

Body mass index of HIV-infected children on antiretroviral therapy compared to HIV-uninfected children in Vietnam

Abstract

Background and Objectives: Body Mass Index is a useful tool to monitor the growth of children in general. HIV disease impacts to weight and height, consequently to BMI. In Vietnam, BMI data of HIV-infected children on ART are lacking in comparing to HIV-uninfected ones. Our study aimed to (1) determine BMI of HIV-infected comparing HIV-uninfected children; and (2) explore possible factors associating to low BMI z-score in HIV-infected children.

Methods: Cross-sectional study was on 209 children (105 HIV-infected, 104 HIV-uninfected) from HIVCHI, Doda Lab and Fila Bavi cohort.

Results: BMI mean of HIV-infected children was 15, 4±2, 7 lower than HIV-uninfected ones with BMI mean 16, 6±2, 1. HIV-uninfected children at group 5-9years had BMI significantly higher than HIV-infected children by both sex (boy & girl) with $p<0.05$. The two other groups of age (2-4years; 10-14years) have no significant difference. The high rate of normal nutritional status at both groups of age was 66, 2 % (2-5years) and 78, 7% (6-14years). Prevalence of underweight at group 2-5years was 29, 9% higher than group 6-14years (14, 2%). HIV-infected children raised by non- parents have higher rate of low BMI z-score compared to those whose parents as main caretakers [91, 4% > 65, 7%, OR=0, 17 with 95%CI (0, 04-0, 64) and $p=0.009$].

Conclusion: Low BMI in both HIV-infected and HIV-uninfected children in Vietnam states that the malnutrition in children is still a big challenge for resource-limited countries. Underweight is more common in HIV-infected children at age group (5-9years) based on BMI z-score ($<-2SD$). HIV-infected children who are being raised by non- parents have a higher a risk of underweight compared to those whose parents are main caretakers.

Keywords: art, children, BMI, HIV, nutritional status, underweight

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Background and objectives

HIV-infected children, who have the immune system in active to struggle against viruses, require more energy than HIV-uninfected ones. According to WHO Technical Consultation, asymptomatic HIV-infected children need about 10% nutrient requirement intake higher than to normal kids. For HIV-infected children with weight loss symptom, the energy intake needs to be increased by 50% to 100% over established requirements for otherwise healthy uninfected children.¹

High nutrient and energy dietary could help HIV-infected children in gaining weight. However, the growth of HIV-infected children is often slow due to high viral load in blood and/or the impact of opportunistic diseases to the metabolism, for instance, diarrhea and intestinal diseases.²

Body Mass Index (BMI) is a useful tool to monitor the growth of children in general and it is an obligatory parameter collected at each time of health check-up visit of HIV-infected children on Antiretroviral Therapy (ART). For illness children, the growth is slow and no weight-gain compared to same age healthy ones. HIV-infected children treated with protease drug may have the impact on weight and height.³ Furthermore, no weight-gain is caused by drug side effects such as nausea, vomit, diarrhea, loss appetite and anorexia.⁴

HIV disease impacts to weight and height, consequently to BMI. HIV patients on ART with BMI less than 17 have risk of mortality 2times higher than other patients who have BMI greater than 18.5.⁵

BMI of HIV-infected children on ART in Vietnam is not reported adequately in comparing to HIV-uninfected ones. Our study aimed to (1) determine BMI of HIV-infected comparing HIV-uninfected children; and (2) explore possible factors associating to low BMI z-score in HIV-infected children.

Methods

Cross-sectional study was on 209 children (105 HIV-infected, 104 HIV-uninfected). HIV-infected children on ART in year 2015-2016 were chosen randomly from HIVCHI cohort (Vietnam National Children's Hospital, Children's Hospital number 1 and Children's Hospital number 2) and they were from both rural and urban settings in Hanoi and Ho Chi Minh City and the surroundings of the two cities. HIV-uninfected children's data were extracted randomly from DodaLab cohort⁶ and FilaBavi cohort.⁷

The weight was measured shoeless and with lightweight clothes, using standard scales according to the guideline from National Institute of Nutrition.⁸

The analysis consists of the 2 groups of study subjects. Standard statistical methods were used. The ordinary least squares method was applied. A p-value of <0.05 was considered statistically significant.

Results

A total of 209 children were enrolled in this study. The age range was vary from 2–14years. The age group 5-9years was the largest [HIV-infected (64/105, 61%), HIV-uninfected (58/104, 55, 8%)].

The mean BMI of HIV-infected and HIV-uninfected children was 15, 4±2, 7 and 16, 6±2, 1, respectively.

In the age groups 2-4years, 5-9years and 10-16years were not

significantly different BMI comparing HIV-infected and HIV-uninfected children ($p>0.05$).

The mean weight of HIV-infected and HIV-uninfected children was 23, 9±7.9kg and 25, 8±7, 0kg, respectively.

The mean height of HIV-infected HIV-uninfected children was 123, 1±13, 8cm and 123, 7±13, 6cm, respectively.

Stratified analysis BMI comparison between 2 groups by sex and age showed HIV-uninfected children at group 5-9years had BMI significantly higher than HIV-infected children by both sex (boy & girl) with $p<0.05$. In the other two age groups have no significant difference (Table 1).

Table 1 BMI grouped by the sex and by the age range between HIV-infected and HIV-uninfected children

| | HIV-infected children(n=105) | | HIV-uninfected children(n=104) | | p-value (t- test) |
|---------------|------------------------------|---------------------|--------------------------------|---------------------|------------------------|
| | Boy, n(%) 45(42,9) | Girl, n(%) 60(57,1) | Boy, n(%) 65(62,5) | Girl, n(%) 39(37,5) | |
| Age range | | | | | |
| 2-4years | 6 (5,7) | 7 (6,7) | 14 (13,5) | 8 (7,7) | NS* |
| 5-9years | 25 (23,8) | 39 (37,1) | 38 (36,5) | 20 (19,2) | |
| 10-14years | 14 (13,4) | 14 (13,3) | 13 (12,5) | 11 (10,6) | |
| Weight (mean) | 23,9±7.9 kg | | 25,8±7,0 kg | | |
| 2-4years | 19,08±5,4 | 14,1±2,0 | 17,8±2,4 | 17,3±2,2 | B (NS) G (p=0.02) |
| 5-9years | 21,5±6,1 | 21,9±5,2 | 27,9±4,8 | 23,2±5,0 | B (p<0.001) G (NS) |
| 10-14years | 29,4±6,7 | 34,8±6,9 | 28,9±5,3 | 35,5±5,2 | B (NS) G (NS) |
| Height (mean) | 123,1±13,8 cm | | 123,7±13,6 cm | | |
| 2-4years | 104,5±6,7 | 100,4±8,5 | 103,8±8,3 | 107,8±7,2 | B (NS) G (NS) |
| 5-9years | 120,2±8,4 | 121,5±9,7 | 127,7±6,9 | 119,1±8,6 | B (p<0.001) G (NS) |
| 10-14years | 134,2±7,0 | 140,5±9,2 | 137,6±6,8 | 139,2±6,5 | B (NS) G (NS) |
| BMI (mean) | 15,4±2,7 | | 16,6±2,1 | | |
| 2-4years | 17,3±3,2 | 13,9±0,8 | 16,5±1,2 | 14,9±1,4 | B (NS) G (NS) |
| 5-9years | 14,7±3,1 | 14,7±2,5 | 17,1±2,2 | 16,2±1,4 | B (p<0.001) G (p=0.02) |
| 10-14years | 16,1±2,2 | 17,5±2,5 | 15,4±3,0 | 18,3±1,6 | B (NS) G (NS) |

B=Boy, G=Girl, p-value (t-test), NS=non-significant, (*) chi-square

Nutritional status classified by BMI z-score in HIV-infected children

Nutritional status is classified by BMI z-score with different criteria according to group age. The high rate of normal nutritional status at

both groups of age was 66, 2 % (2-5years) and 78, 7% (6-14years). Prevalence of underweight at group 2-5years was 29, 9% higher than group 6-14years (14, 2%). The rate of over-weight and obesity in both groups of age were low (less than 10%) (Table 2).

Table 2 Nutritional status classified by BMI z-score in 105 HIV-infected children

| Nutritional status | 2-5years Criteria n = 77 (%) | 6-14years Criteria n =28 (%) |
|-----------------------|------------------------------|------------------------------|
| Severe under-weight | Less than (-3SD) 10 (13) | Less than (-3SD) 2 (7,1) |
| Moderate under-weight | Less than (-2SD) 13 (16,9) | Less than (-2SD) 2 (7,1) |
| Normal | From-2SD to 2SD 51 (66,2) | From-2SD to 1SD 22 (78,7) |
| Over-weight | Greater than 2SD 2 (2,6) | Greater than 1SD 2 (7,1) |
| Obesity | Greater than 3SD 1 (1,3) | Greater than 2SD 0 (0) |

Associated Factors to low BMI z-score (cutoff <-2SD) in HIV positive children

The associated factors (characteristics of children and caretakers) to low BMI z-score between 2 groups (< -2SD; ≥ -2SD) were tested by chi-square test. Accessible and confirmable factors were chosen such as, children (sex, age range, current HIV stage); caretakers (age,

relationship to the child, habitant, education level).

The relationship to the child (caretakers' characteristic) is associated to low BMI z-score with $p < 0.05$. HIV-infected children raised by non- parents have higher rate of low BMI z-score compared to those whose parents as main caretakers [91, 4% > 65, 7%, OR=0, 17 with 95%CI (0, 04 – 0, 64) and $p = 0,009$] (Table 3).

Table 3 Associated factors to low BMI z-score in 105 HIV-infected children

| Characteristics | | BMI z-score | |
|----------------------------|---------------|-------------------------|--------------------|
| | | <-2SD (n=27, 25, 7%) | ≥-2SD (n=78,74,3%) |
| Children | | | |
| Sex | Boy | 11 (40,7) | 34 (43,6) |
| | Girl | 16 (59,3) | 44 (56,4) |
| Age range | 2-4years | 3 (11,1) | 10 (12,8) |
| | 5-9years | 20 (74,1) | 44 (56,4) |
| | 10-14years | 4 (14,8) | 24 (30,8) |
| Current HIV stage | HIV stage I | 24 (92,3) | 70 (92,1) |
| | HIV stage ≥ 2 | 2 (7,7) | 6 (7,9) |
| Caretakers | | | |
| Age | < 30years | 7 (25,9) | 12 (15,4) |
| | 30 – 59years | 20 (74,1) | 58 (74,4) |
| | ≥ 60years | 0 (0) | 8 (10,2) |
| Relationship to the child* | Parents | 3 (8,6) | 24 (34,3) |
| | Non-parents | 32 (91,4) | 46 (65,7) |
| Habitant | Urban | 12 (26,7) | 14 (23,7) |
| | Rural | 33 (73,3) | 45 (76,3) |
| Education level | Illiteracy | 7 (25,9) | 22 (28,2) |
| | Literacy | 20 (74,1) | 56 (71,8) |

(*) Significant difference with $p < 0.05$ (chi-square)

Discussion

The present study documents low BMI in both HIV-infected and HIV-uninfected children (less than 17), and HIV-infected children at group 5-9years are significant lower than HIV-uninfected children. Our low BMI result ($<-2SD$) with prevalence 25, 7% is higher than the result of previous study with 13, 5%.⁹ The rate of malnutrition reported in year 2015–2016 is higher than in year 2012, this may be these children got old and the high rate of malnutrition at group of 5-9years. One more thing, these two studies were at the same study sites (Vietnam National Children's Hospital, Children's Hospital number 1, Children's Hospital's number 2 and An Hoa clinic).

Sunguya et al.,¹⁰ conducted a study on 213 HIV positive age group and documented that 22.1% was underweight.¹⁰ Kapavarapu studied in Bangalore, Indian HIV positive orphans and reported that 79% was underweight.¹¹ Our study in Vietnam, 25, 5% was underweight. Each country has its own impact factors and conditions and changing by time, So the rate of underweight of HIV-infected children representative for country and/or study site at a specific time.

Maternal age is related to child under nutrition¹² and the increased risk of under nutrition in children of younger mothers may relate to inexperience and inadequate child care.¹³ Furthermore, maternal age and illiteracy may be associated with under nutrition of these children.¹⁴ In our study, maternal age is not related to child nutritional status at group of age 30 – 59years have same distribution prevalence 74,1% vs. 74,4% with BMI z-score cutoff $-2SD$. Parents as caretakers play crucial role in reducing under nutrition, particularly keeping BMI z-score higher than $-2SD$ in HIV-infected children as data were found in this study 34,3% ($>-2SD$, parent caretakers) vs. 8,6 % ($<-2SD$, non-parent caretakers).

Children's factors investigated in our study have no relation to the low BMI z-score in HIV-infected children. In Mandefro Asfaw's study, presence of diarrhea in the past two weeks, male sex and pre-lacteal feeding were significantly associated with stunting.^{15,16} Our cohort was in good health at the time of study, no opportunistic diseases like diarrhea, so only several factors were chosen, this is considered as our study limitations.

Conclusion

Low BMI in both HIV-infected and HIV-uninfected children in Vietnam states that the malnutrition in children is still a big challenge for resource-limited countries. Underweight is very common in HIV-infected children at group of age (5-9years) based on BMI z-score ($<-2SD$). Factors associated to underweight in HIV-infected children need to be investigated more in future. In this study, HIV-infected children who are being raised by non- parents have a higher risk of underweight compared to those whose parents are main caretakers.

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Conflict of interest

Author declares that there is no conflict of interest.

References

1. WHO. *Nutrient requirements for people living with HIV/AIDS: report of a technical consultation*. 2003.
2. Sint TT, Lovich R, Hammond W, et al. Challenges in infant and young child nutrition in the context of HIV. *AIDS*. 2013;27(Suppl 2):S169–S177.
3. Arpad SM. Growth failure in children with HIV infection. *JAIDS*. 2000;25:S37–S42.
4. Miller TL, Mawn BE, Orav EJ, et al. The effect of protease inhibitor therapy on growth and body composition in human immunodeficiency virus type 1-infected children. *Pediatrics*. 2001;107(5):e77.
5. Paton NI, Sangeetha S, Earnest A, et al. The impact of malnutrition on survival and the CD4 count response in HIV-infected patients starting antiretroviral therapy. *HIV Med*. 2006;7(5):323–330.
6. Tran TK, Eriksson B, Nguyen CT, et al. DodaLab: an urban health and demographic surveillance site, the first three years in Hanoi, Vietnam. *Scand J Public Health*. 2012;40(8):765–772.
7. Chuc NT, Diwan V, FilaBavi, a demographic surveillance site, an epidemiological field laboratory in Vietnam. *Scand J Public Health Suppl*. 2003;62:3–7.
8. http://www.cdc.gov/nchs/data/nhanes/nhanes_07_08/manual_an.pdf
9. Bui Thi Hanh. Impact of eco-social factors and care and treatment, stigma to health status of HIV-infected children. *Journal of Social Science in Vietnam*. 2012;1:117.
10. Sunguya BF, Poudel KC, Otsuka K, et al. Undernutrition among HIV positive children in Dar es Salaam, Tanzania: Antiretroviral therapy alone is not enough. *BMC Pediatr*. 2011;11:869.
11. Kapavarapu PK, Bari O, Perumpil M, et al. Growth patterns and anaemia status of HIV infected children living in an institutional facility in India. *Trop Med Int Health*. 2012;17(8):962–971.
12. Linnemayr S, Alderman H, Ka A. Determinants of malnutrition in Senegal: Individual, household, community variables, and their interaction. *Econ Hum Biol*. 2008;6(2):252–263.
13. Kimani-Murage EW, Norris SA, Pettifor JM, et al. Nutritional status and HIV in rural South African children. *BMC Pediatr*. 2011;11:23.
14. Ravi Ambey, Saumya Sahu, Anoop Sharma, et al. Assessment of Nutritional Status of HIV Positive Children in Antiretroviral Therapy Center: A Study From Central India. *International Journal of Pediatrics Research and Practice*. 2015;1(1):1.
15. Mandefro Asfaw, Mekitie Wondaferash, Mohammed Taha, et al. Prevalence of undernutrition and associated factors among children aged between six to fifty nine months in Bule Hora district, South Ethiopia. *BMC Public Health*. 2015;15:41.
16. Brinkman HJ, de Pee S, Sanogo I, et al. High food prices and the global financial crisis have reduced access to nutritious food and worsened nutritional status and health. *J Nutr*. 2010;140(1):153S–161S.