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NUTRITIONAL ASSESSMENT OF HIV EXPOSED CHILDREN (0 - 6 MONTHS), ATTENDING AHMADU BELLO UNIVERSITY TEACHING HOSPITAL, SHIKA - ZARIA, NIGERIA

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Abstract
A prospective cohort study of seventy-four mothers - infants' pairs was conducted to assess nutritional status of children born to HIV positive mothers aged zero to six (0 -6) months, the sample size was calculated based on the prevalence rate of HIV in Kaduna state. The study was conducted in Ahmadu Bello University Teaching Hospital– Shika, using anthropometric measurements (weight, height, etc.), and analyzed using WHO Anthro version 3.2.2.1. The birth weight was averagely double by six months of age. At birth 90.54% of the children were within normal weight (insert values) range while only 9.46 % were of low birth weight (insert values). At 2, 4 and 6 months, underweight children increase dramatically to 28.38%, 41.89% and 29.73% respectively. The prevalence of stunting started from birth at 12.16 % and increased to 28.3 8% by 2 months while at 4 months, it reduced to 22.97% with further reduction noticed at 6 months to 16. 22%. Similarly at birth, 2, 4 and 6 months of age, the proportion of children that were wasted was 28.38%, 31.08%, 29.73% and 33.78%, respectively.

Key Words: HIV exposed children; HIV infected Mothers, stunted children, underweight, wasted children.

INTRODUCTION

Majority (>90%) of people with HIV infection live in sub-Saharan Africa, with an estimated 2.3 million children affected worldwide (United Nations, 2008). Over a million HIV-exposed children are born worldwide every year (Sugandhi et al. 2013) and evidence suggests that these
children are at higher risk of morbidity and mortality compared with their un-exposed peers (Brahmbhatt et al. 2006; Marinda et al. 2007; Shapiro et al. 2007; Filteau 2009; Landes et al. 2012). In 2016, 740,000 women of reproductive age were diagnosed with HIV despite this significant progress and approximately half of 180,000 children were newly infected during breastfeeding (UNAIDS 2017). Prevention of mother-to-child transmission (PMTCT) implementation services prevented around 1.4 million HIV infections among children between 2010 and 2018(UNAIDS 2018; Andare et al. 2019). WHO recommended that HIV-infected mothers take antiretroviral (ARV) drugs and exclusively breastfeed their babies for first 6months before introducing appropriate complementary foods and continue breastfeeding for at least 52 weeks, even in the absence of antiretroviral therapy (ART), breastfeeding should continue until a nutritionally adequate and safe diet without breast milk can be provided (WHO2010; World Health Organization 2015).

Malnutrition is defined as a cellular imbalance between the supply of nutrients and energy and the body's demand for them to ensure growth, maintenance and specific functions (WHO, 2010). It is an underlying factor in childhood survival, as it is responsible for more than 50% of under-five deaths worldwide, while also being the most important risk factor for illness and diseases in children worldwide (UNICEF, 2013).The rates of under-nutrition globally, have been on the decline since 1990 (UNICEF, WHO, World Bank 2015), an estimated 45% of global child deaths (3.1million annual child deaths) are caused by under-nutrition (World Health Organization 2015). Underdeveloped and developing countries bear a disproportionate share of this burden with 96% of all wasted and 94% of all stunted children under-five living in Asia and Africa in 2014 (UNICEF, WHO, World Bank 2015). Generally, a child's nutritional status is an indicator of his or her general wellbeing and health status. Nutritional status is influenced by food intake and the quantity and quality of foods ingested and the child's physical health, affecting all aspects of the child's health i.e. growth and development, physical activity and response to serious illness. The spectrum of nutritional status spans from severe malnutrition through normal nutritional status to obesity. Hence, Infant and young child feeding is key in improving child survival and promoting healthy growth and

development particularly in the first 2 years of a child's life (World Health Organization 2015).

Anthropometry, the commonest method of nutritional status assessment in under-fives, involves the measurement of the length/height, weight and mid (upper) arm circumference of a child. These were computed and compared with accepted national and international standards of their expression to determine a child's status. That is; reference data from the 2006 World Health Organization growth chart (WHO Multi Centre Growth Reference Study Group 2006). Children below _2 SD of the WHO median weight-for-age, length-for-age and weight-for-length were considered as underweight, stunted and wasted, respectively. The assessments of a child's weight at birth and of his or her growth are indicators of the child's nutritional status (WHO Multi Centre Growth Reference Study Group 2006). Hence, studies involving infants born to HIV infected mothers may provide useful insights into the nutritional implications of the infection and may contribute to the development of intervention strategies for this segment of the population in Nigeria.

MATERIALS AND METHODS

HIV-exposed infants between zero and one week old, whose mothers were regularly attending HAART clinic (Paediatric Anti - Retro-Viral Section) of Ahmadu Bello University Teaching Hospital **(**ABUTH) Shika –Zaria, and are willing to exclusively breastfed their infants, were enrolled and followed for first six months.

Sample size:

Kaduna state HIV prevalence was 5.1% (DHS, 2014). Assuming standard error of 5% and confidence interval (C.I) of 95%, the sample size for this study was determined using Fisher's and Naing's formula (Fisher *et al.*, 1991; Naing*et al* 2006):

Where:

N: Is the sample size
Z: The value corresponding to the normal deviate (confidence limit) taken as 1.96 at 95% confidence level
p: Proportion of HIV infected women in the study population
q: Proportion of women not infected with HIV in the population (1-p from infinite population)
c: Is the acceptable degree of accuracy (SE) desired (0.05)
The sample size was calculated using the, formula stated below:

$$N = \frac{Z^2 * (p) * (1-p)}{c^2}$$

Therefore the Sample size:

$$N = \frac{1.96^2 * 0.051 * 0.949}{0.05^2} = 74.37184\ 49e$$

Ethical consideration:

This was a prospective cohort study of HIV positive mother - infant pairs attending HAART clinic (Paediatric Anti - Retro-Viral Section) of Ahmadu Bello University Teaching Hospital **(**ABUTH) Shika –Zaria, for over a period of six months. The study protocol was approved by the Scientific and Health Research Ethical Committee of Ahmadu Bello University Teaching Hospital Shika - Zaria, Nigeria via a letter Ref No. ABUTH/HREC/TRG/36 dated 13th October 2014. Verbal and written informed consent was sought and obtained from each subject before an interview was conducted and respondents who participated in the study were assured of confidentiality.

Anthropometric Measurements

Anthropometry is widely used in assessing nutritional status. These measurements are easily measurable, non-invasive and can be compared with other studies. All these measurements are reported in relation to appropriate international standard reference values for the age of the child WHO 2006. Children were weighed with minimal clothing on a scale to the nearest 0.05 kg, and length was measured to the nearest 0.1 cm using measuring boards recumbently. A calibrated 10 kg weight was used to assess the accuracy of the scales. A member of the research team randomly selected children for cross-checking and validating the accuracy of the weighing balance. The weight (in kilograms) and the length (in centimeters) of the exposed infants were measured during regular visits of two monthly. The raw data were vetted and first entered into a Microsoft Excel Move this to data analysis.

Data Collection and Analysis:

On each of their regular visits to the clinic, we educate the Mothers on the risks and benefits of exclusive breastfeeding according to WHO recommendations, that HIV-exposed children be exclusively breastfed 'for the first six months of life' followed by replacement feeding as soon as the baby is 26 weeks old and it should be Acceptable, Feasible, Affordable, Sustainable and Safe, (AFASS), considering the women's individuals' circumstances and situation (World Health Organization 2010). They also, were asked of the feeding practices in the past days such as breastfeeding and frequency, introduction of other liquid or foods including water, tea, juice, cow's milk, infant formula, porridge, etc. We defined exclusive breastfeeding as feeding a child with breast milk only without additional foods or water.

Anthropometric information collected were used to calculate z-scores using Epi-Info version 6.04 and WHO Anthro software Version 3.2.2, 2011 (WHO, 2010). The National Centre for Health Statistics/World Health Organization guidelines (WHO 2006) and cut-off points were also used to determine the degree of stunting, underweight and wasting. The anthropometric indicators used were the weight-for-age z-score, the length -for-age z-score and the weight-for-length z-score. The WHO's z-scores for various nutritional indices were calculated and the WHO definitions of various forms of malnutrition were adopted as follows: Underweight is defined as weight for age Z-score less than -2 standard deviations, wasting is defined as weight for height Z-score less than -2 standard deviations while stunting was defined as height-for-age Z-score less than -2 standard deviations of the WHO/NCHS reference standards (WHO, 2010). The National Centre for Health Statistics/World Health Organization guidelines (WHO 2006). P values less than 0,05 ($P<0.05$) were accepted as statistically significant. Data were obtained by one of the researchers and data handling, analyses and write up were done by the authors.

RESULTS

A total of 74 children were followed up from birth to 6 months of age. Sex distribution shows that 39 (52.70%) of the children were male, while 35 (47.30 %) were females giving a male: female ratio of 1.1: 1. Table 1 shows the age distribution of mean weight and length by sex. At birth and at 2 months of age the weight were similar ($p > 0.05$), while by 4 and 6 months of age the mean weight were significantly higher in the male than in the female ($p < 0.05$). Similarly, the mean length was similar at birth, two months and four months of age ($p> 0.05$) but by 6 months it was significantly lower (insert values) in the female than the male.

Sex combined age distribution of the mean weight and weight-for-age z scores of HIV exposed children are shown on Table 2. The mean birth weight was 3.03±0.89 kg and at 2 months it increased by 1.39 kg to 4.42±0.83 kg, while at 4 months it increased by 1.18 to give 5.60±0.99 kg and the rate of increases between 2 month and 4 months were similar ($p> 0.05$). At 6 months of age, it only increased by 0.77 kg to 6.37±1.15 kg and this was significantly lower than at 4 and 6 months. Also from this Table2, it was also observed that the birth weight was averagely doubled by six months of age. Whereas, at birth, 90.54% of the children were within normal weight range with only 9.46 % having low birth weight. The results further showed at two and four months of age, the level of underweight had increased to 28.38% and 41.89% respectively. However, by 6 months the level of underweight had reduced to 29.73% (Table 2).

Table 3 shows the z – scores of the mean length - for - age and length - for - age for the combined sexes. The mean length at birth was 48.27±4.02 while at 2 months it increased by 5.93cm (12.29%) to 54.25±9.24. Also at 4 months the increment was by 6.03cm (11.12%) to give 60.43±4.45 whereas the increments between these two periods were similar ($p> 0.05$), by six months, it increased by 4.63 (7.66%) to give 65.26±4.16 and it was significantly lower than 2 months and 4 months ($p< 0.05$). The prevalence of stunting started from birth at 12.16 % and increased to 28.3 8% by 2 months. However, at 4 months of age it reduced to 22.97% and even further reduction was observed at 6 months (16. 22%). At birth, 2, 4, 6 months of age the proportion of children that were wasted were 28.38%, 31.08%, 29.73% and 33.78% respectively (Table 4). However, there was no significant difference between the ages as regards wasting ($p > 0.05$).

Table 1 Age distribution of mean weight and length by sex in exposed infants (74)

Age	Weight (Kg)			Length (cm)		
(Months)	Male	Female	Ttest	Male	Female	Ttest
0	3.09±0.67	2.97±0.66	0.22	48.27±4.04	47.33±3.99	0.16
2	4.46±0.88	4.37±0.72	0.30	54.25±4.20	53.21±4.83	0.16
4	5.86±1.01	5.30±0.91	0.01	60.43±4.47	59.07±4.38	0.09
6	6.67±1.12	6.01±1.01	0.003	65.26±4.14	63.49±4.03	0.03

Values are means ± SD.0 month correspond to birth month ($p<0.05$)

Table 2 Age distribution of the mean weight and weight-for-age z scores of HIV Exposed Children (74)

Age (months)	Mean Weight (Kg± SD)	Normal WAZ N (%)	Moderate Underweight N (%)	Severe Underweight N (%)	Total Underweight N (%)
0	3.03±0.89	67 (90.54)	6(8.11)	1(1.35)	7 (9.46)
2	4.42±0.83	53 (71.62)	11(14.86)	10(13.51)	21 (28.38)
4	5.60±0.99	43 (58.11)	19(25.68)	12(16.22)	31 (41.89)
6	6.37±1.15	52 (70.27)	9(12.16)	13(17.57)	22 (29.73)

0 month correspond to birth month ($p<0.05$)

Table 3 Age distribution of the mean length and length-for-age z scores of HIV Exposed Children (74)

Age (months)	Length (cm± SD	Normal LAZ N (%)	Moderately Stunted N (%) (-3<Z<-2)	Severely Stunted N (%) (Z<-3)	Total stunted N (%)
0	48.27±4.02	65 (87.84)	4(5.41)	5 (6.75)	9 (12.16)
2	54.25±9.24	53 (71.62)	6(8.11)	15(20.27)	21 (28.38)
4	60.43±4.45	57 (77.03)	7(9.46)	10(13.51)	17(22.97)
6	65.26±4.16	62 (83.78)	5(6.76)	7(9.46)	12 (16.22)

0 month correspond to birth month ($P<0.05$)

Table 4 Age distribution of weight-for-length z- scores of HIV Exposed Children (74)

Age (months)	Normal WLZ N (%)	Moderate Wasting N (%)	Severe Wasting N (%)	Total Wasting N (%)
0	53(71.62)	8(10.81)	13(17.57)	21(28.38)
2	51(68.92)	9(12.16)	14(18.92)	23(31.08)
4	52(70.27)	24(32.43)	8(10.81)	22(29.73)
6	49(66.22)	11(14.86)	14(18.92)	25(33.78)

0 month correspond to birth month ($p<0.05$)

DISCUSSION

In this study the growth rate of these children was within normal with peak increments at 2 months and they were able to double their birth weight at six months of age on ……. It has been reported that breast-fed infants tend to grow more rapidly in the first 2 months and less rapidly from 3-12 months when compared (NCHS, 2019; DPR Korea and UNICEF. 2017). The weight-for-age of children usually reflects their current nutritional status, because current or recent episodes of under nutrition could leads to weight loss resulting in body weight which is lower than that appropriate for age.

In this study, the weight-for-age of the majority of the children could be described as within the normal range and supporting the report that the weight of the unexposed babies may not defer significantly from that of the reference population (Kamenju *et al.*, 2016) although the HIV status of the children was not ascertained. Nonetheless, the prevalence of underweight malnutrition peaked at age 4 months and began to improve by 6 months of age. The mean prevalence of underweight for all the ages was 27.37% for all children. In this study, the 9.46% low birth weight observed, confirms earlier study that infants that were of low birth weight were at significantly higher risk of being underweight and stunted (NPC/NDHS and ICF. 2019, Kamenju *et al.*, 2016). Also HIV-infected women may be at higher risk for preterm labour and intrauterine growth retardation (Nguefack *et al.*, 2018) since intrauterine growth retardation depend on the degree of maternal immunodeficiency (NDHS 2019).

Stunting (low height - for - age) in children indicates the failure to reach optimal linear growth potential due to long – term cumulative inadequacies of health or nutrition (WHO, 1995). The prevalence of stunted children started from birth (Table 3) which was evidence that the children did not achieve their full growth potential. Stunting is the result of long-term energy/ protein deficiency or the result of other factors including intrauterine events (NDHS, 2019). The prevalence of stunted children in the HIV exposed children continued to the highest at 2 months of age but started decreasing by 4 months (Table 3). Suggesting the importance of a consistent follow up of these children where nutritional counseling was on – going and problems were detected early.

The indicator of weight-for-height is presumed to reflect acute nutritional alterations such as an acute episode of under-nutrition, resulting in the failure of the child to gain weight relative to the height. In general, the majority of the children from all the age group in this study had similar level of weight for height from birth till six months that are within normal (Table 4).

In Nigeria, 7% of children under five are wasted (too thin for height), a sign of acute malnutrition. In addition, 22% of children under five are underweight, or too thin for their age. Rural children have higher levels of stunting, wasting, and underweight, compared to urban children. (NDHS, 2018)

However, in this study, 29.73%, 33.78% and 16.22% of this group of children were already underweight, wasted and stunted, respectively. This may be as a result of maternal HIV status which greatly affects the weight and the growth of the infants. (Nguefack et al. 2018). This appears to suggest that the children in the study attending ABUTH need to be followed up regularly and carefully to prevent the level of wasting surpassing national average as they older.

The prevalence of infants who were underweight peaked at four months of age while stunted clustered at 2-4 months and wasting was similar throughout the months (Tables 2, 3 and 4). This could point to the need for nutritional monitoring of babies starting very early in life in order to commence appropriate and effective intervention strategies on time. What is not known however is to what extent is this problem the outcome of genetic or environmental influence? For instance, the infants may not have received adequate nourishing breast milk if the mothers themselves were malnourished; these are some of the areas that could be investigated.

CONCLUSION

The levels of malnutrition among HIV exposed infants in the clinic, although relatively low, compared to national standards (UNICEF, WHO, World Bank 2015), merits some public health concern, and hence suggesting early growth monitoring of all HIV-exposed infants for possible nutritional advice to the parents to adopt low-cost strategies for improving health and survival outcomes of the infants.

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