected children. The other predictors found were septicemia, Kaposi sarcoma, meningitis, oesophageal candidiasis and anemia.[6]

Sunguya, B. F., Poudel, K. C., Otsuka, K., Yasuoka, J., Mlunde, L. B., Urassa, D. P., Mkopi, N. P., et al. (2011) conducted a study on Undernutrition among 213 HIV-positive children treated with ART in Tanzania and compared with HIV negative children and found that 36.6% were stunted, 22.1% were underweight and 13.6% were wasted. The families of HIV positive children exhibited lower economic status, lower levels of education, food insecurity, unemployment. The study concluded that the initiation of ART alone was not

adequate in addressing the health problem of HIV positive children and the need to develop interventions to ameliorate the nutritional status of them.[7]

Significance and Need for the study

The enjoyment of the highest attainable standards of health is one of the fundamental rights of every human being without the distinction of age, developmental stage race, religion, political belief social status or health condition everyone has the right to enjoy a standard of living adequate for health and wellbeing of himself and of his family including medical care. UN General assembly reaffirms the full realization of all human rights and fundamental freedoms for all is an essential element in the global response to the HIV/AIDS pandemic, including the areas of prevention, treatment, care and support and recognize that addressing stigma and discrimination is also a critical element in combating the global HIV/AIDS pandemic.[3]

WHO defines Quality Of Life as individual's perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards, standards and concerns. It is a broad ranging concept affected in a complex way by the person's physical health, psychological state, level of independence, social relationships, personal beliefs and their relationship to salient features of their environment.[8]

Malnutrition is a common condition in HIV-infected children and is major contributor to mortality in both HIV-uninfected and HIV-infected children. 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 nutritional disorders and immune status and level of viral replication may be important in predicting growth outcomes.[3]

In 2010 about 925 million people were undernourished, and under nutrition accelerates the development of immune deficiency and opportunistic infections and the side effects ART similarly HIV/AIDS also has a strong influence on undernutrition, children who have been orphaned due to HIV/AIDS are likely to be undernourished since an estimated16.6 million children have lost either one or both parents because of AIDS, further food is likely to become scarce in the areas where HIV prevalence is high. Even when food is available people in advanced stage of HIV infection demands more nutrients or the disease symptoms may not favour them to take adequate such as loss of appetite, gastrointestinal malabsorption,

body distribution, more metabolic demands leads to weight loss, muscle wasting, nutrient deficiencies.[3]

Ramalho, L. C. de B., Gonçalves, E. M., Carvalho, W. R. G. de, Guerra-Junior, G., Centeville, M., Aoki, F. H., Morcillo, A. M., et al. (2011) conducted a cross sectional study to find out the abnormalities in body composition and nutritional status among 94 HIV-infected children and adolescents on antiretroviral therapy. The study revealed that they have higher risk of stunting, thinness, higher waist to hip ratios and lower prevalence of overweight when compared to the control group. The study concluded that the findings were consistent with the severity of the infection and the consequences of prolonged ART.[9]

Esan, M. O., Jonker, F. A. M., Hensbroek, M. B. V., Calis, J. C. J. & Phiri, K. S. (2012) conducted a systematic review and found that the prevalence of Iron deficiency in children with HIV-associated anaemia was 34% the findings were similar in high-income (31%) and low-income settings (36%) comparing to the controls. The study explained the possible reasons such as HIV induced haematosuppression and associated hypoferraemia.[10]

Souza, E., Santos, N., Valentini, S., Silva, G., & Falbo, A. (2010) conducted a follow up for 9 years on outcomes among 49 perinatally HIV-infected adolescents with the mean age of 12.5 years and majority of them with normal CD4 count and undetectable viral load and disclosure was reported by 51% of the participants. The study revealed that 89.8% of were in school but failure and dropout was reported by 51% and 28.6% of the participants whereas their scores on quality of life was high and the study recommended that the early detection and intervention.[11]

Koekkoek, S., Sonneville, L. M. J. de, Wolfs, T. F. W., Licht, R. & Geelen, S. P. M. (2008) conducted a study on neurocognitive functioning among 22 HIV-infected school-age children with the median age of 9.46 years. When they were compared with the age appropriate norms the mean IQ of the HIV infected children was found within average range. They also found that the higher CD4% initiation of highly active antiretroviral therapy was associated with better working memory and attention control. The study concluded that HIV infection compromises the executive function and slowed information processing.[12]

Bomba, M., Nacinovich, R., Oggiano, S., Cassani, M., Baushi, L., Bertulli, C., Longhi, D., et al. (2010) evaluated the health-related quality of life and psychosocial adjustment in

twenty seven Italian children with HIV infection and receiving highly active antiretroviral treatment. On PedsQL 4.0 generic scale they displayed significantly reduced scores on physical, psychosocial and school functioning compared to healthy participants. The social competence and behavioral features on Child Behavior Checklist revealed severe limitations on social ability. The study also explained that the familial, environmental and disease related morbidity were influencing the quality of life negatively.[13]

Louthrenoo, O., Oberdorfer, P. & Sirisanthana, V. (2013) studied the Psychosocial Functioning in fifty Adolescents with Perinatal HIV Infection aged between 11 to 18 years and Receiving Highly Active Antiretroviral Therapy. The Youth Self Report revealed lower scores on total competence and Child Behaviour Checklist by the caregivers. The study concluded that the risk of psychosocialfunctioning and impaired social functioning are increasing even the survival is prolonged by the ART.[14]

Sherr, L., Croome, N., Parra Castaneda, K., Bradshaw, K. & Herrero Romero, R. (2014) conducted a systematic review regarding the Developmental challenges in HIV infected children for a period of 5 years. The selected studies revealed that about 81% of the studies reported some form of cognitive delay than the normal population. Some studies revealed language and executive functioning are affected more than other domains. The review concluded that the children with HIV more predisposed to develop cognitive delays and recommended the need to develop tools to monitor internationally and to implement effective interventions.[15]

McHenry, M. S., Dixit, A. & Vreeman, R. C. (2014). Conducted a Systematic Review of Nutritional Supplementation in HIV-Infected Children in Resource-Limited Settings among HIV infected children less than 18 years of age involved macro and micronutrient supplementation. The review revealed that about 15 studies were related to the supplementation of micronutrients, including vitamin A, zinc, multivitamins and multiple-micronutrient supplementation. Eight studies on macronutrient supplementation and ready-to-use foods, spirulina, whey protein and common foods. The study found that vitamin A was associated with improved mortality rates, ranging from 28% to 63%. But health outcomes measured were not associated with Multiple-micronutrient supplementations. The study concluded that Macronutrient supplementation improved the anthropometrics of the HIV infected children.[16]

Anitha menon J, Cristine glazebrook (2012) conducted a randomized control trial aimed to evaluate a 10 week programme of yoga and peer support group on the psychological well being for HIV positive Zambian adolescents aged 11 to 16 years. Their CD4 count, self rated physical health and emotional well being were assessed. The results revealed that the peer support group had some emotional symptoms whereas the group received both peer support and yoga showed a short term wellbeing in physical and emotional wellbeing.[17]

Pathak R S, Mitra M (2010) evaluated the effect of yogasanas and pranayama on immunity of fifty HIV infected individual after six months interventions of both. It was found that their CD4 count was significantly elevated when compared to the control group. The study concluded that practicing of yogasanas and pranayama would increase their longevity.

A Lack of vital nutrients in people living with HIV/AIDS especially in children is linked to the higher rate of morbidity to co infections or opportunistic infections and mortality or speedy progression of the disease. So nutrients can be supplemented with their regular food to slowdown the disease progression and to prolong their healthy life years.

Statement of the problem

A study to evaluate the effectiveness of spirulina supplement and yogasanas on physiological parameters and quality of life of children with HIV infection in Tamilnadu.

OBJECTIVES

- To evaluate the effectiveness of spirulina supplement and yogasanas on quality of life of children with HIV children.
- To evaluate the effectiveness of spirulina and yogasanas on physiological parameters of children with HIV infection.

Research design

The research design adopted for this study was a quantitative experimental design pretest-post test design.

Participants

The study participants were totally 30 children with HIV infection aged between 5-18 years and allotted 15 children randomly For both experimental group and control group using simple random sampling method.

Sampling criteria

Inclusion Criteria

Children with HIV infection

Children aged between 5 to 18 years

Available during the study period

Residing in Tamilnadu, India.

Willing to participate.

Exclusion criteria

Children who are in the severe stage of illness (CD4 cell count less than 200).

Children who are not attending the community centres.

Delimitations

The study is delimited to the assessment of quality of life and of HIV children after the administration of selected interventions.

Description of the tool

Part I -Consists of the physiological parameters. it includes the items such as Age, date of birth, date of measurement, weight, height, Hb level, CD4 cell count.

Part II -. Pediatric Quality of life Inventory TM (PedsQLTM) for age groups (5-7), (8-12), (13-18).

Interventions

Intervention I: Spirulina Supplement: 2g per day for 90 days two 500mg capsules in the form of capsule.

Intervention II: Yogasanas: it includes the demonstration and explanation on the benefits of selected Yogasanas i.e Tadasana, Trikonasana, Padmasana, Vajrasana, Mahamudra and Savasana.

Method of data collection

The ethical clearance was obtained from the institutional ethical committee and the necessary written permission was initially obtained from the community centres for women a Non Governmental organization at Thirupur district. Self Introduction and the particulars regarding the purpose and nature of the study were explained to the parents and children, who fulfilled the inclusion criteria of sampling and obtained their consent.

Data collection procedure

The data was collected from january 2014 to march 2014 The pretest assessment took 30 minutes and the children in the experimental group with the parents were given spirulina supplement 4g/day for 3months and selected yogasanas demonstrated such as Tadasana, Trikoasana, Padmasana, Mahamudra and Savasana. They were instructed to practice it every day for 3months and their parents are instructed to make them to perform it everyday and to make an entry for eachday. Further they were given remainders through the community centre Volunteers. When they were met every 30th day for the data collection their performance was monitored directly.

Data analysis and interpretation

The data were analyzed using descriptive and inferential statistics using Microsoft Excels, Mean, percentage and standard deviation were used to describe the characteristics. The significant mean difference between the experimental and control group were elicited through Friedmans' test.

I. Physiological parameters

1. Hemoglobin

Table 1. Frequency table for the grades of anemia(n-30).

TESTS	SEVERE	MODERATE	MILD
TEST1	4 (13.3%)	19 (63.3%)	7 (23.3%)
TEST2	3 (10%)	20 (66.7%)	7 (23.3%)
TEST3	3(10%)	20 (66.7%)	7 (23.3%)
TEST4	1 (3.3%)	22 (73.3%)	7 (23.3%)

The number of children 4 (13.3%) had severe anemia after the administration the interventions it is reduced to one.

2. CD4 counts

Table 2. CD4 counts according to the WHO immunological stages of children with HIV infection.

TESTS	NONE OR NOT SIGNIFICANT	MILD	ADVANCED	SEVERE
TEST1	26 (86.7%)	4 (13.3%)	0	0
TEST2	26 (86.7%)	4 (13.3%)	0	0
TEST3	26 (86.7%)	4 (13.3%)	0	0
TEST4	27 (90%)	3 (10%)	0	0

Among total number of participants (30) including both experimental and control group majority (26) were belong to none or significant category. after completion of the interventions only one participant showed to be added to the same category.

II. Comparison of Physiological parameters.

EXPERIMENTAL GROUP (n=15)					CONTROL GROUP (n=15)		
		MEAN	STD. DEVIATION		MEAN	STD. DEVIATION	
HAEMOGLOBIN							
ASSESSMENT	I	8.7113	1.70813		8.64	1.48	
	II	9.1920	1.46417	0.01*	8.64	1.48	0.043*
	III	9.5333	1.21694		8.6	1.4	
	IV	9.9000	0 .9673		8.51	1.54	
CD4 counts							
ASSESSMENT	I	791.8667	208.3		776.33	213.77	0.08
	II	791.8667	208.3	0.145	776.33	213.77	
	III	791.8667	208.3		776.33	213.77	
	IV	800.8667	207.3		776.33	213.77	
WEIGHT							
ASSESSMENT	I	32.8	8.83		32.8	8.09	
	II	32.8	8.72	0.001*	32.8	8.09	0.049*
	III	33.8	8.41		33.8	8.55	
	IV	34.1	8.35		31.76	8.48	
HEIGHT							
ASSESSMENT	I	132	10.6		130	14	
	II	132	10.6	0.194	130	14	0.09*
	III	132	10.7		130	14	
	IV	132	10.7		130	14	

- Significant at < 0.05 level.

By using the Friedman's test to compare the Hemoglobin level (P= 0.01 and 0.043) weight of the children (P= 0.001and 0.049) showed that there is a statistical significant difference between the Hemoglobin levels within the repeated assessments of both in the experimental and control groups with a slightly higher mean scores in the experimental group. But there was no significant difference was found in relation to the height and the CD4 counts of the children.

IV. Comparison of parent and children self report scores on PaedQol inventory.

PARENTS REPORT				CHILDRENS REPORT			
DOMAINS		MEDIAN	RANGE	P VALUE	MEDIAN	RANGE	P VALUE
1. PHYSICAL FUNCTIONING:							
ASSESSMENT	I	400	325		400	275	

	II	**475**	**275**	**0.03***	**475**	**325**	**0.02***
	III	**625**	**375**		**600**	**350**	
	IV	**700**	**150**		**700**	**150**	
2.EMOTIONAL FUNCTIONING:							
ASSESSMENT	**I**	**250**	**175**		**275**	**250**	
	II	**375**	**225**	**0.02***	**375**	**200**	**0.003***
	III	**425**	**175**		**400**	**200**	
	IV	**450**	**150**		**450**	**150**	
3. SOCIAL FUNCTIONING:							
ASSESSMENT	**I**	**325**	**125**		**325**	**225**	
	II	**350**	**125**	**0.04***	**350**	**125**	**0.003***
	III	**425**	**250**		**450**	**150**	
	IV	**450**	**150**		**475**	**175**	
4. SCHOOL FUNCTIONING:							
ASSESSMENT	**I**	**300**	**225**		**300**	**125**	
	II	**325**	**200**	**0.04***	**325**	**200**	**0.04***
	III	**450**	**175**		**450**	**175**	
	IV	**450**	**225**		**450**	**225**	

N=15.

- significant at < 0.05 level.

the Fried man's test results of the domains of quality of life of children with HIV infection and the parents report are showing a significant difference in physical functioning, emotional functioning, social functioning and school functioning.

CONCLUSION

The pilot study revealed that the selected interventions, the yoga session and the spirulina supplement have shown to be effective as a significant found in weight and haemoglobin levels and there was no significant difference in the CD 4 counts. Also a significant difference was found in the dimensions of physical functioning, emotional functioning, social functioning and school functioning of the quality of life of the child self report and also in parents report. The study recommends a replication of the study in more population on a long term basis.

REFERENCE LIST

1. WHOI HIV/AIDS; world health organization-2012. http://www.who.int/hiv/en.
2. UNAIDS 2010- joint united nations programme on HIV/AIDS: Global report http://www.unaids.org/global report/.
3. Global 2015: HIV/AIDS in the context of other global challenges; special report for the UN high level meeting on AIDS, 8-10, june 2011.

4. Technical report india HIV estimates 2010: national institute of medical sciences; national AIDS control organization, 14-15.
5. National AIDS control programme phase III; state fact sheets, march 2012. http://www.nacoonline.org.
6. Preidis, G. a, McCollum, E. D., Kamiyango, W., Garbino, A., Hosseinipour, M. C., Kazembe, P. N., Schutze, G. E., et al. (2013). Routine inpatient provider-initiated HIV testing in Malawi, compared with client-initiated community-based testing, identifies younger children at higher risk of early mortality. *Journal of acquired immune deficiency syndromes, 1999; 63*(1): e16-22. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/23364511.
7. Sunguya, B. F., Poudel, K. C., Otsuka, K., Yasuoka, J., Mlunde, L. B., Urassa, D. P., Mkopi, N. P., et al. (2011). Undernutrition among HIV-positive children in Dar es Salaam, Tanzania: antiretroviral therapy alone is not enough. *BMC Public Health*.
8. http://www.who.int/.
9. Ramalho, L. C. de B., Gonçalves, E. M., Carvalho, W. R. G. de, Guerra-Junior, G., Centeville, M., Aoki, F. H., Morcillo, A. M., et al. Abnormalities in body composition and nutritional status in HIV-infected children and adolescents on antiretroviral therapy. *International journal of STD & AIDS*, 2011; *22*(8): 453-456.
10. Esan, M. O., Jonker, F. A. M., Hensbroek, M. B. van, Calis, J. C. J., & Phiri, K. S. (2012). Iron deficiency in children with HIV-associated anaemia: A systematic review and meta-analysis. *Transactions of the Royal Society of Tropical Medicine and Hygiene*.
11. Souza, E., Santos, N., Valentini, S., Silva, G., & Falbo, A. Long-term follow-up outcomes of perinatally HIV-infected adolescents: Infection control but school failure. *Journal of Tropical Pediatrics*, 2010; *56*(6): 421-426.
12. Koekkoek, S., Sonneville, L. M. J. de, Wolfs, T. F. W., Licht, R., & Geelen, S. P. M. (2008). Neurocognitive function profile in HIV-infected school-age children. *European Journal of Paediatric Neurology*, *12*(4): 290-297.
13. Bomba, M., Nacinovich, R., Oggiano, S., Cassani, M., Baushi, L., Bertulli, C., Longhi, D., et al. (2010). Poor health-related quality of life and abnormal psychosocial adjustment in Italian children with perinatal HIV infection receiving highly active antiretroviral treatment. *AIDS care*, *22*(7): 858-865.
14. Louthrenoo, O., Oberdorfer, P., & Sirisanthana, V. (2013). Psychosocial Functioning in Adolescents with Perinatal HIV Infection Receiving Highly Active Antiretroviral

Therapy. *Journal of the International Association of Providers of AIDS Care*. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/23722084.

15. Sherr, L., Croome, N., Parra Castaneda, K., Bradshaw, K., & Herrero Romero, R. (2014). Developmental challenges in HIV infected children—An updated systematic review. *Children and Youth Services Review*. The Authors. Retrieved from http://linkinghub.elsevier.com/retrieve/pii/S0190740914001467.
16. McHenry, M. S., Dixit, A. & Vreeman, R. C. (2014). A Systematic Review of Nutritional Supplementation in HIV-Infected Children in Resource-Limited Settings. *Journal of the International Association of Providers of AIDS Care*. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/24943654.
17. Menon, A., Glazebrook, C., Campain, N. & Ngoma, M. (2007). Mental health and disclosure of HIV status in Zambian adolescents with HIV infection: implications for peer-support programs. *Journal of acquired immune deficiency syndromes, 1999; 46*(3): 349-54. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/17721397.
18. Merchant, R. H., & Lala, M. M. Common clinical problems in children living with HIV/AIDS: Systemic approach. *Indian Journal of Pediatrics*, 2012; 79: 1506-1513.
19. Zanoni, B. C., Phungula, T., Zanoni, H. M., France, H., Cook, E. F., & Feeney, M. E. (2012). Predictors of poor CD4 and weight recovery in HIV-infected children initiating ART in South Africa. *PLoS ONE*, *7*(3).
20. Sunguya, B. F., Poudel, K. C., Otsuka, K., Yasuoka, J., Mlunde, L. B., Urassa, D. P., Mkopi, N. P., et al. (2011). Undernutrition among HIV-positive children in Dar es Salaam, Tanzania: antiretroviral therapy alone is not enough. *BMC Public Health*.
21. Prendergast, A., Bwakura-Dangarembizi, M., Cook, A., Bakeera-Kitaka, S., Natukunda, E., Nahirya, P., Nathoo, K., et al. (2011). Hospitalisation for severe malnutrition amongst HIV-infected children starting antiretroviral therapy in the ARROW trial. *AIDS*. Retrieved from http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=21346514.
22. Madhivanan, P., Mothi, S. N., Kumarasamy, N., Yepthomi, T., Venkatesan, C., Lambert, J. S., & Solomon, S. Clinical manifestations of HIV infected children. *Indian J Pediatr*, 2003; *70*(8): 615-620. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/14510080.
23. Eley, B. S., Hughes, J., Potgieter, S., Keraan, M., Burgess, J., & Hussey, G. D. Immunological manifestations of HIV-infected children. *Annals of tropical paediatrics*, 1999; *19*(1): 3-7.

24. Singh, P., Hemal, A., Agarwal, S. & Kumar, D. (2014). Cardiac Manifestations in HIV Infected Children. *Indian journal of pediatrics*, (Lv). Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/24859474.
25. Abubakar, A., Holding, P., Newton, C. R. J. C., Van Baar, A. & Van De Vijver, F. J. R. The role of weight for age and disease stage in poor psychomotor outcome of HIV-infected children in Kilifi, Kenya. *Developmental Medicine and Child Neurology*, 2009; *51*(12): 968-973.
26. Sherr, L., Croome, N., Parra Castaneda, K., Bradshaw, K. & Herrero Romero, R. (2014). Developmental challenges in HIV infected children—An updated systematic review. *Children and Youth Services Review*. The Authors. Retrieved from http://linkinghub.elsevier.com/retrieve/pii/S0190740914001467.
27. McHenry, M. S., Dixit, A. & Vreeman, R. C. (2014). A Systematic Review of Nutritional Supplementation in HIV-Infected Children in Resource-Limited Settings. *Journal of the International Association of Providers of AIDS Care*. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/24943654.
28. Brown Dr, B., Oladokun, R., Odaibo, G., Osinusi, K. & Olaleye, D. (2008). Clinical and immunological features of paediatric HIV infection at the University College Hospital, Ibadan, Nigeria. *XVII International AIDS Conference. 3-8 August 2008, Mexico City, Mexico*. XVII International AIDS Conference. 3-8 August 2008, Mexico City, Mexico.
29. Buczynski, A. K., Castro, G. F., Leão, A. T. & Souza, I. P. R. Impact of oral health on the quality of life of 3-6-years old HIV-infected children. Quality of life in HIV+ children. *European Journal of Paediatric Dentistry*, 2011; *12*(4): 236-238.
30. Ramalho, L. C. de B., Gonçalves, E. M., Carvalho, W. R. G. de, Guerra-Junior, G., Centeville, M., Aoki, F. H., Morcillo, A. M., et al. Abnormalities in body composition and nutritional status in HIV-infected children and adolescents on antiretroviral therapy. *International journal of STD & AIDS*, 2011; *22*(8): 453-456.
31. Srinivas, A. & Dias, B. F. Antioxidants in HIV positive children. *Indian Journal of Pediatrics*, 2008; *75*(4): 347-350.
32. Esan, M. O., Jonker, F. A. M., Hensbroek, M. B. V., Calis, J. C. J. & Phiri, K. S. Iron deficiency in children with HIV-associated anaemia: A systematic review and meta-analysis. *Transactions of the Royal Society of Tropical Medicine and Hygiene*, 2012; *106*(10): 579-587. Retrieved from http://www.scopus.com/inward/record.url?eid=2-s2.0-84865966188&partnerID=40&md5=82b1d1565d6cc48af24326edf59c3e5f.

33. Chatterjee, A., Bosch, R. J., Hunter, D. J., Manji, K., Msamanga, G. I. & Fawzi, W. W. Vitamin A and vitamin B-12 concentrations in relation to mortality and morbidity among children born to HIV-infected women. *Journal of Tropical Pediatrics*, 2009; *56*(1): 27-35.
34. Shahum, G., Shahum, A., Sladeckova, V., Hardy, M., Rabarova, L. & Benca, G. J. The psychosocial conditions and intensified education that may affect school performance of HIV/AIDS orphaned children on antiretroviral drugs. *Neuro endocrinology letters*, 2013; *34*(Suppl 1): 12-6. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/24013600.
35. Souza, E., Santos, N., Valentini, S., Silva, G. & Falbo, A. Long-term follow-up outcomes of perinatally HIV-infected adolescents: Infection control but school failure. *Journal of Tropical Pediatrics*, 2010; *56*(6): 421-426.
36. Koekkoek, S., Sonneville, L. M. J. de, Wolfs, T. F. W., Licht, R. & Geelen, S. P. M. Neurocognitive function profile in HIV-infected school-age children. *European Journal of Paediatric Neurology*, 2008; *12*(4): 290-297.
37. Bomba, M., Nacinovich, R., Oggiano, S., Cassani, M., Baushi, L., Bertulli, C., Longhi, D., et al. Poor health-related quality of life and abnormal psychosocial adjustment in Italian children with perinatal HIV infection receiving highly active antiretroviral treatment. *AIDS care*, 2010; *22*(7): 858-865.
38. Louthrenoo, O., Oberdorfer, P. & Sirisanthana, V. (2013). Psychosocial Functioning in Adolescents with Perinatal HIV Infection Receiving Highly Active Antiretroviral Therapy. *Journal of the International Association of Providers of AIDS Care*. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/23722084.