

**IMPACT OF HIV INFECTION ON INFANT FEEDING PRACTICES AMONG HIV-
POSITIVE MOTHERS, AND NUTRITIONAL ASSESSMENT OF THEIR CHILDREN
(0-6 MONTHS) IN AHMADU BELLO UNIVERSITY TEACHING HOSPITAL**

ZARIA, NIGERIA

By

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AHMADU BELLO UNIVERSITY,
ZARIA, NIGERIA**

SEPTEMBER, 2015

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ZARIA, NIGERIA

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(M.Sc/SCIE/28222/2012-2013)**

**A THESIS SUBMITTED TO THE SCHOOL OF POSTGRADUATE STUDIES,
AHMADU BELLO UNIVERSITY, ZARIA IN PARTIAL FULFILLMENT OF THE
REQUIREMENTS FOR THE AWARD OF A MASTER DEGREE IN NUTRITION**

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SEPTEMBER, 2015

DECLARATION

I declare that the work in this Thesis entitled “Impact of HIV Infection on Infant Feeding Practices among HIV-Positive Mothers, And Nutritional Assessment of Their Children (0-6 Months), In Ahmadu Bello University Teaching Hospital Zaria, Nigeria” has been carried out by me in the Department of Biochemistry. The information derived from the literature has been duly acknowledged in the text and a list of references provided. No part of this thesis was previously published or presented for another degree or diploma at this or any other Institution.

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CERTIFICATION

This Thesis entitled “Impact of HIV Infection on Infant Feeding Practices among HIV-Positive Mothers, And Nutritional Assessment of Their Children (0-6 Months), In, Ahmadu Bello University Teaching Hospital, Zaria, Nigeria” by BURBA, Rimamtsiwe Adi (M.Sc/Scie/28222/2012-2013) meets the regulations governing the award of the degree of Master in Nutrition of Ahmadu Bello University, and is approved for its contribution to knowledge and literary presentation.

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DEDICATION

This research work is dedicated to Jesus Christ my Lord and personal Saviour and my comforter in life- the Holy Ghost.

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ABSTRACT

A prospective study of seventy four mothers was designed to assess impact of HIV infection on infant feeding practices and nutritional status of children born to HIV positive mothers' aged zero to six months. The study carried out in Ahmadu Bello University Teaching Hospital-Zaria, from birth to six months, with the objectives of assessing the impact of HIV infection on infant feeding practice among HIV infected mothers, assessing the effect of feeding practices on the nutritional status of infants of HIV infected mothers, and assessing the impact of education, on infant feeding practicing among HIV positive mothers. Data collection involved administration of semi-structured questionnaire, taking anthropometric measurement of their babies and their folders were used to collect more information that could not be obtained from the caregivers directly such as CD4+ count. Data was analyzed using WHO Anthro. Maternal knowledge on Mother to Child Transmission of HIV was high and is reflected in maternal choice of infant feeding practice where 95.95% practiced exclusive breastfeeding. On the other hand, level of formal education attained has no association on choice of infant feeding practice while exposure to other information received through health talks and or counselling from health workers or media influenced their choices. Despite high level of maternal knowledge on Prevention of Mother to Child Transmission of HIV, few respondents practiced mixed infant feeding before 6 months. The exposed children were moderately undernourished because, in all the indexes; none was below -2 Z-score, with values revolving between -1 Z-score and -2 Z-scores. In conclusion, the choice of infant feeding practice is significantly associated ($p < 0.05$) with level of maternal knowledge of PMTCT of HIV as seen in the Chi-square value calculated compared to the

tabulated value, while commonly used infant feeding option among the mothers is exclusive breast feeding.

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ABBREVIATIONS

ABUTH: Ahmadu Bello University Teaching Hospital.

AFASS: Acceptable, Feasible, Affordable, Sustainable and Safe

ANC: Antenatal Care

ARI: Acute Respiratory Infection

ART: Antiretroviral Therapy

ARVs: Antiretroviral Drugs

BMI: Body Mass Index

CD4: Cluster of Differentiation 4

DHS: Demographic Health Survey

ELISA: Enzyme - Linked Immunosorbent assay

FANTA: Food and Nutrition Technical Assistance

FMOH: Federal Ministry of Health

HAART: Highly Active Antiretroviral Therapy

HCT: HIV Counselling and Testing

HMIS: Health and Management Information System

HIV: Human Immunodeficiency Virus

ICFI: Infant and Child Feeding Index

IYCF: Infant and Young Child Feeding

LAZ: Length-for-Age Z-score

LDCs: Low Developing Countries

MDG: Millennium Development Goals

MTCT: Mother-to-Child Transmission of HIV/AIDS

NGO: Non-Governmental Organization

PCR: Polymerase Chain Reaction

PMTCT: Prevention of Mother to Child Transmission of HIV/AIDS

PNT: Post Natal Transmission

PTCT: Parent-To-Child Transmission of HIV/AIDS

SD: Standard Deviation

TRAC: Treatment and Research AIDS Center

UN: United Nations

UNICEF: United Nations Children's Fund

VCT: Voluntary Counseling and Testing

WAZ: Weight-for-Age Z-score

WHZ: Weight-for-Height Z-score

WLZ: Weight-for-Length Z-score

WHO: World Health Organization

CHAPTER ONE

1.0

INTRODUCTION

1.1 Research Background

The Global Strategy for Infant and Young Child Feeding (IYCF), adopted by the World Health Organization (WHO) and United Nations Children Fund (UNICEF), states that the optimal feeding pattern for overall child survival is exclusive breastfeeding for the first six months, and continued breastfeeding for up to two years and beyond, with complementary feeding from age six months, together with related maternal nutrition and support (WHO, 2010). The Global Strategy contains specific recommendations for children in exceptionally difficult circumstances, including those born to HIV-positive women. Action to reduce child morbidity and mortality and to promote family health has greatly improved child health (Walker *et al.*, 2002, Black *et al.*, 2003).

Promotion of breast-feeding has contributed significantly in that it provides optimum nutrition, protects against common child-hood infections, reduces mortality significantly, and has child-spacing effects (Nicollet *al.*, 2000; WHO Collaborative Study Team, 2000). Nearly all infants in developing countries are initially breastfed, and most continue until at least six months of age but often into the second year (Nicollet *al.*, 2000, WHO Collaborative Study Team, 2000). Continued breastfeeding (beyond six months) is common in sub-Saharan Africa and Asia, but much less so elsewhere. Up to 94% of infants in the world are estimated to be ever breastfed, 79% to continue at one year, and 52% at two years, with an estimated median duration of breast feeding of 21 months (WHO, 2010). Overall, an estimated 41% of infants less than four months of age and 25% under six months are exclusively breastfed; in sub-Saharan Africa 23% of infants less than six months of age are exclusively breastfed (WHO, Global Databank on Breastfeeding

and Complementary Feeding, 2003a). In 2001 the World Health Assembly endorsed the recommendation that infants should be exclusively breastfed for the first six months of life to achieve optimal growth, development and health. After six months, they should receive nutritionally adequate and safe complementary foods while breastfeeding continues up to 24 months or beyond. This recommendation takes into account the considerable benefits of breastfeeding, as well as the adverse effects of artificial feeding at an early age. Exclusive breastfeeding is the best form of feeding for the infant during the first six months of life (WHO, 2001a). Also, it helps the mother space her pregnancies. A woman who exclusively breastfeeds during the first six months and who has not resumed menstruation has a less than 2% risk of becoming pregnant (WHO, 2000b). Exclusive breastfeeding on a population basis has been shown to be feasible with adequate support and training of health-care professionals (Kramer *et al.*, 2001; Bhandari *et al.*, 2003).

Infant and young child feeding in the context of Human Immunodeficiency Virus (HIV) poses significant challenges due to the risk of transmission of the virus via breastfeeding. Prior to the 2010 guidelines on HIV and infant feeding, avoidance or early cessation of breastfeeding seemed logical or appropriate (United Nations, 2014). However, the repercussions for the health and survival of the infants were serious, with studies showing much higher mortality rates due to diarrhoea, malnutrition and other diseases in non-breastfed children. The 2010 recommendations were based on evidence of positive outcomes for HIV-free survival through provision of ARVs to breastfed HIV-exposed infants. Thus the focus is now firmly on ensuring HIV-free survival, not just on preventing transmission. The WHO, (2010) guidelines provide a much clearer pathway towards this goal. Breastfeeding carries significant health benefits for infants and young children and is an essential child survival intervention. Without intervention, about 35% of HIV-

positive pregnant women will pass on the infection to their babies during pregnancy, delivery and post-natally through breastfeeding. Without preventive interventions, about 10-20 per cent of infants born to infected mothers will contract the virus through breast milk if breastfed for two years. The risk of postnatal HIV transmission after 6 weeks of age is estimated at around 1% per month of breastfeeding (WHO, 2006). Several other factors affect the risk of transmission, including the “viral load” or amount of virus in the mother’s body (highest risk after infection and when AIDS develops; a very sick mother is eight times more likely to transmit HIV to her infant than a healthy mother), the duration of breastfeeding (the longer the period, the greater the risk, as transmission is cumulative), and the condition of the breasts (whether there are sores around the nipples e t c.) (WHO, 2010).

Method of infant feeding is clearly associated with the risk of transmission through breast milk. Exclusive breastfeeding for the first six months is associated with a 3-4 fold lower risk of HIV transmission as compared to mixed feeding (mixed feeding means the infant receives both breastmilk and any other food or liquid including water, non-human milk and formula before 6 months of age)(WHO, 2010). One study found that only about 4% of exclusively breastfed infants became infected with HIV between 6 weeks and 6 months, even in the absence of ARVs (WHO, 2007). It is believed that mixed feeding in the first six months carries a greater risk of transmission because the other liquids and foods given to the baby alongside the breastmilk can damage the already delicate and permeable gut wall of the small infant and allow the virus to be transmitted more easily. Mixed feeding also pose the same risks of contamination and diarrhea as artificial feeding; diminishing the chances of survival (WHO, 2010). Unfortunately mixed feeding is still the norm for many infants less than six months old in many countries with high HIV prevalence.

Exclusive breastfeeding rates among children less than six months of age in two-thirds of developing countries with trend data have increased between 1998 and 2008, but are still quite low at 33% in sub-Saharan Africa (WHO, 2010). Thus HIV transmission through breastfeeding can be reduced if HIV-positive women breastfeed exclusively for six months rather than practising mixed feeding. Public health programs for protection, promotion and support of breastfeeding can have major benefits for HIV-positive women and their children, as well as for the population in general. With the new recommendations, it is postulated that an HIV-infected woman who takes ARVs and mix-feeds may still have a higher rate of transmission than a mother who exclusively breastfeeds and takes ARVs: the transmission risk is shifted downwards for all breastfeeding mothers but the pattern of higher risk remains for the mixed-fed infants (WHO, 2010). Therefore continued emphasis needs to be placed on discouraging mixed feeding in the first six months. The risk of HIV-infection has to be compared with the risk of morbidity and mortality due to not breastfeeding. In general, babies who do not breastfeed are more than 14 times more likely to die from diarrhoea or respiratory infections than babies who are exclusively breastfed in the first six months (Bhandari *et al.*, 2003).

The benefits of breastfeeding have been well described in the medical literature (Cesar *et al.*, 1999; WHO, 2000a; Kramer *et al.*, 2001). These benefits – including providing optimal nutrition, preventing common childhood illnesses and improving child spacing – are of particular importance in resource-poor countries such as in sub-Saharan Africa. For this reason, the possibility of HIV transmission through breastmilk poses a dilemma, particularly in conditions where breastfeeding is a strong cultural norm, and where large numbers of women are infected with HIV.

It is estimated that 15% of infants born to HIV-infected women acquire the infection through breast-feeding (De Cock *et al.*, 2000). Risk factors for Mother-To-Child Transmission of HIV (MTCT) through breastfeeding include: the duration of breast-feeding; maternal characteristics such as younger maternal age and higher parity; low CD4+ count; high peripheral blood and maternal milk viral load; mastitis and breast abscess; infant characteristics such as oral candidiasis; and possibly the pattern and duration of breastfeeding (de Martino *et al.*, 1992; Ekpini *et al.*, 1997; Miotti *et al.*, 1999; Semba *et al.*, 1999; Coutoudis and Rollins, 2003).

Research has provided some evidence about the risk of HIV transmission according to the pattern of breastfeeding, and has provided additional incentive for consistent and strict definitions of infant feeding patterns (Greiner, 2002). The possible association between infant feeding patterns among infants who are breastfed by infected mothers and the risk of MTCT was first evaluated in a prospective study conducted in South Africa (Coutoudis *et al.*, 2001). In the study, it was found that, by 15 months of age, the cumulative probability of HIV infection was lower among infants who were exclusively breastfed compared with those who were mixed fed (i.e. those who received other foods and liquids in addition to breast milk). These findings were later confirmed in Zimbabwe (Ilf *et al.*, 2005)

HIV can be transmitted through breast milk at any point during lactation, and thus the rate of infection in breastfed infants increases with duration of breastfeeding. The persistence of maternal antibodies and the presence of a “window period” during which infection is undetectable by current technology makes it difficult to determine whether an infant has been infected during delivery (intrapartum) or – through breastfeeding – immediately after birth. There is too little information to estimate the exact association between duration of breastfeeding and risk of transmission. There is strong evidence, however, that the longer the duration of

breastfeeding the greater the risk of transmission – in other words, the risk is cumulative (Leroy *et al.*, 1998; Miotti *et al.*, 1999; Leroy *et al.*, 2002; Read, 2003).

It is difficult to draw any conclusions about the relative risk of transmission by colostrum and mature breast milk (Van de Perre *et al.*, 1993; Ruff *et al.*, 1994; Nduati *et al.*, 1995; Lewis *et al.*, 1998). First, colostrum and mature breast milk contain different types of cells and different levels of immune modulating components (e.g., vitamin A, immunoglobulins and lactoferrin). Second, the infant ingests much less colostrum than mature breast milk. Third, the infant's immune system is less well developed in the first few days of lactation than later, and younger infants have an increased blood concentration of maternal antibodies. There is no evidence to suggest that avoidance of colostrum would reduce the risk of breastfeeding transmission to the infant (Lewis *et al.*, 1998).

Statistical modelling, with data from studies in which breastfeeding was of limited duration, has suggested that the highest-risk period for transmission is the first several weeks of life, and that infectivity may vary in populations at different stages of the epidemic (Dunn *et al.*, 1998). The randomized trial in Nairobi, Kenya, comparing breast milk with formula, suggested that 10% of the cumulative difference in infection rates between infants in the breastfed and formula-fed arms had occurred by six weeks of age, compared with the total cumulative difference of 16%. Also, 75% of all breastfeeding transmission had occurred by six months of age (Nduati *et al.*, 2000).

Given the risk of HIV transmission associated with breastfeeding, it would appear that the simplest and most straightforward approach to prevention is to avoid breastfeeding when mothers are infected. This is the recommendation in many parts of the developed world

(American Academy of Paediatrics, Committee on Paediatric AIDS, 1995). However, a similar recommendation would be difficult for sub-Saharan Africa. First, most women in sub-Saharan Africa breastfeed their infants from birth, and for well over two years. Second, in most parts of Africa, replacement feeding is often associated with an increased risk of morbidity and mortality, in part because poverty constrains the provision of appropriate and safe replacement feeds for children (WHO, 2000b).

WHO guidelines for infant feeding in the context of HIV recommend the avoidance of all breast feeding in conditions where foods that can replace breastmilk are 'Acceptable, Feasible, Affordable, Sustainable and Safe'. These conditions are often referred to as the AFASS conditions for replacement feeding. Otherwise, the WHO recommends exclusive breast-feeding up to 6 months of age. Thereafter, because the risk of HIV transmission may outweigh the protective benefits of breast milk, mothers should quicken transition from breastfeeding to exclusive replacement feeding (ERF) (Ross and Labbok, 2004). In the HIV and infant feeding literature, this is commonly referred to as 'rapid weaning'. Rapid weaning poses an additional problem for HIV-infected mothers. Even before the advent of the HIV pandemic, the risk of transition from breast milk to replacement feeds had been widely recognized. Up to 6 months of age, breastfeeding provides considerable benefits for infant health; however, thereafter, breastmilk is an inadequate source of nutrition, and it needs to be supplemented with other foods and liquids (Ross and Labbok, 2004).

With the introduction of weaning foods, infants experience an increased risk of morbidity, particularly when the transition is not well managed, putting them at a high risk of malnutrition and/or infection. This is commonly referred to as the 'weanling dilemma'. Diarrhoea rates have been shown to be highest between the ages of 6 and 12 months, coinciding with the introduction

of weaning foods (Pelto *et al.*, 2003). There have been relatively few studies investigating the issue of rapid weaning for HIV-infected mothers. Anecdotal reports suggest that rapid weaning is associated with increased mortality, particularly for mothers who do not have adequate weaning foods. However, to the best of my knowledge, there have been no published studies investigating the problem of rapid weaning for HIV-infected mothers.

1.2 Statement of Research Problem

Paediatric AIDS is poised to become a major public health problem in Nigeria. Nutritional status of mother is an important indicator which determines the fetal malnutrition, newborn morbidity and mortality in HIV infection.

Forty two countries in the developing world carry 90% of child global deaths, and 25% of those deaths could be reduced through simple and preventive nutritional interventions, such as, exclusive breastfeeding, appropriate complementary feedings, and vitamin A and zinc supplementation. (Bhandari *et al.*, 2003).

Various ongoing or planned trials and studies concern either mode of infant feeding (exclusive or mixed) or antiretroviral therapy to either the mother or the infant over the breastfeeding period; but the main problem is, whether breastfeeding by HIV-infected mothers can be made safer as to transmission risk, given the possible adverse effects of refraining from breastfeeding (Ross and Labbok, 2004).

Nutritional impairment is a big problem in our society today, with all the Government has initiated, i .e. different nutritional strategies at both community and health facility levels. At the community level, an outreach program of vitamin A supplementation for 6 to 9 months-old children was implemented. Further, IYCF strategies and policies were adjusted to guide health

workers and nutritionists practicing at central and local levels in counseling HIV-positive mothers [WHO, 2009]; but still there are no positive results.

Little is known about infant feeding practices and their relationship to the nutritional status among HIV exposed infants. Still less knowledge on this topic has been generated from longitudinal data.

1.3 Justification for Research

- i. Although some data exist about the deleterious effect of HIV infection on the growth of infected children, no data exists about the importance of nutritional assessment of newborn of HIV infected mothers.
- ii. Prevention of HIV transmission during breast-feeding should be considered in a broad context that takes into account the need to promote breastfeeding of infants and young children in the general population.

In view of the above statements, there is a need to understand and come up with effective strategies of infant feeding among HIV positive mothers.

1.4 Aim and Objectives

1.4.1 Aim

The aim of this study is to assess the Impact of HIV on infant feeding practices and nutritional status of HIV-exposed infants (0-6 months) of HIV positive mothers.

1.4.2 Specific Objectives

- i. To assess the impact of the HIV infection on infant feeding practice among HIV infected mothers.
- ii. To assess the effect of feeding practices on the nutritional status of the infants of HIV infected mothers using anthropometry parameters.
- iii. To assess the impact of education, on the infant feeding practiced, among HIV positive mothers.

1.4.3 Research Hypothesis

Null Hypothesis (H_0): There is no association between educational status and breast feeding pattern.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Overview of HIV and AIDS Epidemic

Globally, the pandemic of HIV and AIDS has continued to constitute serious health and socio-economic challenges for more than two decades. In underdeveloped and developing countries, it has reversed many of the health and developmental gains over the past three decades as reflected by indices such as life expectancy at birth and infant mortality rate among others. The epidemic has also facilitated the re-emergence of disease conditions such as pulmonary tuberculosis and other opportunistic infections. The HIV/AIDS epidemic has become a major problem in many countries globally and continues to have a devastating effect on sub-Saharan Africa. The overwhelming majority of HIV-infected people—more than 90%—live in developing countries. Adults living in sub-Saharan Africa are 10 times more likely to be infected with HIV than adults living in North America, and 20 times more likely than adults living in Western Europe. Eighty percent of women currently living with HIV are in sub-Saharan Africa, and out of all the children born with HIV globally, 90% are in this same region. As at the end of 2009, about 33.3 million persons were estimated to be infected with HIV globally. Of these, 22.5 million (i.e. 68% of the global total) were in Sub-Saharan Africa, and about 2.98 million in Nigeria. Thus, Nigeria has the second highest number of people living with HIV in the world after South Africa (UNAIDS HIV epidemic update 2010).

Nigeria reported her first AIDS cases in 1986 and since then, the HIV and AIDS epidemics have continued to spread and attract due attention. In 1991, the country initiated a HIV sero-

prevalence sentinel survey among the antenatal clinic attendees; the survey commenced with a few states and progressively expanded until all the states became involved by 1999. Nigeria HIV prevalence is estimated at 3.6% based on a general population survey (FMOH, 2007). The HIV prevalence among pregnant women (antenatal care sentinel survey) was 4.6% (FMOH, 2008) which indicates an improvement from 5.8% in 2001. Current estimate of people living with HIV in Nigeria is 2.98 million implying that over 95% Nigerians are uninfected. This scenario thus underscores the need for laying premium on HIV prevention efforts; while concomitantly addressing the challenge of treatment needs for those infected and mitigating other impacts of the infection on all categories of affected people.

Nigerian HIV Prevalence amongst women attending ANC clinics is estimated to be 4.6%. It is estimated that Up to 10% of HIV infections result from mother-to-child transmission (56,681 HIV-infected infants were born in 2008). PMTCT service coverage is only 1.1% while coverage for administration of ART prophylaxis during pregnancy was 7% in 2007 for mothers needing the service and only 2% of HIV exposed infants had access to ART prophylaxis. The Ante Natal Clinic (ANC) biological survey conforms to the first generation surveillance system. It determines HIV prevalence among the sentinel population at fairly regular and short intervals and it is used to track the trend and distribution of the HIV epidemic across the country. The HIV prevalence obtained from the ANC survey is used to estimate prevalence in the general population. The 2010 round of the ANC HIV sentinel survey is the ninth in the series in Nigeria. In 2008, the survey included the simultaneous collection of data from the HCT/PMTCT services of the participating sentinel sites for the purpose of comparison with the ANC survey data. This exercise was maintained in 2010.

In line with the World Health Organization (WHO) guidelines for progress towards the second generation surveillance system, a Behavioural Surveillance Survey (BSS) was introduced in 2002; it expanded to an Integrated Bio- Behavioural Surveillance Survey (IBBSS) in 2007. Similarly, a general population-based behavioural survey termed National HIV/AIDS and Reproductive Health Survey (NARHS) was introduced in 2003. In order to generate general direct population HIV prevalence, a biological component was incorporated into NARHS in 2007.

Nigeria has a national HIV prevalence of 4.1%. The prevalence ranged from 1.0% in Kebbi State to 12.7% in Benue State. A total of 16 States and FCT had prevalence above 5%. Five of the six States in the South-South Zone, three of the five in the South East Zone, five of the seven in North Central Zone, two of the six in North East Zone, and one of the six in South West Zone had prevalence of 5% and above. The three States with the highest rates were Benue, Akwa-Ibom and Bayelsa. The prevalence was generally higher in urban than rural areas except in eight States, namely Benue, Adamawa, Kaduna, Akwa-Ibom, Yobe, Jigawa, Kebbi and Ondo where the reverse was the case. The highest site prevalence of 21.3% in the country was reported in Wannune (Benue State) while the lowest prevalence of 0.0% was reported in four sites, namely Kwami (Gombe State), Rano (Kano State), Owhelogbo (Delta State) and Ganawuri (Plateau State). The prevalence rose with increasing age-group and peaked at age 30-34 years (5.7%) after which it declined; a higher HIV prevalence among singles than married was observed (FMOH, 2012);

Though, a declining trend of HIV prevalence among women attending ANC in Nigeria was reported from 5.8% in 2001 through 5% in 2003 to 4.4% in 2005. However, the national prevalence seemed to stabilize between 2005 and 2010 as shown by the reported prevalence's -

4.4% (2005), 4.6% (2008) and 4.1% (2010). While six States showed a consistent downward trend between 2005 and 2010, eight States showed a consistent rise. Other States showed no consistency in trend. Trend analysis of HIV prevalence among youths 15-24 years showed a consistent decline from 2001 to 2010 (i.e. from 6.0% (2001), through 5.3% (2003), 4.3% (2005), and 4.2% (2008) to 4.1% (2010). Based on the overall national prevalence of 4.1% obtained in this survey, it is estimated that 3.1million people in Nigeria are living with HIV/AIDS in 2010. Of these people, about 1.5 million require ARV drugs ;(FMOH, 2008).

2.2 Knowledge, Attitudes and Behaviours toward HIV and AIDS

AIDS cases are becoming very visible in Nigeria. About one out of every four persons in Nigeria had seen someone with HIV or known someone who died of AIDS. In addition, awareness of HIV and AIDS was generally very high (93.8%). However, correct knowledge of all the routes of HIV transmission and two methods of prevention have remained low (54% and 52.5% respectively). Furthermore, the use of condom in the last sex act was low (16%) despite the fact that sexual transmission is the predominant mode of HIV spread in Nigeria (NARHS, 2007).

2.2.1 Cluster of Differentiation 4 (CD4) cell count

The CD4count is used to determine the immune status of the HIV infected individual. This is necessary to determine whether treatment or prophylaxis is required. Sites offering PMTCT services that do not have this available should have a blood sample referral system with the nearest laboratory equipped to conduct the test. CD4 tests can be either manual or automated. Manual tests are simple and can be performed at most laboratories with trained personnel, a microscope and the necessary test kits. They involve staining for CD4 cells and using a counting

chamber to count the cells under a microscope. Manual technology is ideal for PMTCT linked sites and primary health care centre's. Examples include Cytospheres and Dynal beads.

Automated tests use computerized machines (Cyflow, Point care, Guava) to measure CD4 count. Some of these machines also measure the CD4 percentage. They are ideal for laboratories with a high volume of samples, a good power supply and good temperature control.

2.2.2. The use of anti-retroviral drugs in PMTCT

There is a significant amount of new evidence available on the effectiveness of ARV prophylaxis to prevent mother to child transmission of HIV. Particularly important are the evidences indicating the benefits of starting ARV prophylaxis earlier during pregnancy and its extended use for mothers or infants in decreasing the risk of breast milk transmission. This and the availability of new information on optimal timing for ART initiation make the revision of the National Guidelines imperative. Since the use of ARVs to reduce MTCT has been found to be effective in Nigeria, revision of The Guidelines provides an important opportunity to simplify and standardize current recommendations, and to provide updated guidance for more effective PMTCT interventions.

In addition to the criteria for initiation of ART in adults infected with HIV as outlined in the National ART Guidelines, pregnancy constitutes another indication for the use of ARVs for therapy or prophylaxis. Therapy is indicated as per the WHO criteria. When the mother does not meet the criteria for treatment then prophylaxis should be offered.

2.2.2.1. When to initiate ARV therapy or prophylaxis

Pregnancy in the HIV positive woman is an indication for ARVs irrespective of CD4, VL or clinical stage. The time to commence and ARV choice depend on the clinical setting. ARVs should be provided as soon as possible with expert consultation where necessary.

2.2.2.2 Use of anti-retroviral drugs for therapy (ART)

ART should be initiated in HIV positive pregnant women based on the following criteria:

- a. CD4 Count \leq 500 irrespective of WHO clinical staging
- b. WHO AIDS Stages III & IV disease, irrespective of CD4 cell count.

2.2.2.3. Use of anti-retroviral drugs for prophylaxis

ARV prophylaxis should be provided for HIV positive pregnant women who do not meet above criteria. They include women with WHO Stages I & II AIDS with CD4 of >500 cells/ml. (FMOH, 2010).

2.2.2.4. Use of nevirapine (NVP) for infant

All infants irrespective of type of feeding should receive daily NVP from within 72 hours of birth to 6 weeks of age:

- a. For babies with weight $<2,500$ g, give NVP 10mg or 1ml once daily
- b. For babies with weight $\geq 2,500$ g, give NVP 15mg or 1.5ml once daily.

2.3 Maternal Knowledge on Prevention of Mother to Child Transmission of HIV (PMTCT)

Prevention of mother-to-child transmission (MTCT) of HIV—also known as vertical, prenatal or parent-to-child transmission (PTCT) to reflect the role of men in the overall chain of transmission— has become a priority for many developing country governments and agencies. This priority is consistent not only with the broader goals of HIV/AIDS prevention, but also with commitments to improving child health and survival.

Infants and children in Africa are infected by HIV/AIDS in multiple ways. Those who are most directly affected are children who acquire HIV/AIDS through MTCT. They face severe morbidity and near-certain death where sophisticated and costly treatments are nonexistent and even the availability of basic medicines to treat opportunistic infections is likely to be erratic. Infant mortality rates, although reduced between 1981 and 1986, have now risen dramatically, largely due to AIDS. Almost all AIDS deaths in Africa in young children can be traced back to MTCT.

In developed countries, MTCT rates have fallen to as low as 2% of births among HIV-infected mothers in recent years with the introduction of HIV counselling and testing, short-course zidovudine (ZDV) or azidothymidine (AZT)prophylaxis, elective Caesarean delivery and safe use of infant formula instead of breastfeeding. In Africa, however, where prolonged breastfeeding is the norm, about 25-35% of HIV-infected mothers pass on the disease to their infants.

The severity of the MTCT problem in sub-Saharan Africa is due to a number of factors, including high rates of HIV infection in women of reproductive age, a large total population of women of reproductive age, high birth rates, and a lack of effective MTCT prevention

interventions. Rates of infections in women are high in sub-Saharan Africa and are growing rapidly.

Transmission of HIV through breast milk is of concern in many developing countries where HIV infection in women is common and breastfeeding is universally practiced. In Africa, 30-40% of children born to HIV-infected women acquire HIV, and 30-50% of infected infants acquire the disease through breastfeeding. This has reversed previous gains made in child survival and has eroded health worker confidence in recommending breastfeeding as the best and safest form of infant feeding.

Promotion of exclusive breastfeeding as the best possible nutrition for infants has been the cornerstone of child health and survival strategies for the past 20 years, and has played a major part in lowering infant mortality in many regions of the world. Therefore, the evidence that has accrued over recent years that breast milk is a significant source of HIV infection has caused a real dilemma for mothers, health personnel, and policymakers. Today, decisions about infant feeding in settings of high HIV prevalence require a careful balancing of risks, with the risk of transmitting HIV on one side and the risk of morbidity, mortality and stigmatisation that can result from not breastfeeding on the other.

Malnutrition has been endemic in Africa for decades, complicated by a combination of factors and more recently by the impact of AIDS. It is estimated that one-third of all children under five in sub-Saharan Africa are stunted, and more than half suffer from some form of micronutrient malnutrition. Malnutrition is also common among adults in most parts of Africa, where more than half of all pregnant women suffer from anaemia.

HIV/AIDS and malnutrition are inextricably interrelated. Studies show that malnutrition increases both the risk of HIV transmission from mothers to babies and the progression of the HIV infection. In turn, HIV infection exacerbates malnutrition through its attacks on the immune system and its impact on nutrient intake, absorption, and utilization. This puts the lives of HIV-infected infants at risk from both malnutrition and AIDS-related infections. The severity of the MTCT problem in sub-Saharan Africa is due to high rates of HIV infection in women of reproductive age, a large total population of women of reproductive age, high birth rates, and the lack of effective MTCT prevention intervention. An estimated 330,000 children younger than five died in the sub-Saharan Africa in 1999 from HIV infections. Four countries (Botswana, Namibia, Swaziland, and Zimbabwe) have rates of HIV-attributable under-five mortality of above 30 per 1000, and an additional 16 countries have rates between 10 and 25 per 1000.

2.4 Infant Feeding in the Context of HIV and AIDS

In the absence of any intervention, the risk of MTCT of HIV is estimated between 15% and 30%. This proportion can rise as high as 30% to 45% with prolonged breastfeeding and lack of exclusive breastfeeding (WHO 2006) among other factors such as low CD4, high viral load, unsafe sexual practices, etc. MTCT accounts for 90% of HIV transmission in children during pregnancy, labour, birth or breast feeding (UNAIDS2010). Globally, breast milk contributes 15% of HIV risk (UNAIDS, 2010). Breast feeding beyond 24 months increases infection by between 25-45% (Nduati *et al*, 2000). Every hour about 30 children die as a result of AIDS (UNAIDS, 2010) Mother-to-child transmission of HIV interventions requires more than provision of drugs and commodities. Systems must be strengthened and communities prepared for these programs. Therefore commitment to provide a range of core MTCT interventions is required to reduce the incidence of MTCT of HIV. During the postnatal period, transmission of

HIV through breastfeeding can be reduced with the administration of a short course of ARVs to mother and infant around the time of delivery and during the first postpartum months, with the addition of ART for eligible mothers.

2.4.1 Breastfeeding

Breast feeding is the normal way and breast milk is all the baby needs for the first six months of life (Burgess *et al*, 2009). It is a universally accepted infant feeding practice. Optimal breast feeding carries significant health benefits for infants and young children (Oguta, 2001). It reduces infant morbidity and mortality and contributes to good health status, survival and development. Breast milk has essential nutrients, antibodies and enzymes that protect against infections and strengthens the infant's immune system (De Cock *et al.*, 2000). Without intervention, about 35% of HIV-positive pregnant women will pass on the infection to their babies during pregnancy, delivery and post natal through breastfeeding. Without preventive interventions, about 10-20% of infants born to infected mothers will contract the virus through breast milk if breastfed for two years (WHO, 2010 and FANTA, 2004).

2.4.2 Exclusive breastfeeding

WHO (2010) recommends mothers to safely breast feed exclusively for 6 months and continue breastfeeding until 12 months alongside complimentary feeding after 6 months provided that they or their infants receive ARV drugs during the breast feeding period. Exclusive breast feeding is where an infant receives only breast milk and no other liquids or solids, not even water, with the exception of drops or syrups consisting of vitamins, mineral supplements or medicines (Burgess *et al.*, 2009). This has been shown to give infants the best chance to be protected from HIV transmission in settings where breastfeeding is the best option.

Studies show that complementary foods introduced to an infant less than 6 months of age) damages the already delicate and permeable gut wall of the infant and allows the virus to penetrate easily (WHO, 2010). As a result UNICEF, WHO and many health providers recommended exclusive breastfeeding for about 6 months. Recent studies in South Africa suggest that combination of breastfeeding and artificial feeding has more potential harm to the infant in the first months of life and that those who are exclusively breastfed, at least for the first 3 months, may face a significantly lower risk than was previously thought (Coutsoudis *et al.*, 1999). The study suggests that feeding other solids or fluids in addition to mother's milk in the first months of life may be what injures the baby's gut and allows the HIV to enter the body tissues. It is believed that lower transmission among exclusively breastfed infants is attributed to a healthy gut epithelium, which acts as a viral barrier, and that breast milk contains immune factors which have been shown to have anti-viral and anti-HIV effects in vitro (Wahl *et al.*, 1997). HIV negative women and those with unknown status should be encouraged to continue breastfeeding. Confidentiality, informed choice, protection, respect and fulfillment of human rights are key issues in HIV situation. Key rights of clients need to be observed, for example, right to health, survival, information and informed consent (Campbell and MacPhail, 2002).

2.4.3 Exclusive Replacement Feeding (ERF)

Replacement feeding is also referred artificial feeding. It is used in the context of HIV to describe feeding infants who are receiving no breast milk with a diet that provides the nutrients infants need until the age at which they can be fully fed on family foods. During the first six months, replacement feeding should be with a suitable breast milk substitute, which definition includes infant formula. Infant formula is a breast milk substitute formulated industrially that

should be in accordance with applicable Codex Alimentarius standards [developed by the joint FAO/WHO Food Standards Programme] (WHO and UN AGENCIES, 2006).

This includes commercial infant formula and generic infant formula (Oguta, 2001) Replacement feeding should aim to provide the entire infant's nutritional requirements as completely as possible. Soy protein has been found to be closest in nutrient composition to breast milk (Sebalda *et al.*, 2006). Breast milk alternatives lack special nutrients, vitamins and antibodies that protect against bacterial infections. Bacteria may therefore contaminate the feed during preparation, so it is imperative that high hygienic standards are kept during preparation and feeding. This calls for access to clean water, fuel and sufficient time. Even where hygiene is good, artificially fed infants suffer five times as many bacterial infections as breastfed infants, and in situations where hygiene is poor, the risk of death from diarrhea in artificially fed young infants may be twenty times that of breastfed infants (WHO, 2003b). Families feeding their infants with breast milk alternatives therefore need access to health care.

2.4.4 Mixed feeding

This is infant feeding involving combination of breast milk with other fluids; this could be solid foods and/or non-human milk, such as infant formula or animal milks. Predominant mixed feeding is where breastfeeding is combined with small amounts of water or water based drinks only. Partial breastfeeding is a type of mixed feeding where breastfeeding is combined with non-human milk or food based fluid or solid food. An infant who is either predominantly or partially breastfed is considered to be receiving mixed feeding (WHO and UN AGENCIES, 2006). Mixed feeding before 6 months is not recommended because studies suggest it carries a higher risk than exclusive breastfeeding (WHO, 2010). Before this period the baby's stomach and intestinal

lining is not fully developed and cannot withstand solid food. Mixed feeding may damage the lining of the baby's stomach and intestines and thus makes it easier for HIV in breast milk to infect the baby (WHO, 2010).

2.5 Barriers to Exclusive Breastfeeding

Women in poor areas face barriers to exclusive breastfeeding such as cultural traditions, perceptions of insufficient milk production, maternal age, beliefs about HIV transmission through breast milk, social stigma, economic status, and family influences on Breast Feeding (Thairu *et al.*, 2005, Clifford *et al.*, 2006, Taha *et al.*, 2006, Thairu, 2007).

A study conducted in South Africa (2000) suggested that those with less medical training, such as community workers and staff nurses, tended to suggest supplementing with formula, water, or glucose water in different scenarios (Shah *et al.* 2005).

With regard to infant feeding options, HIV-infected mothers have been found to introduce fluids and wean their infants significantly earlier than uninfected mothers; hence, the infants of HIV-infected mothers had lower weight-for-age, indicating poorer nutritional health status. In Côte d'Ivoire (Yeo *et al.*, 2005) and Nigeria (Abiona *et al.*, 2006), a study was performed to assess the acceptance of breastfeeding. The majority of women tended to recommend breastfeeding as the appropriate method of infant feeding, as it is normative in many developing countries, but water was considered an appropriate complement to breastfeeding.

In addition to informing and educating women, other factors, such as a continued support for women, could empower them to make informed infant feeding decisions and to adhere to those choices (Coutsoudis, 2005). Individual factors such as maternal education, maternal age, support from other women with children, type of delivery, satisfaction with labor and postpartum care,

infant feeding method as planned, anxiety (Dennis, 2006), husband participation in infant feeding decisions, (Freed and Fraley, 1993) as well as body shape (Bentley *et al.*, 2005) have also been associated with infant feeding decisions among HIV-positive women.

2.6 Factors That Influence Maternal Choice of Infant Feeding Options in the Context of HIV and AIDS

2.6.1 Social stigma and discrimination

Social stigma is strongly associated with HIV and the relationship of choice of infant feeding mode (Oguta, 2001). In a community where breastfeeding is normative in the strongest sense of the word, choosing replacement feeding would seem abnormal, even prior to the advent of the HIV pandemic. Now there has been sufficient public discussion about transmission of the virus through breast milk that choosing to bottle feed is tantamount to announcing that one is HIV positive. As a consequence of negative community attitudes, women face a serious difficulty in decision about whether to disclose their HIV status, when they learn they are infected.

2.6.2 Culture and norms

What do we mean by culture? As defined by Edward Taylor, culture is that complex whole which includes knowledge, belief, art, morals, law, custom, and any other capabilities and habits acquired by man as a member of the society (Olorode, 1989). Culturally, most African communities practice mixed feeding instead of exclusive breastfeeding (Bland *et al.*, 2002). In most circumstances, primary health practitioners advise mothers according to formal guidelines without being adequately aware of the mothers' preferences, skills and home circumstances.

2.6.3 Maternal knowledge

HIV positive women face difficult choices about how to feed their infants (Latham and Preble, 2000). They face challenges of inadequate information related to HIV and safe infant feeding. A lot of risks are associated with replacement feeding especially in poor resource settings characterized by poor sanitation and economic constraints. The basic principle of ‘informed choice’ requires that HIV positive women are provided with adequate information before making decision on appropriate infant feeding option (United Nations, 1990).

2.6.4 Family influence

This social bias may leave the women with no other option but to breastfeed the infant thus increasing the risk of HIV through MTCT via breast milk (FANTA, 2004). According to Thairu, 2000, elderly mothers readily disclose their HIV status. Young are in denial of their status and more likely for a longer period compared to older adults (Campbell and MacPhail, 2002; Eaton *et al.*, 2003).

It is difficult to practice exclusive breastfeeding in situations where family members do not understand its value. This is likely to be acute in young women. Adolescent mothers frequently receive advice from their families to practice mixed feeding which conflict with advice from health care providers. As described by Bentley *et al.*, 1999, adolescents may also be inexperienced and insecure about their own beliefs and logically turn to their families, particularly their mothers and grandmothers, for parenting help. In event where adolescent mothers express disagreement, families may insist on their own decisions or, less frequently, implement their preferred feeding practices without the mother’s consent. Accommodating the

family's wishes may be an adaptive coping strategy as adolescent mothers struggle with the enormous challenge of parenting in the midst of their own development.

2.6.5 Beliefs

Statements that relate to transmission of HIV through breast milk are given by mothers with explicitly associated fear of infecting the infant. On the other hand, the potential for transmission is sometimes discussed without an explicit statement of fear. This clearly influences the mother's choice of infant feeding option (Thairu, 2000).

Mothers know that breast feeding protects the infant against diseases. Often the value of breastfeeding is juxtaposed to formula as in the following statement: 'the baby who is formula fed always gets sick'. The strength of the belief in the superiority of breast milk over formula is so great and therefore may influence maternal choice on infant feeding option.

2.6.6 Economic factors

Infant feeding has cost implications and greatly influences maternal choice. This is particularly evident among mothers in low resource settings. According to FANTA 2004, the choice of infant feeding should be based on the AFASS principle. That is, the practice chosen should be affordable, feasible, accessible, safe and sustainable. Mothers in low resource settings rarely opt for commercial formula because it is expensive and therefore not feasible and sustainable (WHO, 2006). HIV mothers who wish to opt to practice replacement feeding but do not have adequate resource to meet the cost of buying infant commercial food may find themselves in dilemma. In some instances, these may result into dilution of food fed to an infant or unconsciously practice mixed feeding. Sebalda *et al.*, 2006, points out, mothers are generally uncertain about the use of

infant formula. Those who have used it experienced problems in calculating the right amounts of formula powder and water.

2.7 Anthropometry of under-five years

Anthropometry: is the study and technique of taking body measurements, especially for use on a comparison or classification basis FANTA, (2003). Changes in body dimensions reflect the overall health and welfare of individuals and populations. Anthropometry is used to assess and predict performance, health and survival of individuals and reflect the economic and social wellbeing of populations. Anthropometry is a widely used, inexpensive and non-invasive measure of the general nutritional status of an individual or a population group. Anthropometry can be used for various purposes, depending on the anthropometric indicators selected. For example, weight-for-height (wasting) is useful for screening children at risk of malnutrition and for measuring short-term changes in nutritional status. However, weight-for-height is usually not appropriate for evaluating changes in a population over longer time periods FANTA, (2003). A clear understanding of the different uses and interpretations of each anthropometric indicator will help to determine the most appropriate indicator(s) for evaluation.

2.7.1 Anthropometric Indicators

The four building blocks or measures used to undertake anthropometric assessment are: sex, age, length, (or height), and weight. Each of these variables provides one piece of information about a person. When they are used together they can provide important information about a person's nutritional status. When two of these variables are used together they are called an index FANTA, (2003). Three indices are commonly used in assessing the nutritional status of children:

- i. Weight-for-age;

- ii. Length-for-age or Height-for-age;
- iii. Weight-for-length or Weight-for-height.

There are many other anthropometric measures including mid - upper arm circumference (MUAC), sitting height to standing height ratio (Cormic Index), and skin-fold measures. The advantages and disadvantages of the three indices and the information they can provide is summarized below:

2.7.1.1 Weight-for-age

Low weight-for-age index identifies the condition of being underweight, for a specific age. The advantage of this index is that it reflects both past (chronic) and/or present (acute) under-nutrition (although it is unable to distinguish between the two).

2.7.1.2 Height-for-age

Low height-for-age index identifies past under-nutrition or chronic malnutrition. It cannot measure short term changes in malnutrition. For children below 2 years of age, the term is length-for-age; above 2 years of age, the index is referred to as height-for-age. A deficit in length-for-age or height-for-age is referred to as stunting.

2.7.1.3 Weight-for-height

Low weight-for-height helps to identify children suffering from current or acute under-nutrition or wasting and is useful when exact ages are difficult to determine. Weight-for-length (in children under 2 years of age) or weight-for-height (in children over 2 years of age) is

appropriate for examining short-term effects such as seasonal changes in food supply or short-term nutritional stress brought about by illness.

The three indices are used to identify three nutritional conditions: underweight, stunting and wasting, respectively.

2.7.1.4 Underweight

Underweight, based on weight-for-age, is a composite measure of stunting and wasting and is recommended as the indicator to assess changes in the magnitude of malnutrition over time.

2.7.1.5 Stunting

Low length-for-age, stemming from a slowing in the growth of the fetus and the child and resulting in a failure to achieve expected length as compared to a healthy, well nourished child of the same age, is a sign of stunting. Stunting is an indicator of past growth failure. It is associated with a number of long-term factors including chronic insufficient protein and energy intake, frequent infection, sustained inappropriate feeding practices and poverty. In children over 2 years of age, the effects of these long-term factors may not be reversible. Information on stunting for individual children is useful clinically as an aid to diagnosis. Stunting, based on height-for-age, can be used for evaluation purposes but is not recommended for monitoring as it does not change in the short term such as 6 - 12 months FANTA, (2003).

2.7.1.6 Wasting

Wasting is the result of a weight falling significantly below the weight expected of a child of the same length or height. Wasting indicates current or acute malnutrition resulting from failure to gain weight or actual weight loss. Causes include inadequate food intake, incorrect feeding

practices, disease, and infection or, more frequently, a combination of these factors. Wasting in individual children can change rapidly and shows marked seasonal patterns associated with changes in food availability or disease prevalence to which it is very sensitive. Because of its response to short-term influences, wasting is not used to evaluation, but may be used for screening or targeting purposes in emergency settings and is sometimes used for annual reporting. Weight-for-height is not advised for evaluation of change in non-emergency situations since it is highly susceptible to seasonality.

2.7.1.7 Edema

Edema is the presence of excessive amounts of fluid in the intracellular tissue. Edema can be diagnosed by applying moderate thumb pressure to the back of the foot or ankle. The impression of the thumb will remain for some time when edema is present. Edema is diagnosed only if both feet show the impression for some time. As a clinical sign of severe malnutrition, the presence of edema should be recognized when using short term indicators such as wasting. The presence of edema in individuals should be recorded when using weight-for-height for surveillance or screening purposes. When a child has edema, it is automatically included with children counted as severely malnourished, independently of its wasting, stunting, or underweight status. This is due to the strong association between edema and mortality.

2.7.1.8 Mid - Upper Arm Circumference (MUAC)

MUAC is relatively easy to measure and a good predictor of immediate risk of death. It is used for rapid screening of acute malnutrition from the 6-59 month age range (MUAC overestimates rates of malnutrition in the 6-12 month age group). MUAC can be used for screening in emergency situations but is not typically used for evaluation purposes.

2.8 Conceptual Frame Work

The main purpose of the this research work is to explore infant feeding practices adopted by HIV positive mothers attending HAART clinic of ABUTH, and their association with the nutritional status of their infants during the first six months of life. The literature review highlighted the difficulties of choice related to infant feeding practices of HIV-exposed infants, based on individual and household characteristics and clinical backgrounds. However, most of the findings related to feeding practices were based on a single indicator of feeding practices and explain their association with nutritional status and morbidity or mortality only in early infancy. Little is known about feeding practices among HIV-exposed infants during this period, and there has been no systematic research conducted on the use of anthropometric indices to evaluate nutritional status among HIV-exposed infants.

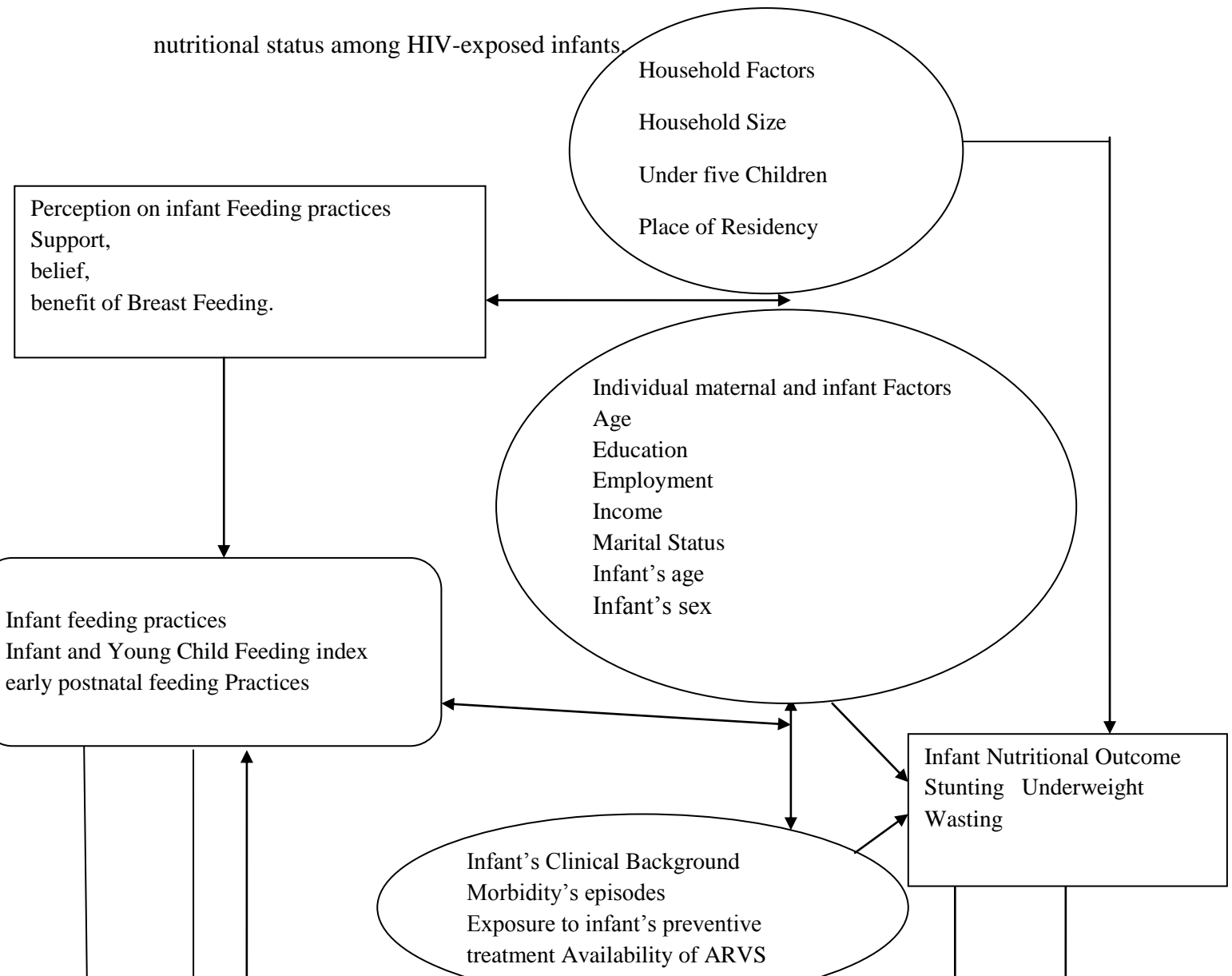


Figure 2.1: Conceptual Frame Work of infant and young child feeding index and its association to nutritional status. Adopted from Ruel M. (Ruel and Menon 2002) and Becket R. (Becquet *et al.*2006)

CHAPTER THREE

3.0 MATERIALS AND METHODS

This was a prospective study directed towards infant feeding practices, nutritional assessment of children of HIV positive mother and impact of education on feeding choices, over a period of six months; that is, from birth to six months of age, using anthropometric parameters of nutritional status assessment. Factors like socioeconomic status, maternal age, parity; educational status, clinical status, HIV viral load, CD4 count and antiretroviral treatment were taken into consideration. All neonates were weighed, using an electronic weighing scale; Length was measured by infantometer. Data were taken within 72 hours of birth, after two months, four months, and at six months.

3.1 Study Area / Location

This study was carried out in Highly Active Antiretroviral Therapy (HAART) Centre, Ahmadu Bello University Teaching Hospital, (ABUTH) Zaria. The Centre has standard health facilities, and offers PMTCT services. The study area was chosen because it has a functional follow up programme for HIV positive patients.

3.2 Target Population

The study involved HIV positive mothers aged 19-49 years with infant zero –six months of age in the HAART Centre. Health workers from the health facilities which offered PMTC were very instrumental in educating the mothers.

3.3 Sample Size

The 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 was:

$$N = \frac{1.96^2 * 0.051 * 0.949}{0.05^2} = 74.37184 \approx 74 \text{ Subjects}$$

Allowing fall out rate of 20% the study targeted 94 respondents

3.4 Ethical Clearance and Informed Consent

The study was approved by Ahmadu Bello University Teaching Hospital Health Research Ethics Committee, ABUTH/HREC/TRG/36; dated 13th October 2014, Ministry of Health Kaduna State through the Commissioner, MOH/AM/744/VOL.I, dated 10th September 2014. Verbal and written informed consent was sought from respondents before an interview was conducted. Confidentiality was assured to respondents who participated in the study, that is no name or any contact address was taken.

3.5 Inclusion Criteria

The respondents who were eligible to participate in the study included mothers of reproductive age bracket (19-49 years) aware of their HIV sero-status, had a child aged 0-6 months and do attend HAART centre of ABUTH Zaria. Similarly, respondents who gave verbal / written informed consent participated in the study.

3.6. Exclusion Criteria

Ineligible respondents included those who were young or older than the framed age bracket (19-49 years), had no infant or had a child over 6 months of age. Respondents and or their children who were sick with opportunistic infections and unable to participate in the interview were excluded. Those who had no record on antenatal care with the centre were also excluded from the study. Respondents who did not give verbal/ written informed consent were also excluded from the study.

3.7. Data Collection / Gathering Techniques

A semi-structured questionnaire was designed and used to collect quantitative data from individual respondents. The choice of questionnaire as a tool was due to its ease of administration, relative low cost and its versatility to collect the needed data. The questionnaire used is attached as an appendix 1.

3.8. Data Analysis

At the end of the study period, the data was analyzed using WHO Anthro, and SPSS; to determine if the changes in z-scores are statistically significant $p=0.05$. Z-scores also known as standard deviation (SD) scores, have no 'units' and are used to describe how far a measurement is from the mean (average). Percentiles are commonly used in the clinical or community setting because they indicate simply and clearly a child's position within the context of the reference population. Z-scores are useful for population and research purposes. For comparison purposes, the 50th percentile is equal to a z-score of 0. Comparison of z-scores and percentiles based on recent growth references and standards are shown in table in appendix 2

CHAPTER FOUR

4.0 RESULTS

4.1 Cluster of Differentiation 4 (CD4) cell count and prevalence of EBF of HIV Infected Mothers

Figure 4.1 shows the percentage distribution Cluster of Differentiation 4 (CD4) count of HIV Infected Mothers. 42 (56.76%) of the respondents are on ARVs; that is their CD4 count less than 500 cells/ml, while 32 (43.24%) of them, had CD4 count above 500 cells/ml. In Figure 4.2 it can be seen that 95.95% exclusively breastfed their child while 4.05% did not. As shown in Figure 4.3; 97.3% did not give pre-lacteal feeds before initiating breast feeding while 2.7% gave pre-lacteal feeds.

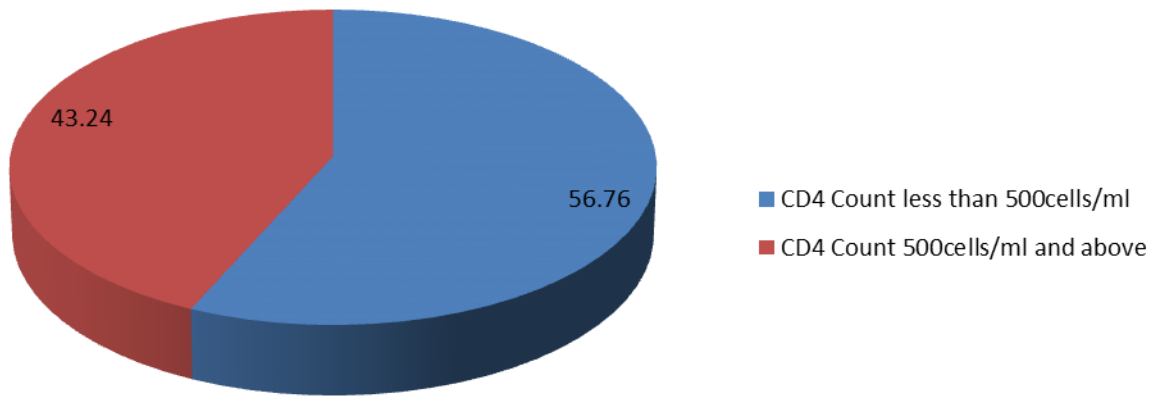


Figure 4.1. Distribution of HIV Infected Mothers at ABUTH Zaria

By their CD4+ Cell Count

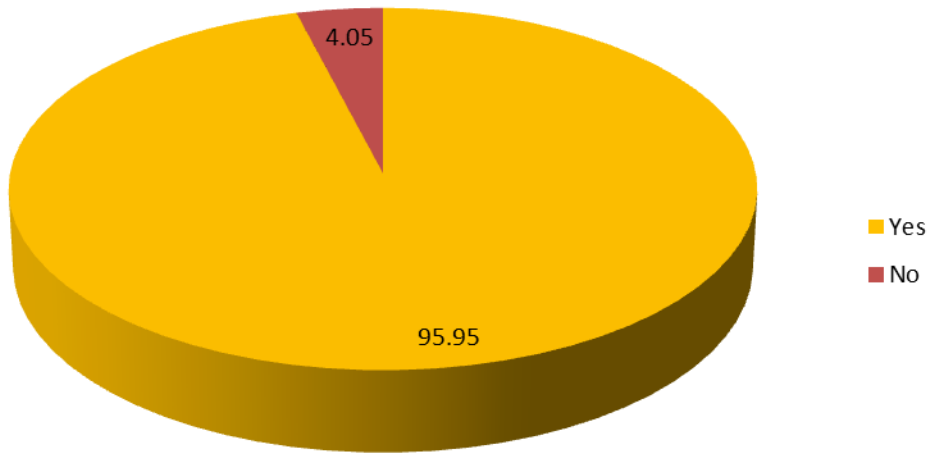


Figure 4.2. Prevalence of Exclusive Breast Feeding Among HIV Infected Mothers Attending ABUTH Zaria

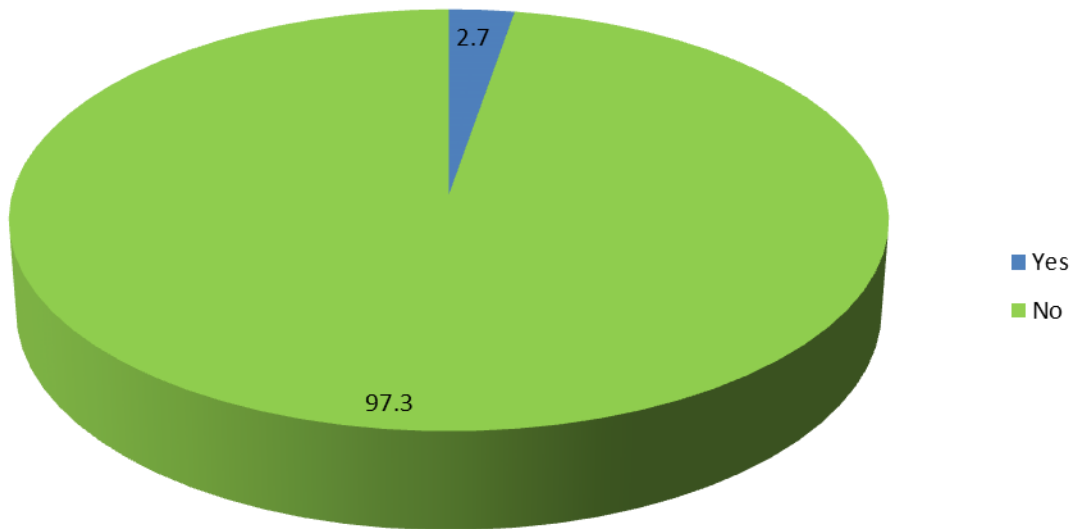


Figure 4.3 Prevalence of Pre-Lacteal Feeding Among HIV Infected Mothers Attending ABUTH Zaria.

4.2 Description of Anthropometric Indices of HIV Exposed Children According to Z-scores

Anthropometric indices of the children (39 boys and 35 girls) are presented generally in the following figures below; but detail graphical representation from WHO Anthro is shown in the appendices, according to their Z-score distributions. Infant's length-for-age, weight for-age, and weight-for-length were normally distributed. The percentage Z-score distributions are shown in table 4.1, 4.2, and 4.3.

Table 4.1 Percentage Z-score distributions of malnutrition Based on Length for Age in HIV Exposed Children

Age (months)	Normal (%)	Under nutrition (%)			Total Undernourished (%)
		Mild (-2<Z<-1)	Moderate (-3<Z<-2)	Severe (Z<-3)	
0	78.38	9.46	5.41	6.77	21.62
2	55.41	16.22	8.11	20.27	44.59
4	54.05	22.97	9.46	13.51	45.95
6	66.22	17.57	6.76	9.46	33.78

Table 4.2 Percentage Z-score distributions of malnutrition Based on Weight for Age in HIV Exposed Children

Age (months)	Normal nutrition (%)	Under nutrition (%)			Total Undernourished (%)
		Mild (-2<Z<-1)	Moderate (-3<Z<-2)	Severe (Z<-3)	
0	62.16	28.38	8.11	1.35	37.84
2	44.59	27.03	14.86	13.51	55.41
4	40.54	17.57	25.68	17.57	59.46
6	39.19	31.08	12.16	17.57	60.81

Table 4.3 Percentage Z-score distributions of malnutrition Based on Weight for Length in HIV Exposed Children

Age (months)	Normal nutrition (%)	Under nutrition (%)			Total Undernourished (%)
		Mild (-2<Z<-1)	Moderate (-3<Z<-2)	Severe (Z<-3)	
0	60.81	10.81	10.81	17.57	39.19
2	55.41	13.51	12.16	18.92	44.59
4	40.54	29.73	32.43	10.81	59.46
6	33.78	32.43	14.86	18.92	66.22

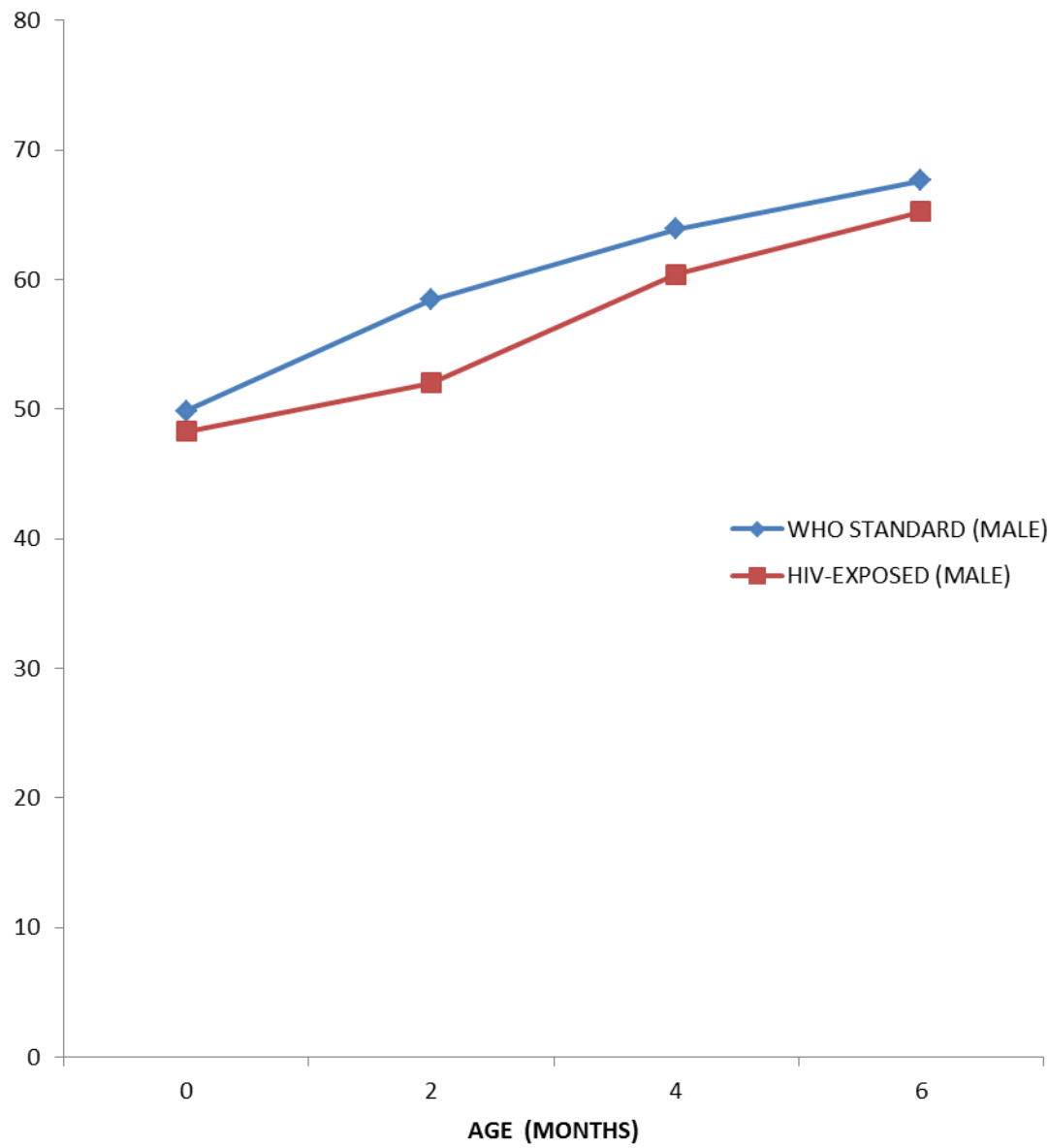


Figure 4.4: Distribution of Length-for-Age Z-scores (LAZ) of the Exposed Male Children

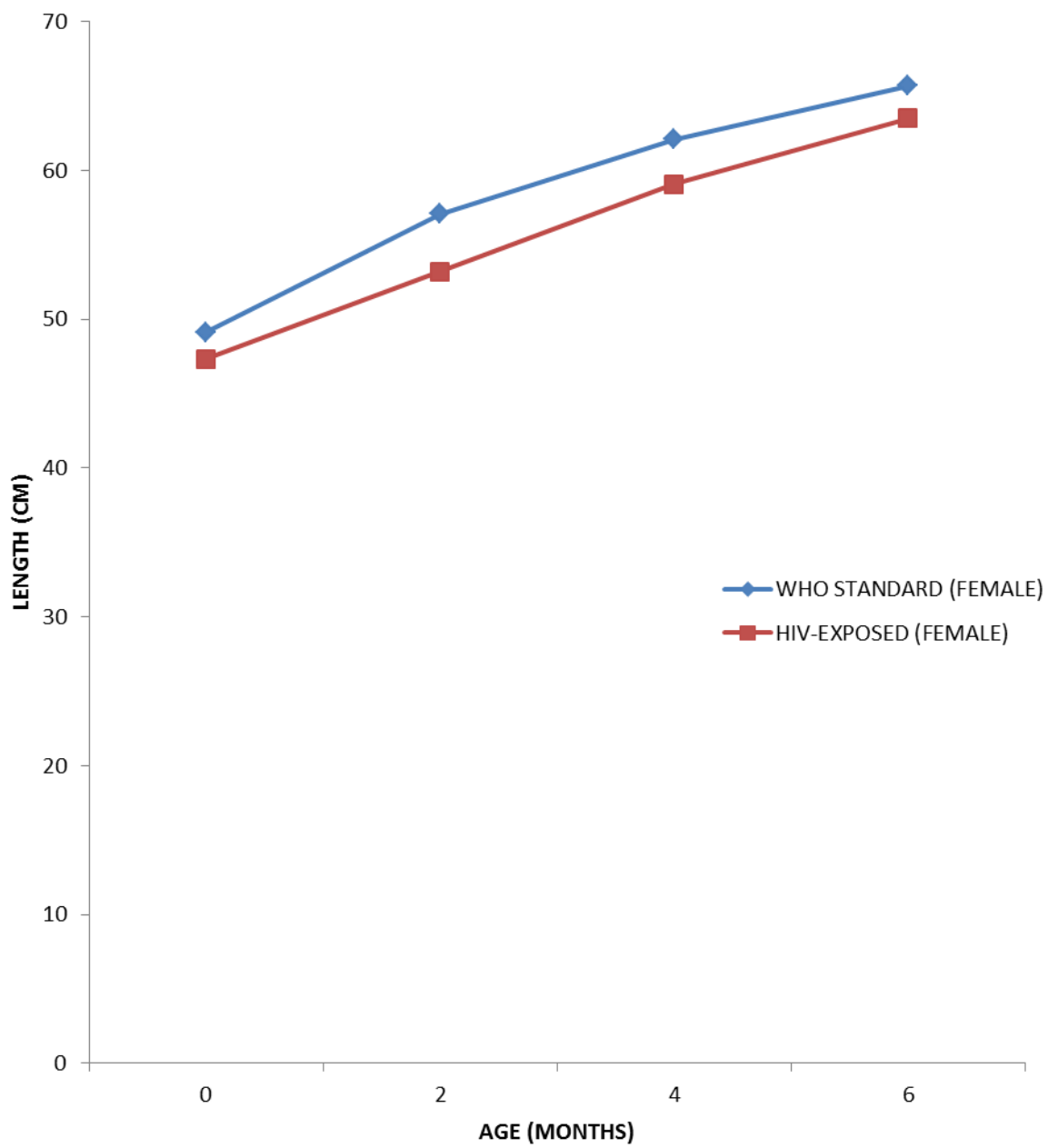


Figure 4.5: Distribution of Length-for-Age Z-scores (LAZ) of the Exposed Female Children

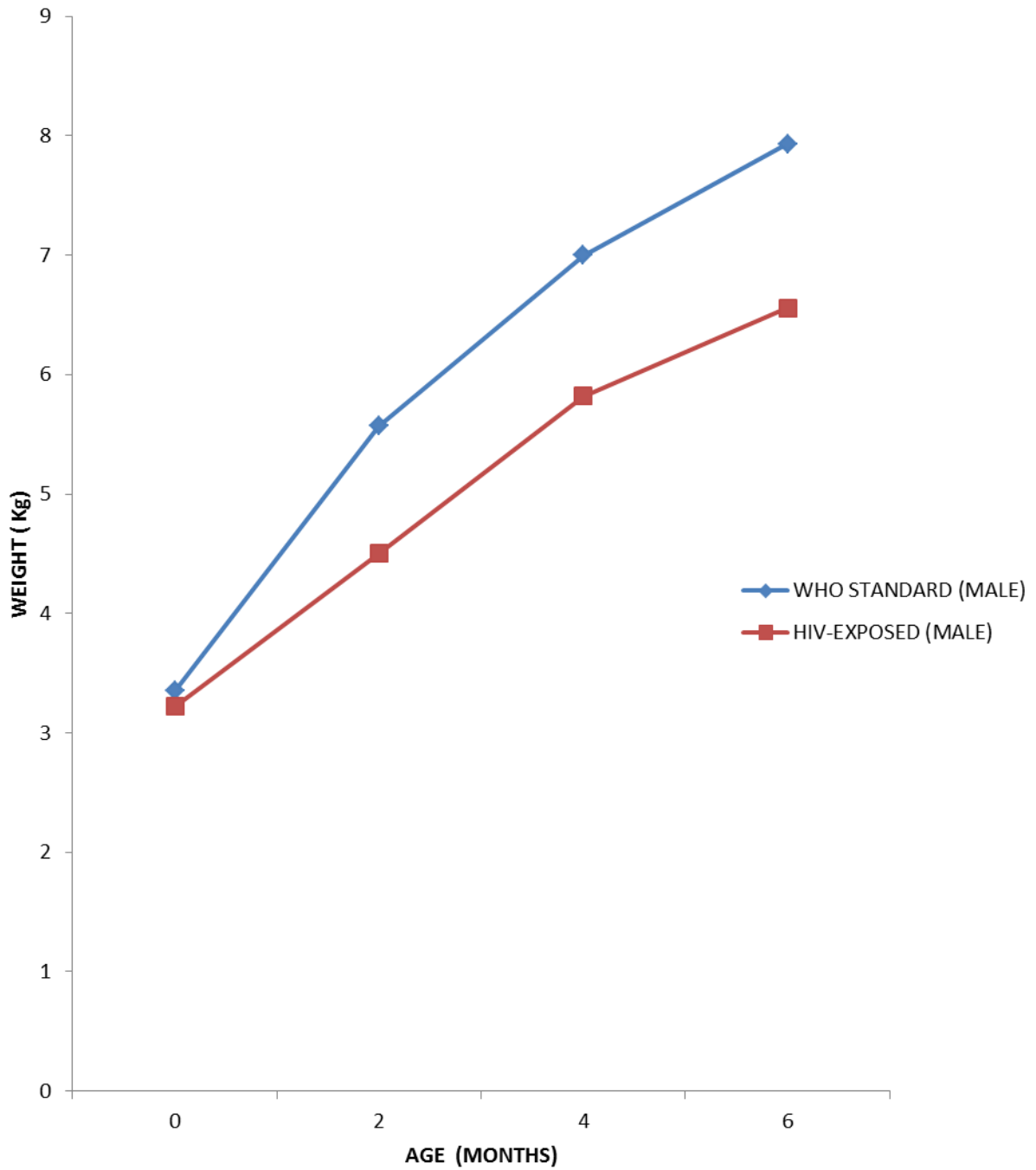


Figure 4.6: Distribution of Weight for-Age Z-scores (WAZ) of the Exposed Male Children

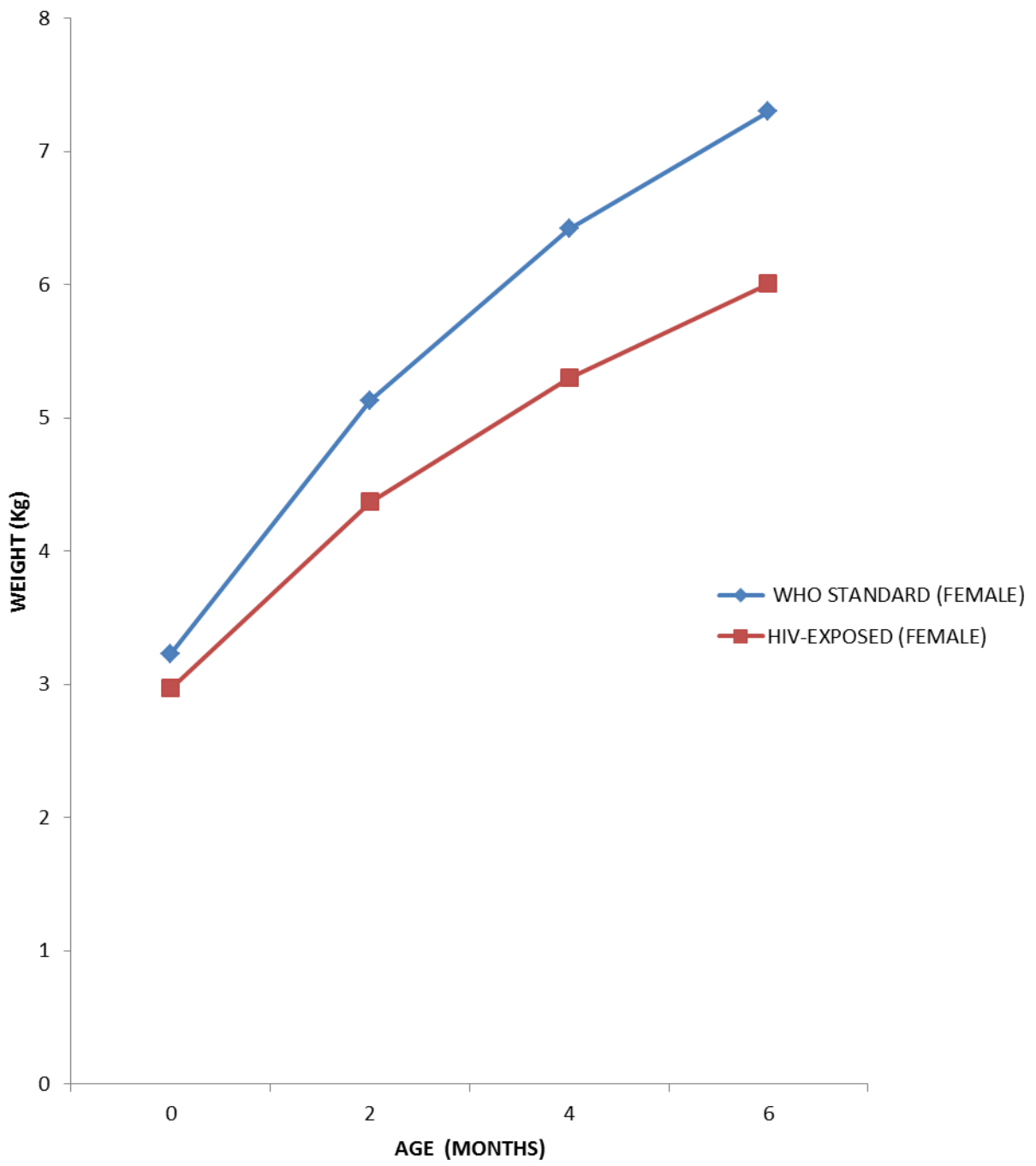


Figure 4.7: Distribution of Weight for-Age Z-scores (WAZ) of the Exposed Female Children

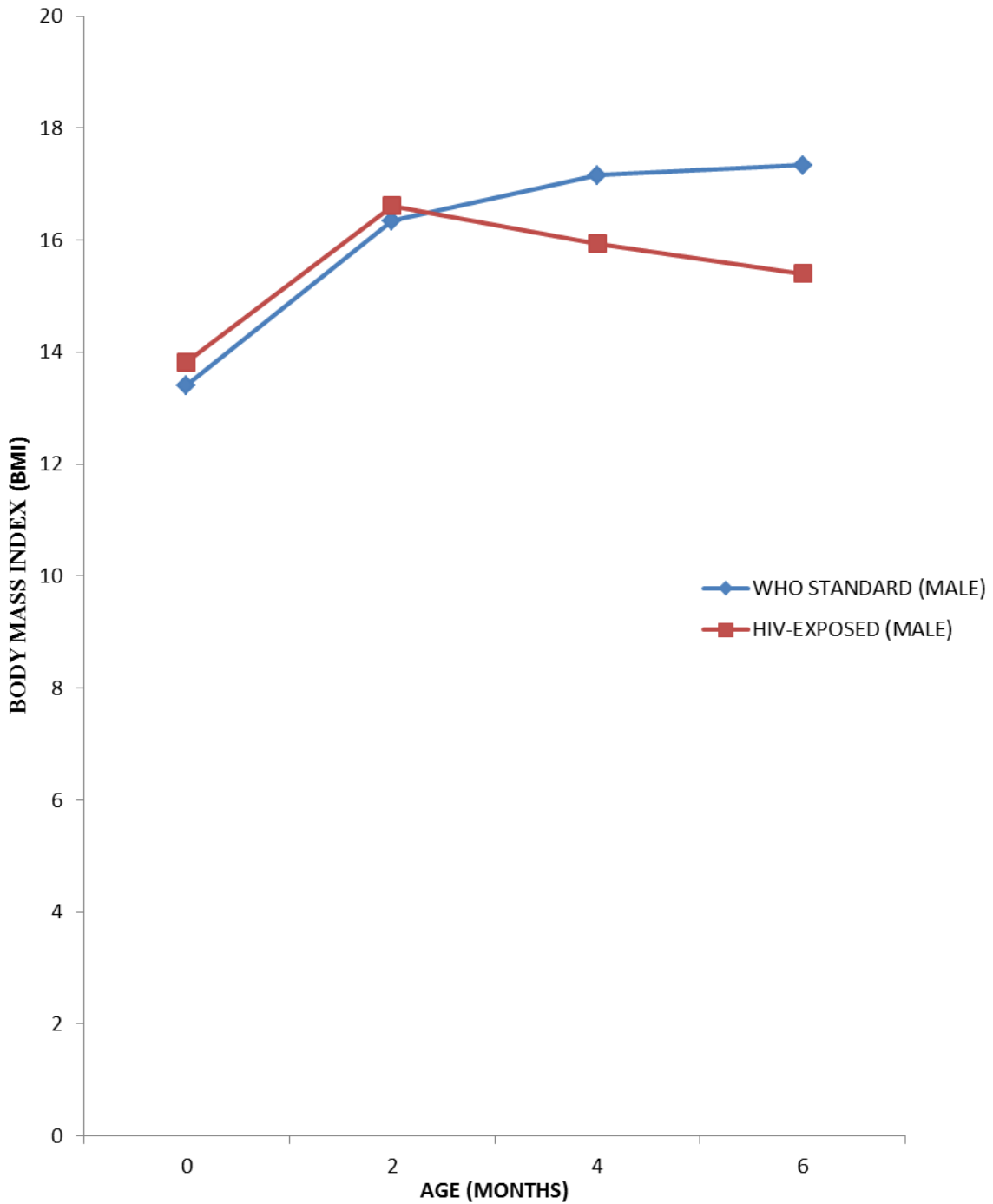


Figure 4.8: Distribution of Body Mass Index Z-scores (BMIZ) of the Exposed Male Children

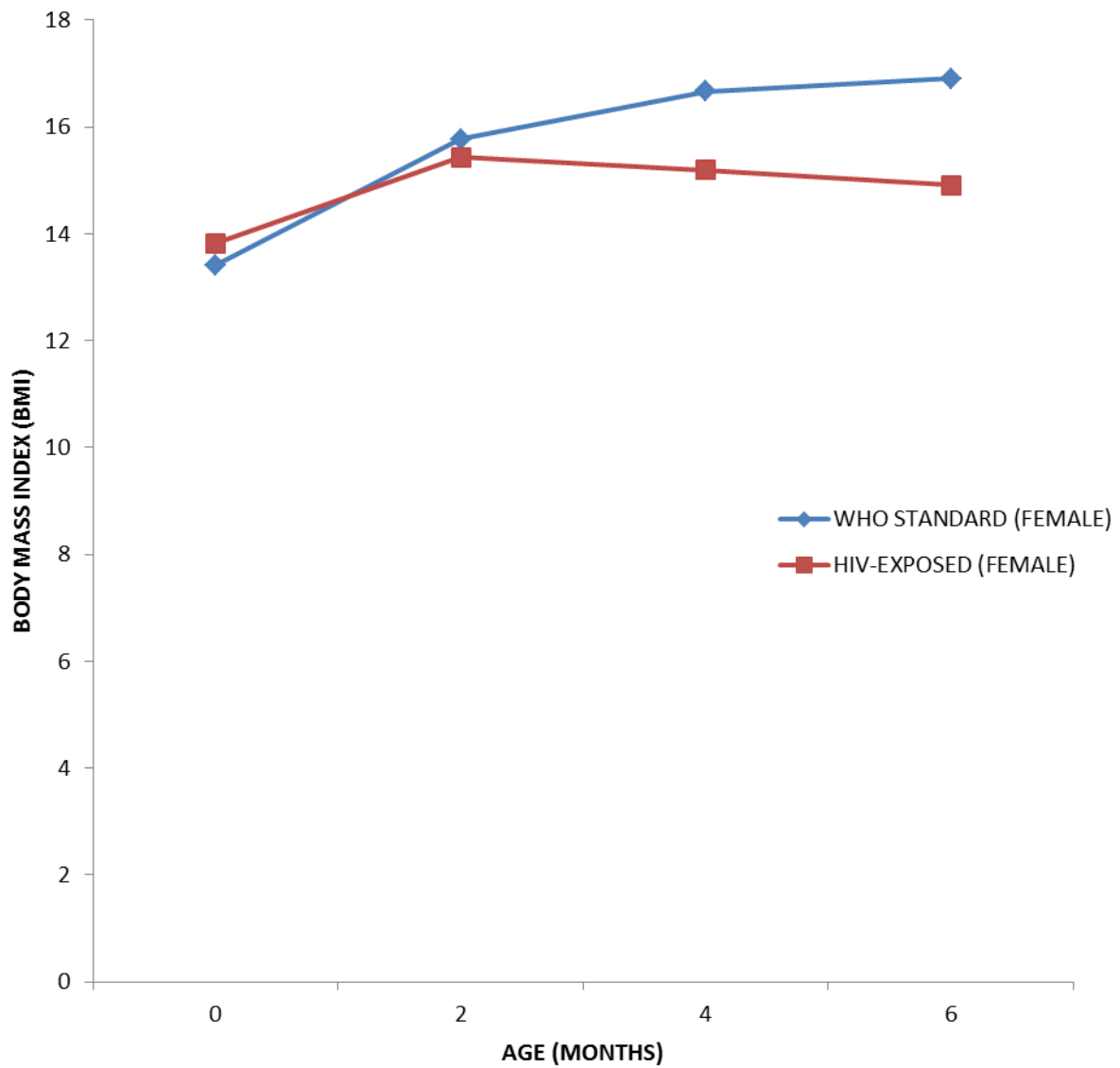


Figure 4.9: Distribution of Body Mass Index Z-scores (BMIZ) of the Exposed Female Children

4.3 Socio-Demographic Characteristics of the Caregiver

The socio-economic /demographic characteristics of the Caregivers who were administered questionnaire in this study are presented in table 4.4. Also the anthropometric parameters of 39 boys and 35 girls were taken and assessed. It is deducible from the table that; 97.29% of the caregivers are in the age group of 20-40 which is the highest, while 1.35% is in bracket age less than 20years or greater than 40 years. Also 40.54% of respondents had no formal education; followed by 22.97% of respondent's with primary level education and 18.92% of respondents having secondary school level of education. Those of the respondents who had attained college/university education were 8.11% and post graduate educations were 6.76%.

About 96% of respondents were married while 2.70% are single and the rest were either separated/ divorced. It is also shown on the table that 66.22% of respondents were full time house wives while, 6.76% and 17.57% of respondents are civil servants and traders respectively; 9.46% of respondents are Artisans.

The respondents in this study engaged in different income generating activities with 71.62% of them receiving less than five thousand naira in a month, 14.86% of respondents receiving five to fifteen thousand while 5.41% of respondents receives twenty six to thirty five thousand and 4.05% of respondents receive sixteen to twenty six thousand in a month; while the rest of percentage is above thirty six thousand.

The respondents received their information mainly from the clinic that is 59.46%, 36.49% relays on health workers closest to them. 2.70% and 1.35% depend on television and radio respectively.

The study also reveals that 81.08% of respondents uses pit toilet, 16.22% of them use water system; and 2.70% use bush for defecation.

TABLE 4.4 Some Socio-Demography characteristic of Caregivers in ABUTH Shika

Variables		Sample Size (N)	Percentage (%)
		74	
Age(Years)	<20	1	1.35
	20-30	24	32.43
	31-40	48	64.86
	>40	1	1.35
Education	No Formal(NFE)	30	40.54
	Primary (PEC)	17	22.97
	Junior Secondary (JAS)	1	1.35
	Senior Secondary (SSC)	14	18.92
	Tertiary (PSE)	6	8.11
	Post graduate (SPE)	5	6.76
Marital Status	Single	2	2.70
	Married	71	95.95
	Widowed	1	1.35
Employment Type	Artisan	7	9.46
	Trader	13	17.57
	Civil Servant	5	6.76
	Complete Housewives	49	66.22
Monthly Income (Naira)	≤ 5,000	53	71.62
	5000-15000	11	14.86
	16,000-25,000	3	4.05

	26,000-35,000	4	5.41
	36,000-45,000	1	1.35
	46,000-55,000	1	1.35
	≥55,000	1	1.35
Source of Drinking Water	Bore Hole	15	20.27
	Bottle	2	2.70
	Rain	1	1.35
	Sachet	34	45.95
	Well	22	29.73
Source of Information	Clinic	44	59.46
	Health Workers	27	36.49
	Radio	1	1.35
	Television	2	2.70
Method of Waste Disposal	Bush	2	2.70
	Pit Toilet	60	81.08
	Water System	12	16.22

Table 4.5; is a chi-square table showing both the calculated chi-square value 0.069691; and the tabulated chi-square value 3.84; explaining the relationship between education and the choice of

infant feeding of these HIV-positive mothers which states that; there is no association between educational status and breast feeding pattern

Table 4.5 Relationship between educational status and Infant and young child feeding pattern

H₀: There is no association between educational status and breast feeding pattern

Observed	Observed frequency(O)	Expected frequency(E)	O-E	(O-E) ²	(O-E) ² /E
F/EBF	42	42.22	-0.22	0.0484	0.001146
F/NEBF	2	1.78	-0.22	0.0484	0.027191
NF/EBF	29	28.78	0.22	0.0484	0.001682
NF/NEBF	1	1.22	-0.22	0.0484	0.039672
TOTAL	74	74			$\chi^2 = 0.069691$

df=1, $\alpha = 0.05$, $\chi^2_{\alpha, df} = 3.84$, $\chi^2_{\text{calculated}} < \chi^2_{\alpha, df}$ F: Formal education; NF: Informal education; EBF: Exclusive breast feeding; NEBF: Non exclusive breast feeding; χ^2 : chi square; DF: Degree of freedom.

CHAPTER FIVE

5.0 DISCUSSION

A lot of work has been done on HIV including MTCT but there remains still, a dearth of information related to appropriate feeding for infants of mothers infected with HIV and its impact on the child nutritional status. Some suggested infant feeding in theory have lots of merit but not much has been done to determine their practical feasibility and acceptability especially in the Sub-Saharan African communities.

Age, marital status, religion and education status are socio demographic characteristics which can influence individuals' values, knowledge, attitudes, behaviour and practices. These also affect our decision making ability hence maternal infant feeding choices.

This study shows that 95.95% of mothers who participated in the study practiced exclusive breast feeding (figure 4.2); which is in line with WHO 2010 guidelines. Breast milk is standard and provides all the nutrients an infant needs in early stages of life (UNAIDS, 2008). According to WHO 2010 guidelines, HIV positive mothers are recommended to practice exclusive breast feeding for first 6 months of infant's life and gradually introduce complementary foods while continuing breastfeeding for at least 12 months as long as the mother and or the child are on Anti-retro viral treatment. On the basis of these results it is therefore revealed that most mothers do follow recommended guidelines. Although wet nursing and expressed heat treated breast milk were not observed among mothers in the study, WHO recommend them as long as the surrogate

mother is tested for HIV and is found negative and correct heat treatment of expressed breast milk is observed.

On the other hand, exclusive replacement feeding was not observed by the mothers. This could be due to economic constraints or other factors. Replacement feeding practice was investigated in the context of popularity, accessibility, feasibility affordability, safety and sustainability (AFASS) (FANTA, 2004).

Though 95.95% of mothers who participated in the study practiced exclusive breast feeding; however 4.05% of these mothers practiced mixed feeding and 2.7%, still gave pre-lacteal feeds to their children. This is contrary to WHO and UNICEF guidelines 2010. UNAIDS 2008 documented that mixed feeding is not recommended since it increases risk of HIV transmission through breast feeding. A study done in South Africa suggested that combination of breastfeeding and artificial feeding has even more potential harm to infants in the first months of life (Coutsoudis *et al.*, 1999) and that those who are exclusively breastfed, for 6 months, may face a significantly lower risk than was previously thought (WHO, 2010).

For all anthropometric indices, the basic model was the same across nutritional status (appendix 6-9). Gender was associated with all anthropometric indices; whereas, child age was more closely associated with Length-for-age Z-score than weight-for-age Z-score. One of the monitoring tools used to assess nutritional status at both age groups was the weight-for-age graphed on a weight chart. That indicator, called underweight, is in effect a composite indicator that measures both acute and chronic malnutrition status. A high weight-for-age Z-score, which is a reflection of long-term exposure and short-term

exposure, is more likely to occur if feeding practices offered to infants were adequate both in quantity and quality. Results from analysis show that the infant and child feeding index was strongly and positively associated with weight-for-age Z-score. However this study indicated that 59.46% of the children were underweight and wasted at four months of age (table 4.2 and 4.3).

40.54% of these mothers had no formal education and 71.62% are of low income; which shows that women in the environment of this study are left behind in formal education. In a study done by Wapang'ana (2013) shows that most of the women had just primary education which is still not encouraging, this lack of formal education could be reasons why the mothers were mostly of low income status.

Finally, the study also reveals that formal education had no impact on the feeding pattern chosen by these mothers rather their knowledge on PMTCT informed their choices on the feeding type which is Affordable, Feasible, Acceptable, Sustainable, and Safe (AFASS) to them.

CHAPTER SIX

6.0 SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

6.1. Summary

This study was carried out over the space of six months, which is from birth to six months of age of the child. 95.95% of HIV infected Mothers practiced Exclusive Breast Feeding; this could be as a result of social stigmatization or their HIV status.

Moreover, 39 boys and 35 girls were assessed, and their nutritional status falls majorly within range of -1 to +1 Z-scores which is still very much within the normal range.

Moreover, the choice of feeding practiced by these mothers was mainly influenced by their knowledge on Prevention of Mother to Child Transmission (PMTCT) of HIV.

6.2. Conclusion

In conclusion, HIV infection has so much impact on infant feeding, it possess so much difficulty for HIV positive mothers to decide on which options will be the best for their child, however in this work, 95.95% Exclusively breast fed their child

Moreover, the nutritional status of these children was very much within the range, that is; more than seventy percent are within -1 to +1 Z-scores values.

Finally, the result of this work shows that, formal education has little or nothing to do with the choice of feeding adapted by these mothers instead they are mainly influence by their knowledge on Prevention of Mother to Child Transmission (PMTCT) of HIV.

6.3. Recommendations

Finally, this study also recommends further research on assessment of maternal nutritional status and adherence to WHO infant feeding guidelines in context of HIV.

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APPENDIX 1.
QUESTIONNAIRE

SECTION A: Background Information

Date...../.....Hospital No: mother.....Child:.....

SECTION B: Socio Economic and Demographic Characteristics of Nursing Mother.

1. Caregiver: Father [], Mother [], Grandmother [], Aunt, [] Older siblings []
Others (specify) _____
2. Age of caregiver.....years
3. What is the marital status of the Care giver? A. married [] B. single [] C. widowed []
D. Divorced [] E. No Response []
4. Since when have you been tested HIV positive?
5. Are you on medication? Yes [] No []
6. Total number of household members/ Household size. Father [] Mother []
7. How many children do have you (parity)?.....how many _____ Alive. _____dead
and age of last child before this one_____
8. What is/are your source of drinking water? Borehole [] Bottle water [] pure water/ Sachet
water [] well water [] River Water [] Rain water [] Tap water [] others
(specify).....
9. What is your major means of communication? Hand set[] others (specify).....

10. What is your means of transportation? Public Transport [] Private Transport []
11. What is your source of information? Health workers [], Radio [] TV [], Clinic []
Friends [] others (specify).....
12. What is means of waste disposal? Pit Toilet [] Bush [] water system toilet [] others
(specify).....
13. What is your main occupation? A. Civil servant [] B. Trader [] C .Housewife []
D .Farming [] E. Artisan/ Hand work [] F. Others (Specify) _____
14. What is your level of formal education? A. No formal education.[] B. Primary school
education uncompleted.[] C. Primary education completed[] D Junior Secondary
School uncompleted. [] E. Junior secondary school completed [] F. Senior Secondary
School uncompleted. [] G. senior secondary school completed [] H. Post secondary
school education. [] I. Some postgraduate Education [] J. Islamiyya / Arabic school []
K. Others Specify.....
15. Estimated Household monthly income. A. ≤ N5, 000 [] B. N5, 000 - N15000.[]
C. N16, 000-25,000 [] D. N26, 000-35,000 [] E. N36, 000-45,000 []
F.N46, 000-55,000 [] G. ≥ N55, 000[]

Skip/ leave question 16.

16. Mother's laboratory results:
- a. ELISA b. CD4 count.....c. viral load..... d.HIV type.....
- e. Child's PCR results

SECTION C:Child Information.

1. Was this child given Nevirapine at birth? Yes [] No [],if yes, for how
long?..... If no why?
2. Sex? A. Male [] .B. Female []

3. Anthropometric Measurements

	Head circumference (CM)	Length (CM)	MUAC (CM)	Weight (kg)	Chest circumference (CC)
Within 72 hour of birth					
At two months					
At four months					
At six months					

SECTION D: Feeding Practices

- Did you give your baby anything before, first breastfeeding? Yes. No
 if yes what is it? and why?.....
- Exclusive breastfeeding? Yes . No ,
- Formula; Yes No
- Age of stopping breastfeeding? _____
- When did you start (initiate) breastfeeding your child?
 Immediately after delivery , within 12 hours , within one day
 Within 2 days , After 5 days , Others (specify)[.....]
- Did you feed your baby with the first yellowish milk (colostrums)?
 Yes , No .Why?
- On the average, how many times do you breastfeed your child in a day?

A. less than 3 times [],B.4-8 times [],C. On demand.[],G. Others (specify)...

8. At what age will you give additional food to breast milk? months_____

9. Type of food given: Home Made [] Commercial [].Others (specify).....

APPENDIX 2.

Comparison of z-scores and percentiles

Z-score	Exact Percentile	Rounded Percentile
-3	0.1	1 st
-2	2.3	3 rd
-1	15.9	15 th
0	50	50 th
+	84.1	85 th
+	97.7	97 th
+3	99.9	99 th

MINISTRY OF HEALTH, KADUNA STATE

All Communications to be addressed to:
THE HON. COMMISSIONER
Quoting Reference and Date
Tell: (062)248084
(062)248252



Independence Way,
P.M.B. 2014,
Kaduna,
Kaduna State, Nigeria

MOH/ADM/744/VOL.I

10th September 2014

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ETHICAL CLEARANCE AND PERMISSION TO CONDUCT RESEARCH

I have been directed to convey the Ministry's approval to **BURBA RIMAMTSIWE ADI**, an MSC Student of the department of BIOCHEMISTRY, Faculty of Sciences, Ahmadu Bello University Zaria to conduct a research on the topic: "**Impact of HIV infection on infant feeding practices and Nutritional Assessment of Newborns of HIV positive Mothers in HAART Centres in Zaria Kaduna State**"

It is expected that necessary assistance be accorded him in the process of the research please.

However, it is mandatory for the researcher to submit a copy of his research finding(s) to the office of the Honourable Commissioner, Ministry of Health, as soon as it is concluded.

Accept the assurances of the Honourable Commissioner's highest regards.

F. A. KURAH (MRS)
Secretary Ethical Committee.

APPENDIX 4.



HEALTH RESEARCH ETHICS COMMITTEE

AHMADU BELLO UNIVERSITY TEACHING HOSPITAL
SHIKA - ZARIA, NIGERIA.

E-mail: abuth@yahoo.com

Website: www.abuth.org

Chairman of Board: Chief. Shuaib Oyedokun Afolabi *Fnll*

Chief Medical Director: Prof. Lawal Khalid, *MBBS, FMCS, FWACS, FRCS(ED) mnl*

Chairman, Medical Advisory Committee: Prof. Abdullahi Mohammed, *MBBS, FWACP, FICS*

Director of Administration: Barr. Ishak Bello, *LL.B, BL., LL.M, PGDM, AHAN, FCAI*

ABUTH/HREC/TRG /36

Our Ref: _____

13th Oct, 2014

Your Ref: _____

Date: _____

ABUTH HREC FULL ETHICAL CLEARANCE CERTIFICATE

RE: APPLICATION FOR ETHICAL CLEARANCE CERTIFICATE

Impact of HIV Infection on Infant Feeding Practices among HIV Positive Mothers, and Nutritional Assessment of Their Newborns, in HAART Centres in Zaria.

ABUTH Ethics Committee assigned number: - ABUTHZ/HREC/L08/2013

Name of the principal Investigator: - Mr. Burba Rimamtsiwe Adi

Address of the Principal Investigator: - Dept. of Biochemistry. A.B.U, Zaria.

Date of receipt of valid application: - 12/3/2014

Date of meeting when final determination on ethical approval was made: - 3rd & 4th Sept, 2014

This is to inform you that the research described in the submitted protocol, the consent forms and other participant information materials have been reviewed and **given full approval by the Health Research Ethics Committee.**

Please note: this approval dates from **14th October, 2014– 14th October, 2015**

No participant recruitment into this research may be conducted outside these dates.

All informed consent forms in this study must carry the ABUTH HREC number assigned to this research and the duration of ABUTH HREC approval of the study.

This HREC expects that you submit your application as well as an annual report for ethical clearance renewal 3 months prior to expiration of study dates. This is to enable you obtain renewal of your approval and avoid interruption of your research.

If there is delay in starting the research, please inform the ABUTH HREC so that starting dates can be adjusted accordingly.

No changes are permitted in the research without prior approval by ABUTH HREC, except in circumstances outlined in national code for Health Research Ethics: <http://www.nhrec.net>.

ABUTH HREC reserves the right to conduct compliance assessment visits to your research site without prior notification.


Prof. A. I. Mamman
Chairman, ABUTH HREC

APPENDIX 5.

**DEPARTMENT OF BIOCHEMISTRY
SCHOOL OF POSTGRADUATE STUDIES,
AHMADU BELLO UNIVERSITY, ZARIA, NIGERIA.**

INFORMED CONSENT FORM (ICF)

Serial No.:*Hospital No.:* *Age:*..... *Phone No.:*
.....

This Informed Consent Form is basically for interviewing HIV Positive Nursing Mothers that comes to this hospital in order to find out ways and strategies to minimize infant malnutrition and financial barriers to improve their nutrition in this community. I will need to ask you personal questions which you may find difficult to answer. Your answers will be kept completely confidential and will not be shown to other persons. The information collected from you and people like you will be used solely to come up with a better ways infant feeding for HIV positive Mothers. Your honest answers to these questions will be greatly appreciated. You have the right to decline and withdraw at any given time if you choose to. However, your honest answers to these question will help us better understand how create more impact on infant feeding practices.

The study is a non invasive study as no sample would be collected from you and will not pose any discomfort to you. I will greatly appreciate your help in responding to the survey and taking part in the study. The survey will take about 10 minutes to ask the questions. **[Interviewer asks if the respondent has**

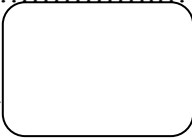
any questions and provides the necessary clarifications before proceeding with the informed consent].

Would you be willing to participate?

CERTIFICATE OF CONSENT

I.....of do hereby consent to participate in this study. The full procedures of the study have been explained to me by the investigator. I understand that no biological sample will be taken for the study. I therefore give this consent voluntarily without being subjected to any pressure.

Name of Participant

Signature/right thumb print of participant  Date

Statement by Witness:

I have witnessed the accurate reading of the consent form and detail explanation of the study to the potential participant, and the individual has had the opportunity to ask questions. I confirm that the individual has given consent freely.

Name of witness.....

Signature of witness..... Date

Statement by the Researcher/Person Taking Consent

I confirm that sufficient information, including about risks and benefits, to make an informed decision have been fully explained to the participant. The participant was given an opportunity to ask questions about the study, and all the questions asked by participant have been answered correctly and to the best of my ability.

I confirm that the individual has not been coerced into giving consent, and the consent has been given freely and voluntarily.

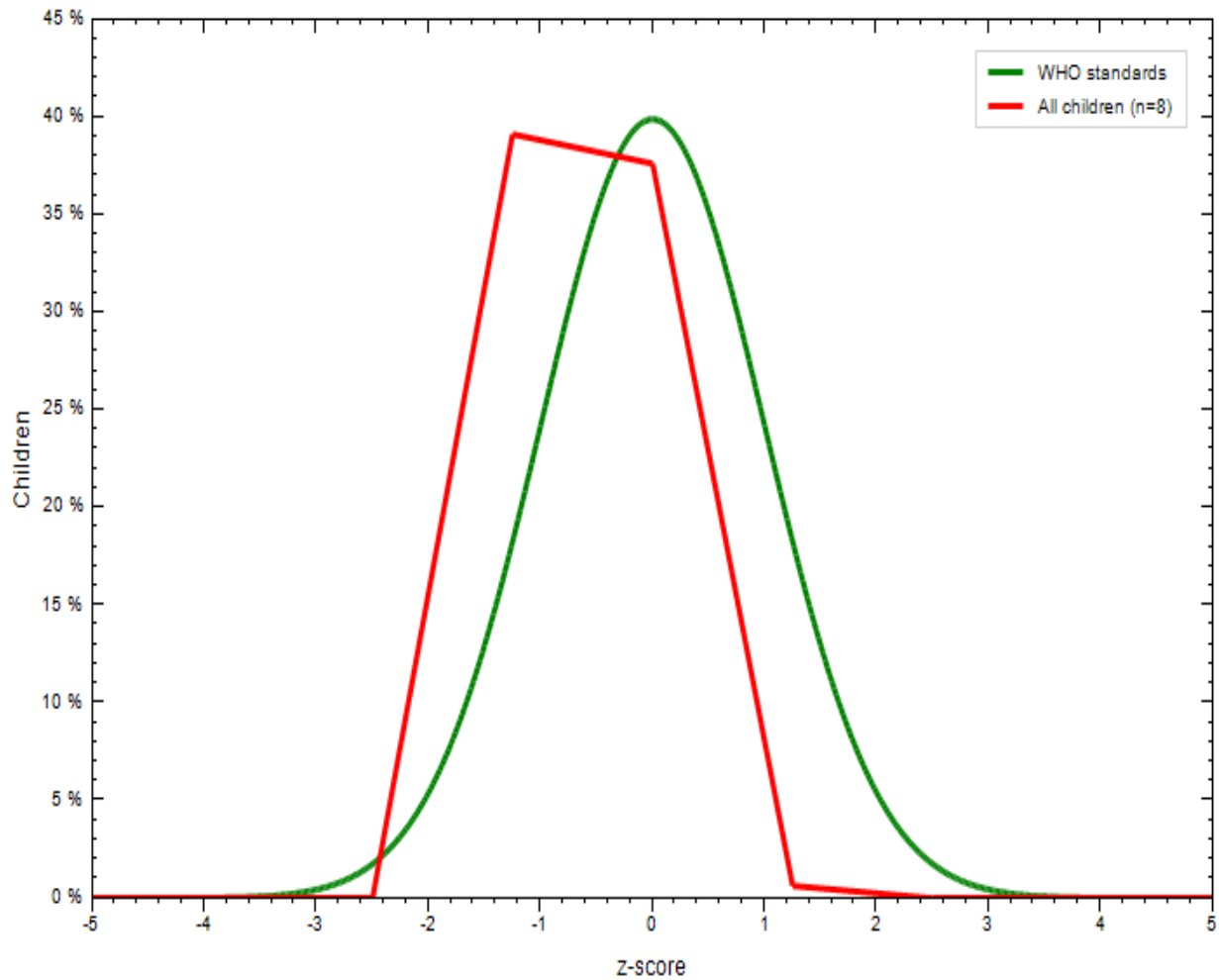
Name of Researcher: Rimamtsiwe Adi BURBA.

Signature

Date.....

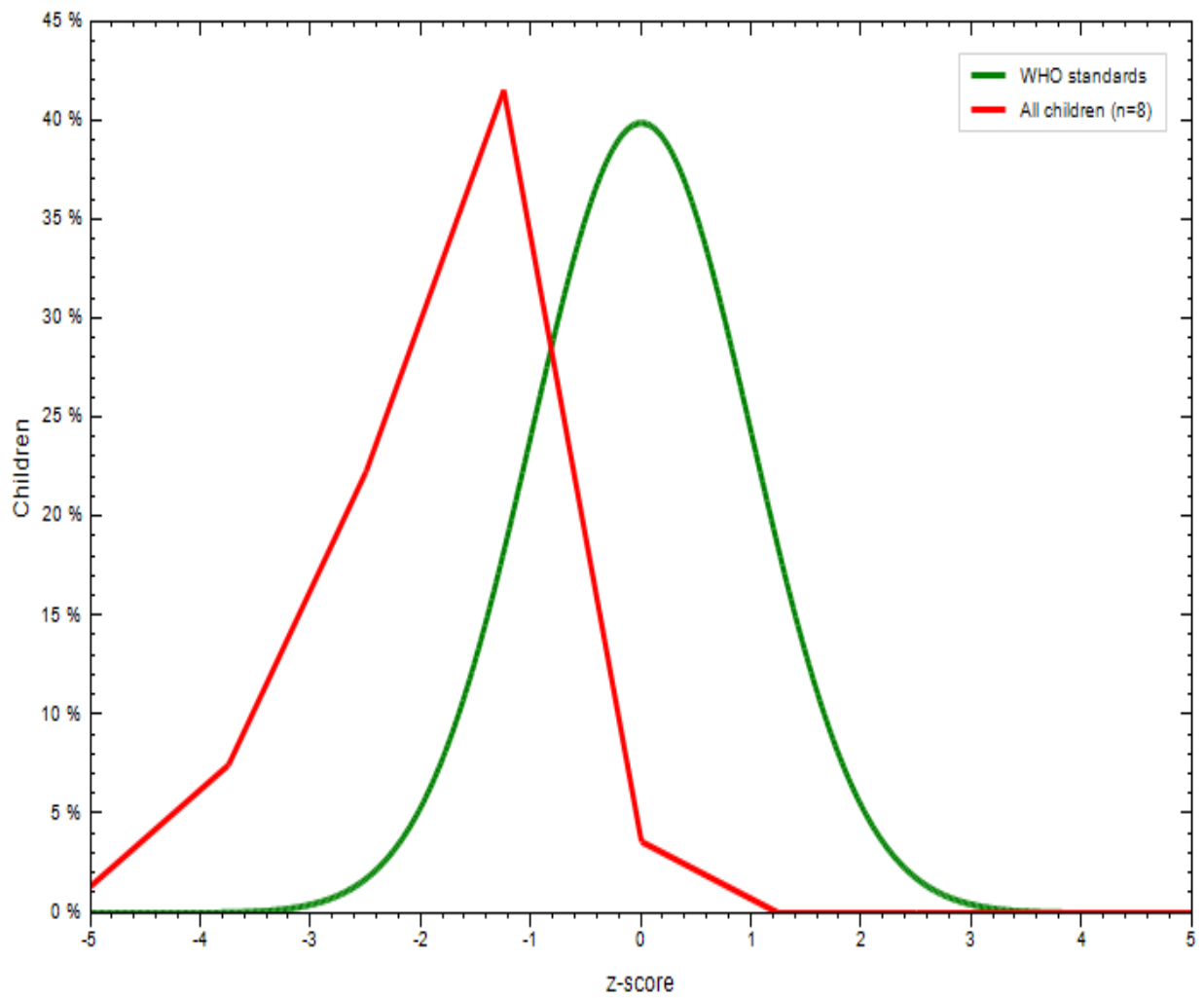
Graphical description of Anthropometric Indices of HIV Exposed Children According to Z-scores using WHO Anthro (Appendices 6-9)

APPENDIX 6;



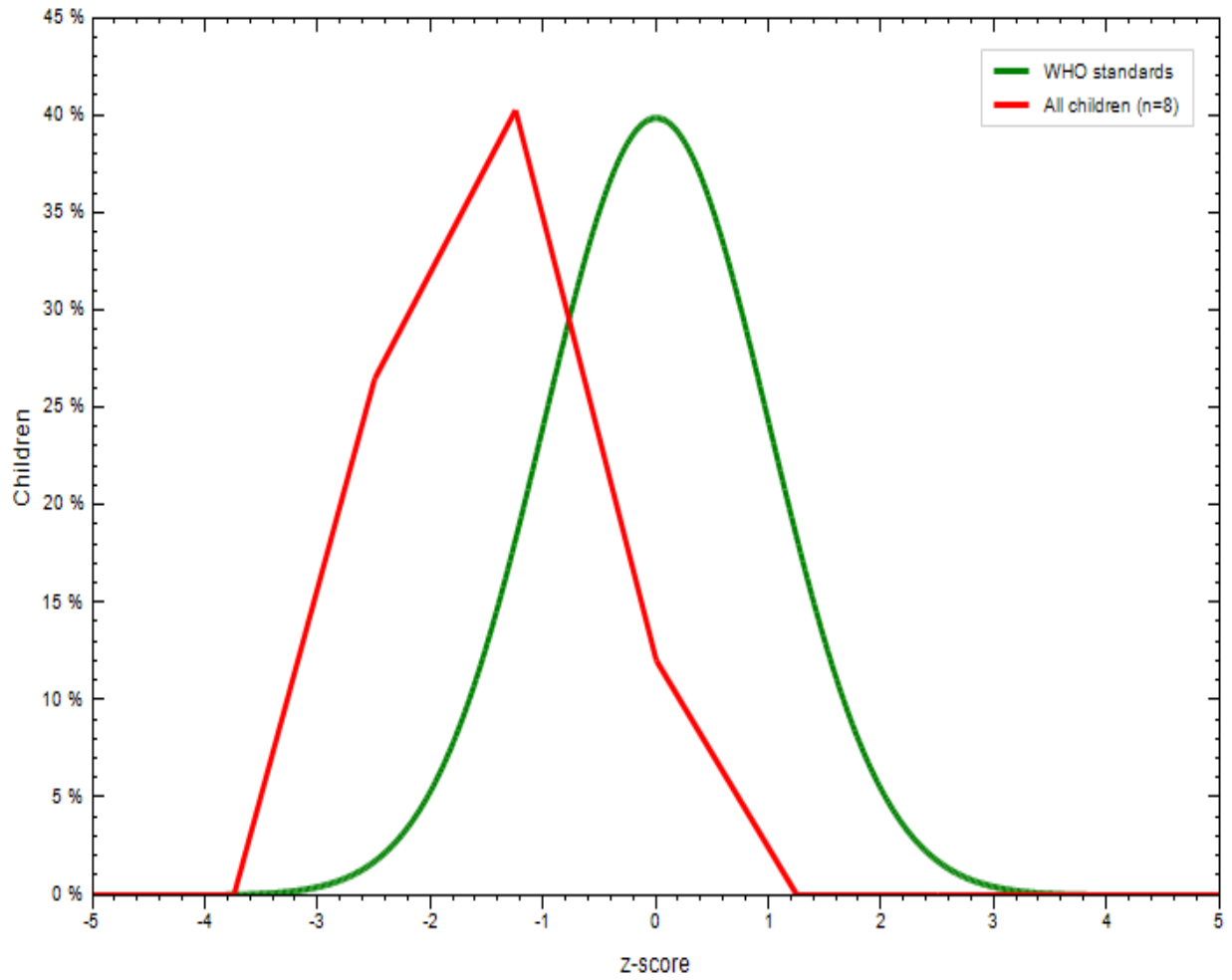
Distribution of Body Mass Index Z-scores (BMIZ) of the Exposed Children

APPENDIX 7;



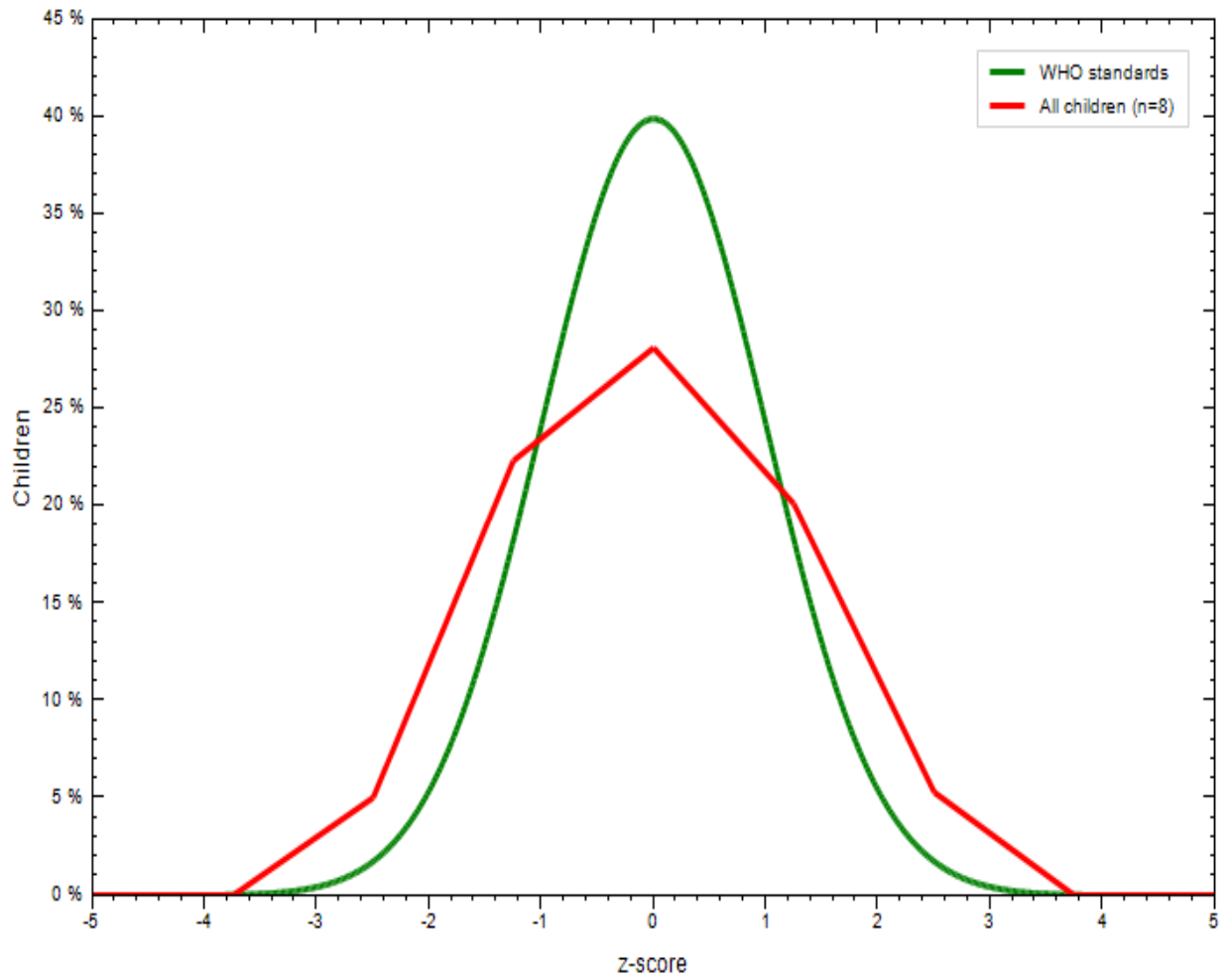
Distribution of Length-for-Age Z-scores (LAZ) of the Exposed Children

APPENDIX 8;



Distribution of Weight for-Age Z-scores (WAZ) of the Exposed Children

APPENDIX 9;



Distribution of Weight for- Length Z-scores (WLZ) of the Exposed Children