EFFECTS OF EXCLUSIVE BREASTFEEDING ON COGNITIVE DEVELOPMENT DURING EARLY CHILDHOOD IN KAHAWA WEST WARD, NAIROBI, KENYA

BY

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DECLARATION

I declare that, this thesis is my original work and has not been presented in any other University /Institution for consideration. This thesis has been complemented by referenced sources duly acknowledged. Where text, data (including spoken words), graphics, pictures or tables have been borrowed from other sources, including the internet, these are specifically accredited and references cited in accordance in line with anti-plagiarism regulation.

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ABSTRACT.

**Background:** The effects of breastfeeding during infancy have been a major point of inquiry among scientists. Scientists link breastfeeding to child cognitive, educational, mental, behavioral and psychomotor development (Kramer, 2008; Oddy, 2006). The literature was sourced using the relevant research articles from Psych Net, PubMed and Google Scholar among others.

**Objectives:** The general objective of the research was to find out the effects of exclusive breastfeeding on cognitive development on early childhood in Kamae, Kiwanja and Soweto slums at Kahawa West ward, Nairobi, Kenya.

**Key words:** cognitive development, low birthweight, exclusive breastfeeding, infants and toddlers and postnatal period.

**Methodology:** The research design was ex post facto in which the children who were exclusively breastfed for the first six months of birth were compared with their counterparts who were formula fed. Cognitive assessment was done for both groups using Bayley’s Screening test for infant development between 1-42 months. Total number of children was 180,(Females=93, males= 87).

**Results:** The results showed that there was no significant difference in cognitive development between the exclusively breastfed and the formula fed (M=1.444, SD=0.5) and (M=1.556, SD=0.5) respectively. ANOVA comparing the two groups was [F (1, 179) = 0.088, p= 0.767]. Likewise there was no gender difference in cognitive functioning. ANOVA comparing the two groups (males=87 and females=93) was[F (1,180) =0.147, p=0.997]. Socioeconomic status and cognitive development was not assessed.

**Conclusion:**

The research concludes that there is no difference in cognitive functioning of exclusively breastfed compared to the formula fed. Gender difference was also insignificant. Finally more longitudinal studies need to be done with large samples to establish the cause and effect of the investigated variables.
DEDICATION

This work is dedicated to my classmates and my family and all my lecturers who took time to take me through this challenging but memorable period.
LIST OF ABBREVIATIONS

**BSID** - Bayley’s Scale for Infant Development.

**DDST** - Denver Development Screening Test

**GoK** – Government of Kenya

**UN** - United Nations


**UNDP** - United Nations Development Programme

**WHO** – World Health Organization

**ICN**-International Congress of Nutrition

**SA**-South Africa
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CHAPTER 1

INTRODUCTION AND BACKGROUND

1.0 Introduction

This chapter presents the background to the study, the statement of the problem, the significance of the study and the hypotheses. It also presents the objectives of the proposed study. The general objective of the proposed research is to find out the impact of exclusive breastfeeding on cognitive development on early childhood in Kamae, Kiwanja and Soweto slums of Kahawa West ward, Nairobi, Kenya. The chapter also outlines the research questions and justification of the study. The limitations and delimitations of the study are also concisely explained. A short summary of the chapter has been included at the end of the chapter.

1.1 Background

Breastfeeding is the biological norm for human infants which is widely identified for promoting health and development among the infants. Health authorities consider optimal feeding for infants to be 6 months of exclusive breastfeeding then later followed by introducing appropriate complementary foods, at the same time continuing breastfeeding until toddlerhood. (National Health and Medical Research Council, 2003)

The effects of breastfeeding during infancy have been a major point of inquiry among scientists. Scientists link breastfeeding to child cognitive, educational, mental, behavioral and psychomotor development (Kramer, 2008; Oddy, 2006). Much of these studies have been a consequence of a century-old study by Hoefer and Hardy that found breastfed babies have better cognitive abilities than artificially fed children (Hoefer & Hardy, 1929). The association between child cognitive development and breastfeeding has conflicting results as many studies report mixed outcomes. While some research show a positive association (Geoff & Dreary,
2006), others found no relationship between the two variables. In their desk review of studies on breastfeeding and cognitive development, Geoff and Dreary (2006) found that out of over 80 studies reviewed, the quality of positive and negative studies were even and so did not differ. They also noted that apart from higher quality studies, the remaining showed a decrease in effect of exclusive breastfeeding after analysis. Other factors such as the duration of breastfeeding, socioeconomic status, genetic reasons, and gender differences may confound the relationship between breastfeeding and child cognitive development (Geoff et al., 2006). The present study seeks to investigate the impact of exclusive breastfeeding on cognitive development on early childhood.

According to Kramer et al. (2008), there is strong evidence of cognitive development effects of 3-6 IQ points for children who were exclusively breastfed for 4 months and more, compared to the ones who were breastfed for 3 months or less. Although the biological mechanism behind the effect of exclusive breastfeeding on cognitive development is not clear, biochemical components of human milk, such as fatty acids and hormones have been identified to play a great role in brain development (Oddy, 2006). Human breast milk contains components such as bioactive proteins that lack or are in lower quantities in other milk substitutes such as cow milk (Agostoni, et al., 2001). These components offer various benefits to the baby including enzyme activities, antimicrobial effects that enhances nutrient absorption and stimulates growth. (Agostoni et al.,2001). It also has milk fat globule membrane (MFGM) which can explain the difference in cognitive development between breastfed and formula fed children (International Congress of Nutrition (ICN), Granada Spain (2013).

It is well documented that cognitive development in childhood is vital for an individual’s capacity to learn and take advantage of the opportunities available within a particular environment (Angelsen, 2001). Individuals scoring higher on intelligence tests in early childhood are usually more successful in professional careers and achieve a higher level
of education and better socioeconomic status, which may in turn positively affect their health status (Kimani-Murage, Madise & Fotso, 2011).

1.2 Statement of the problem

The evidence that breastfeeding improves cognitive development is based almost entirely on observational studies and is thus prone to confounding by subtle behavioral differences in the breastfeeding mother's behavior or her interaction with the infant (Kramer et al., 2008). A breastfeeding promotion intervention modeled on the Baby-Friendly Hospital Initiative by the World Health Organization and UNICEF which was the largest randomized trial ever conducted in the area of human lactation, provide strong evidence that prolonged and exclusive breastfeeding improves children's cognitive development (Kramer et al., 2008). However, according to Kenya Demographic Health Survey (KDHS) (2014), 91% of children were breastfed; 61% of children below the age of 6 months were exclusively breastfed. Around 81% of exclusively breastfed children got complimentary foods between 6-9 months.

Exclusive breastfeeding as per the WHO recommendation (2003), in the first six months through to two years is also a period of rapid physical and mental growth of the child. In slum areas, the poor economic situation prohibits most mothers from providing adequate nutrition and also breastfeed their children (Kimani-Murage et al., 2011). Although mothers recognize the recommendation by WHO for exclusive breastfeeding, actualizing these recommendations seem impractical due to various factors such as mothers’ poor nutritional status and low socio-economic status hence being a hindrance to proper cognitive development of their babies in the 1st year of life. (WHO recommendations on postnatal care of the mother and the new born, 2013). Adequate nutrition is critical to children’s growth and development. The period from birth to age 2 years is especially important for optimal physical, mental, and
cognitive growth, health, and development. Unfortunately, this period is often marked with nutrient deficiencies that interfere with optimal growth and may cause common childhood illnesses such as diarrhea and acute respiratory infections including tuberculosis (Popkin & Bisgrove, 1998). A woman’s nutritional status has important implications on her health as well as for the health of her children. Malnutrition in women results in reduced productivity, increased susceptibility to infections, slowed recovery from illness, and a heightened risk of adverse pregnancy outcomes (Oddy & Kendall, 2003). Micronutrient deficiencies, has a greater risk of obstructed labor, of having a baby with a low birth weight, death from postpartum hemorrhage, and of morbidity for both herself and her baby (Taffa, Chepengo, & Amyunzu-Nyamongo, 2005). All these factors put together would impact negatively on the baby’s cognitive development.

1.3 Objectives

1.3.1 General objective

The general objective of the proposed research is to find out the impact of exclusive breastfeeding on cognitive development on early childhood in Kamae, Kiwanja and Soweto slums at Kahawa West ward, Nairobi, Kenya

1.3.2 Specific objectives

i. To assess the effect of exclusive breastfeeding on neurocognitive development during the 1st year of life.

ii. To determine whether socio-economic status has any influence on:
   
   (a) Breastfeeding and (b) cognitive development of a child.

iii. To assess if there is any gender difference in cognitive development during the first year of life among the children.
1.4 Research Questions

i) To what extent does exclusive breastfeeding improve the neurocognitive development of children in the 1st year of life?

ii) Does socio-economic status have any influence on (a) breastfeeding (b) children’s cognitive development?

iii) Are there gender differences in cognitive development during the 1st year of life?

1.5 Justification

High rates of participation are needed across the two groups of study period of research. In our research, we suggest the use of incentives which are effective at eliciting participation. The study therefore suggests providing food supplements to the participating mothers throughout the study period so as to ensure that both our experimental group and control group are subjected to same conditions, and also to act as an incentive for the mothers to participate in the study. This incentive level may appear to be high. However, this is a very rigorous study requiring participation over a period of three months. A large incentive is imperative if we are to achieve adequate participation and response to a study involving 200 participants.

1.6 Significance of the Study

The findings of the proposed study would contribute to the knowledge on the numerous health benefits for breastfeeding as well as helping the mother and child bond. Greater intensity could be added on the various studies done which have attempted to establish the impact of breastfeeding on cognitive ability by testing children of various ages. Through this research, Kamae, Soweto and Kiwanja slums may provide some insight on issues of exclusive breastfeeding in the slum dwellings.
1.7 Basic research assumptions

The study was based on the following assumptions

i) That all breastfeeding mothers would follow instructions given by the researcher for purposes of data collection.

ii) That all respondents would cooperate and provide truthful information.

1.8 Limitations of the study

Limitations are aspects of a research that may influence the results negatively but over which the researcher has no control over (Mugenda & Mugenda, 2003). The following factors might be limitations to the study.

- Possibility of controlling the attitudes of the respondent. Some respondents might give socially acceptable answers to please the researcher.
- Kamae, Soweto and Kiwanja areas are just but some of the slum areas in Kenya. The result of the study might not be generalized in the whole Nairobi County.
- Time and resources available might be limiting.

1.9 Delimitations of the study

- The study will confine itself to breastfeeding mothers who will cooperate with the researcher.

1.10 Definition of terms

Exclusive breastfeeding: Refers to the first 6 months during which a baby is strictly fed on the mother’s breast milk.
**Postnatal period**- This is the period extending from the first day of delivery to up to six weeks.

**Cognitive development**-Cognitive development is the construction of thought processes, including remembering, problem solving, and decision-making, from childhood through to adolescence and adulthood.

**Infants and toddlers**-For the purposes of this research, these are children whose age range will be 10-14 months.

**Low birth weight (LBW)**-Refers to a live infant of birth weight less than 2.5 kilograms

### 1.11 Chapter 1 summary

In this chapter I introduce our research topic, impact of exclusive breastfeeding on cognitive development during the first one year of life. The key words are cognitive development, postnatal period, exclusive breastfeeding and low birth weight. The objective of this research is to find out to what extent exclusive breastfeeding impacts on cognitive development of infants and toddlers, and whether gender and socio-economic status account for any difference. The sample will consist of 200 breastfeeding mothers already clustered as exclusively breastfeeding and nonexclusively breastfeeding or using formulae feeds. The research design will be Ex Post Facto in which the children who were breastfed for the first six months and have attained the age of between 10 -14 months will be assessed for cognitive development and compared to a similar cohort who were not exclusively breastfed.
CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

This chapter reviews the literature related to the proposed study. It is organized into different sub-topics related to breastfeeding at a global perspective, regional and at local scale. The literature relevant for this study was collected through online search of articles using the following search engines: Google scholar, psychNet and Pub med amongst other sources. The search was consolidated to the last 15 years. However, some literature as early as 1975 and 1985 were reviewed due to their historical worth.

2.1 Breastfeeding

It has been made clear that there are numerous health benefits for breastfeeding as well as helping the mother and child bond; however the validity of the correlation between breastfeeding and cognitive ability remains unclear. This subject has been researched greatly over the years. The various studies done have attempted to establish the impact of breastfeeding on cognitive ability by testing children of various ages. Hornwood and Fergusson’s (1998) study was on how breastfeeding duration affected an individual’s academic achievement from 8 to 18 years old. The study revealed that there were few detectable links between breastfeeding and improved educational achievement and cognitive ability.

Several studies show that breastfeeding has a positive effect on cognitive function in babies, however, in such studies the women who chose to breastfeed were older, more educated, and had a higher socioeconomic status than the mothers who breastfed less or chose not to breastfeed (Angelsen, Jacobsen & Bakketeig, 2001). While many studies focus on how breastfeeding will affect an individual’s cognitive ability during their childhood and later years, fewer of them look at how breastfeeding impacts an individual during their infancy. Andres et
al., (2012) study looked at how breast milk, milk-based formula and soy-based formula affected the developmental status of a child when they were just 1 year old. Focusing on nutrition at such an early age can help maximize the benefits of promoting health and preventing diseases later in life.

According to Leon et al. (2002), children who are breastfed do better on tests of cognitive and motor development than children who are not breastfed at all. When potential confounders are considered, the difference margin is small but persistent, showing that not all of the observed effect is due to confounding. The consistency of these differences across time suggests that this effect is real and has a biological basis. The authors found the biological explanations for a relation between breastfeeding and intellectual development to be the presence of long-chain polyunsaturated fatty acids known for their important role in brain growth and development. The Unique physical contact between mother and infant provided by breastfeeding also is thought to provide psychosocial stimulation and bonding that may have developmental benefits.

Kramer et al. (2008) did a study through cluster-randomized trial, enrolling 17,046 healthy breastfeeding infants’ participants from June 17, 1996, to December 31, 1997, and did a follow-up from December 21, 2002, to April 27, 2005. To assess whether prolonged and exclusive breastfeeding improves children's cognitive ability at age 6.5 years. From the study, they found that exclusive breastfeeding improves children's cognitive development. It showed higher results on IQ tests and other measures of cognitive development among children who had been breastfed.

The Australian Time use Survey of Australian Mothers (TUSNM) was conducted from April 2005 to April 2006. A sample of 188 mothers were included in the survey, and the study examined time spent by mothers on exclusive breastfeeding of the infants from 3-9 months and compared the infants who were fed solids and infants who were not breastfed. The findings
concluded that exclusive breastfeeding was important to cognitive development through physiological and psychological mechanisms. The matter of breastfeeding has been addressed in several forums in terms of promoting good nutritional status of the newborns and also passing passive immunity from the mother to the child in the first year of life. From the nature’s perspective, breastfeeding is instinctual and comes automatically during suckling which is a birth reflex. The suckling, apart from providing the nutrition to the baby, creates a firm psychological and social bond between the baby and the mother.

2.2 Breastfeeding and cognitive development

In order to improve exclusive breastfeeding practices and achieve the World Health Organization target of a 50% increase in exclusive breastfeeding for the first 6 months, then specific interventions are needed especially in urban slum settings to sensitize mothers on the importance of exclusive breastfeeding of the children and benefits of doing so to child health, growth and cognitive development.

The link between breastfeeding duration and subsequent development, cognition, educational, mental, psychomotor and behavioral functioning of the infant has been the subject of much scientific enquiry. Indeed, the effect of feeding on infant health and development was first discussed more than half a century ago when breastfed babies were reported to have better cognition.

According to Wieslaw et al. (2011), analysis on cognitive development in Poland found out that there was a relationship between exclusive breastfeeding in infancy and long term cognitive benefit. The study findings revealed that exclusive breastfeeding in infancy for 6 months or longer was associated with an average 3.8 point higher gain in IQ score during the 7th year follow-up. The study findings confirmed that exclusive breastfeeding in infancy enhances cognitive ability of the children.
A meta-analysis by Angelsen (2001) concluded that breast feeding is associated with significantly higher scores for cognitive development than was formula feeding, after adjustment for confounding factors. This meta-analysis included mainly studies that compared children who had been breast fed with children who were exclusively formula fed (Angelsen et al., 2001). However, there are a number of flaws with these studies to date. A significant one being majority of these studies were done in developed countries. What about the women on the other end of the spectrum, who live in poorer countries and come from rural areas, where achieving education may be a challenge. For this paper, the focus will be how exclusive breastfeeding will impact on the cognitive development of infants who are only 1 year old, and will be using mothers that live in Kahawa West Ward.

There are many studies that have been done to show the impact of breastfeeding on child cognitive development (Oddy & Kendall, 2003). Previous studies on the impacts of breastfeeding focused on neurocognitive development for children born with low birth-weight (Vohr, 2006). A study by Kremer et al. (2008), found that exclusive breastfeeding and breastfeeding longer duration increased a child’s IQ. However, the association between breastfeeding and IQ increase would only be established by the time the child was six years old. Few of these studies have focused on the benefits that exclusive breastfeeding has on the neurocognitive development of children in their 1st year of life.

The majority of breastfeeding studies use large age spans (age 1-18 years). Cognitive studies done during infancy or adulthood are more likely to find a null association as the child may have adjusted. A major challenge would be the reduced accuracy of IQ tests for infants of less than one year. Similarly, additional factors may influence the IQ of people older than 18 years (Koren, 2013). This article proposes that gains associated with breastfeeding in the first year of life could predict the cognitive development trajectories for children, which may continue later in life.
Socioeconomic status has been hypothesized to influence breastfeeding and cognitive development. According to Bauchner (1986), breastfeeding is more common among women of high social class and may affect the interpretation of breastfeeding studies. The woman’s socioeconomic status has been an important confounder of breastfeeding analysis. According to Koren (2013), the association of breastfeeding with favorable familial socioeconomic status is beyond theoretical foundation. In developed nations breastfeeding is likely in women from families with greater economic and social resources (Vohr et al., 2006). Socioeconomic status may complicate the interpretation of the effects of breastfeeding on cognitive development (Li, 2008). However poor breastfeeding and complementary feeding practices have been widely documented in the developing countries. According to Murage and Madise, (2011), only about 39% of infants in the developing countries, 25% in Africa are exclusively breastfed for the first six months. Additionally, 6% of infants in developing countries are never breastfed. In Kenya, according to Kenya Demographic and Health Survey 2008-2009, 32% of children under the age of six months are exclusively breastfed, improving from only 13% in 2003., Substantial levels of child malnutrition and poor child health and survival have been documented in Kenya. Deriving from the broad principles of the joint WHO and UNICEF's Global Strategy for infant and young child feeding developed in 2002; the government of Kenya is implementing a strategy aimed at improving infant and young child feeding practices in Kenya. The strategy is actualized through revitalization of the BFH (Friendly Hospital Initiative).This study will seek to address the issue by considering the socioeconomic variables such as income levels, maternal IQ, housing, standards of living. A study of middle-income and low-income countries can also be set so as to find the association in developed countries.

There are several studies showing maternal socioeconomic status as a confounding factor of the association between breastfeeding and cognitive development. High rates of breastfeeding have been found in many low and middle-income countries (Li, 2008). The
parental socioeconomic status, parental IQ, income levels can be used to examine the differences between cognitive development for homogenous breastfed and non-breastfed children (Koren, 2013). However, studies done in developed nations show greater heterogeneity between breastfed and non-breastfed population (Hunter, 1986). Thus, breastfeeding is closely associated with the socioeconomic status, maternal intelligence, income levels, and social advantage (Hunter, 1986, Moffitt, 1981). These studies rule out biological effect between infant IQ and breastfeeding as such relationship would exist in multiple settings such as both the developing and developed world. Thus, IQ disparities are more apparent in socially advanced families because they have the choice to breastfeed.

Gender differences in children’s cognitive development are apparent during the first year of life. According to Oddy et al. (2012), gender differences in early childhood development as girls are less responsive to exclusive breastfeeding than boys. For example, breastfeeding a boy for extended durations can be used to predict academic achievement in boys older than ten years for mathematics and spelling. However, only a small and insignificant number of girls show benefit for reading. Gender, therefore, should be included in the discussion of the association between breastfeeding and neurocognitive development. According to Catalano et al. (2005), boys are more vulnerable to adversity in critical periods such as infancy than girls. The gender discrepancy is explained by the neuroprotective effects of estradiol which are highly concentrated in girls (Garcia-Segovia et al., 2001). The neuroprotective components in breast milk, coupled with the downstream effects for development, have greater benefits for boys than girls. Baron-Cohen et al. (2005), found compelling evidence for sexual dimorphism in the brain, especially the developing brain, which may be responsible for the gender differences in the cognitive development of children. For instance, males perform better in mental rotation tests, targeting, map reading, and embedded figures. Similarly, female perform better in emotional recognition tests, verbal fluency, and
social sensitivity. These tendencies explain why girls start talking earlier than boys (Baron-Cohen et al., 2005).

Despite the compelling evidence of cognitive development differences between boys and girls, few studies have been done to show the association between child development and breastfeeding across different genders. Broad (1972) found that breastfeeding improved speech and readings in boys. Thus, breastfeeding can be hypothesized to accelerate the maturation of boys (Broad 1975). It was found that significant gender differences exist in the association between educational outcomes and breastfeeding. Thus, this study should analyze boys and girls separately. In my literature search, I never encountered any recent study which has analyzed the gender differences in cognitive and speech development associated with exclusive breastfeeding.

2.3 Child cognitive development

Child cognitive development has been found to be influenced by both environmental and genetic factors (Agostini et al., 2001). The child’s cognitive development is largely determined by the potential of cognitive development. However, human factors such as nutrition and the parent’s ability to create a conducive environment for growth may influence the child’s cognitive development (Koren, 2013). Breastfeeding has been positively associated with cognitive development (Dreary, 2010). Despite these findings, numerous confounders have been known to present problems in the studies. Such confounders as mother’s age, IQ level, education level, socioeconomic status positively mediate the duration that mothers breastfeed. When adjustments for these confounders are made to some of these studies, the association between child’s cognitive development and breastfeeding is not significant (Jing et al., 2010; Dreary, 2010). Recent meta-analysis studies show that the breastfeeding is a significant determinant of cognitive development than formula feeding (Anderson, 1999).
However, these studies exclusively studied cognitive adjustment for confounding factors for children who are breastfed and those who are formula-fed.

The World Health Organization has recommended exclusive breastfeeding for the first 6 months of a child’s life (WHO, 2003). Breastfeeding should continue to get breast milk together with other foods until they are two years old. Despite these recommendations, the confounding factors continue to affect the likelihood initiating breastfeeding and limit the breastfeeding duration (Koren, 2013; Vohr, 2005). The most significant confounders include socioeconomic factors which may have a bearing in the child cognitive development.

Breastfeeding has been associated with a range of benefits in the general population (Dell, 2001; Kramer et al., 2008). Whether a child has been breastfed for 6 months or more, the duration of the breastfeeding has been seen to reduce the risk of early childhood respiratory tract infection such as asthma as well as diarrhea (Dell, 2001). There are positive associations between breastfeeding and health of mother, as well as the cognitive and motor development of children (Jonsdottir, 2012). Breastfeeding is also associated with reduced middle ear and urinary tract infections (Dyson et al., 2006). A few studies show that breastfeeding can lead to better motor development (Sacker et al., 2006). Despite the growing research in this field, the mechanisms for these relationships are incomplete among scientists. It has been theorized that several components of breast milk –especially long-chained polyunsaturated fatty acids that accumulate in the retina and the brain- can affect the cognitive development because of their effects on neural development (Petryk et al., 2007). The effect of sensory stimuli in the development of a child’s nervous system may influence cognitive development. According to Britton et al. (2007), the skin-to-skin contact between the mother and the child may create an important stimulus to the child’s which may be apparent in their cognitive development. Breastfeeding releases hormones in the mother that are related to the nurturing behavior (Petryk et al., 2007). Breastfeeding research in the field of epigenetics associate breastfeeding with
genetic pathways associated with stress responses and intestinal health (Chapkin et al., 2010) that are different in non-breastfed children.

The relationship between breastfeeding and cognitive development was found a century ago when Hoefer and Hardy observed that breastfed babies had better cognitive abilities than artificially fed children (Hoefer & Hardy, 1929; Jedrychowski et al., 2013). Exclusive breastfeeding has long-term benefits because maternal milk has numerous fatty acids and other bioactive components that are essential for brain development, especially of infants (Jedrychowski et al., 2013). Arachidonic acid (ARA) and Docosahexaenoic acid (DHA) are two fatty acids that have been associated with the development of nerve cells in the brain and retina (Petryk et al., 2007). These fatty acids are present in breast milk only. The cow’s milk used in the preparation of infant formula does not have these fatty acids. DHA and ARA have been found to improve motor responses and improve eyesight in infants and young children (Jedrychowski et al., 2013).

Many clinical studies show that breastfed children score high on cognitive function tests than those fed on infant formula. However, controversy is evident especially concerning whether the cognitive development benefits result from breastfeeding alone. The effect of confounding factors such as maternal education, IQ, and socioeconomic status remain the major criticism of breastfeeding studies. Many studies also suffer from traditional design, inadequate psychometric measurements, limited generalizability and small sample. These studies also disregard the different effects if exclusive breastfeeding and the combined breast-and-bottle feeding. These faults threaten the reliability of the results.

The breastfeeding and cognitive development literature fail to define the nature of the relationship between the two variables. It is not easy to establish if the observed association is causal or consequential because exclusive breastfeeding is done by mother with certain
characteristics such as high socioeconomic and social class, higher IQ, high-income and education levels, high motivation, and resource endowment. It is impossible to conduct controlled experiments although facilities to promote breastfeeding can now be established (Kramer et al., 2008). The majority of breastfeeding studies are done through randomized trials. The issue of causality has recently caught the attention of most scientists researching in this area. The most common method in this literature involves a wide array of controllable variables controlled in the outcome regressions (Belfield & Kelly, 2010; Rees & Sabia, 2009). A few researches study sibling pairs so as to control the unobserved family traits (Rothstein, 2011, Rees & Sabia, 2009). Other studies use instrumental-variables methods such as breastfeeding rates (Rothstein, 2011), the hospital the child was born and whether it promotes breastfeeding (Del Bono & Rabe, 2011), caesarean births, mother’s drug record, county-level variables on health care and social support (Kelly, 2005).

Few studies have looked at the cognitive development of children who have been breastfed exclusively in the first year of their lives. Jedrychowski et al., (2013) investigated the effects of exclusive breastfeeding on the development of cognitive function in children. The study revealed that exclusive breastfeeding enhances cognitive development for children in the first year of age. However, this observation was only true when maternal education and other confounding factors appeared to be insignificant. Jedrychowski et al(2013) found that the benefits of exclusive breastfeeding on the child gained in the first year of age manifested on IQ score and were sustained through preschool years. Similarly, the difference in IQ scores for those children who received mixed breastfeeding remained uniform during the entire preschool period. This observation suggests that exclusive breastfeeding during infancy may set the trajectories of cognitive development for children later in life, possibly influencing the cognitive ability in adolescence and adulthood.
Exclusive breastfeeding has strong biological effects on the neonatal brain. According to a study by Jing et al. (2010), the development of brain electrical activity during a child’s first year of life differs from that of one who is fed infant formula containing soy milk or cow’s milk. According to this study, the omega-3 polyunsaturated fatty acids present in breast milk and other bioactive elements essential for cognitive development may explain the differences in the brain electrical activity between infants who are breastfed and those fed using milk-formula.

The effect of exclusive breastfeeding on child cognitive function may indicate a sound maternal status. Recent research shows that a safe and sound maternal attachment has a positive influence on the child’s psychological development (Jasen, Weerth & Riksen, 2008; Meedya, 2010). Breastfeeding promotes mutual touch, mother’s gaze, and physical stimulation, which are absent in bottle-feeding. Breastfeeding may also be a marker of maternal intelligence although most studies such maternal characteristics are unmeasured. These studies assume that maternal intelligence is highly correlated with maternal cognitive abilities.

Only a few studies dissociate breastfeeding with child’s development. According to a large prospective study done by Der et al. (2006), breastfeeding had no effect on a child’s intelligence. However, the study was faulted for considering only children who were breastfed and not exclusively breastfed.

Cognitive development in children may be affected by excessive gestation weight. There is, however, no research done in this area. Most studies look into the effects on weight gain in premature birth rates, obesity in offspring, and possibility of complication during birth. Further research is required to establish the effect of excessive gestational weight gain on the child’s cognitive development (Shenkin, Starr & Deary, 2004).
The World Health Organization exclusive breastfeeding recommendation for the first 6 months of a child’s life is consistent with many researches that have observed long-term effects of early nutrition on the health and development of children later in life. The duration of breastfeeding and its effects on the developmental status of the baby is significant in determining the outcome of this research. Infants who are exclusively breastfed for six months have higher breast milk intake. Thus, it is hypothesized that exclusive breastfeeding would ensure they have better cognitive development in their early childhood.

Mothers who breastfed differ from those who chose not to breastfeed in many aspects, which may influence the infant cognitive development. These differences may include socioeconomic status or nurturing qualities. Thus, nursing mothers who participated in this study had the same socioeconomic status. They practiced exclusive breastfeeding until the child is six months of age so as to minimize the effect of the confounding factors on cognitive development. Gender differences in children’s cognitive development are apparent during the first year of life where girls are less responsive to exclusive breastfeeding than boys (Oddy & Kendall, 2003). Gender differences, therefore, should be included in the discussion of the association between breastfeeding and neurocognitive development.

Gladstone et al. (2007), conducted a research in Malawi which intended to establish whether the developmental tools developed from the Western countries could be adapted for use in the African countries. They used Denver II or Denver Development Screening test (DDST). Their subjects scored above the normal values in the five fields of development for each of the instruments.

In Nigeria, Aina and Morakinyo (2005) using the normative data of Nigerian children, found out there were high scores in the motor and personal–social fields, especially among subjects in the lower age groups of 8, 16, and 32 weeks when compared to data from the western
world. The subjects scored above the normal values in the five fields of development for each of the instruments. Their finding concluded that it was possible to apply these tools in the Nigerian Children particularly the psycho motor domain. The social development was difficult to adapt according to their finding.

Rademeyer and Jacklin (2013), studied South African children to evaluate the performance of black South African urban infants on the Bayley Scales of Infant Development III. The results of this study showed that SA (South Africa), scores were statistically significantly higher than the US norms. Clinically, however, the difference was found to be small when one considers the variability of development. It was therefore apparent that our decision to use BSID was based on previous results used with the African children. It was important to note that our research was interested in the cognitive development as opposed to social development.

Overall, most studies showed that exclusive breastfeeding during infancy may have beneficial effects on a child’s cognitive development. The association between exclusive breastfeeding and cognitive development in children in these studies was subject to bias towards confounding factors. This research used exclusive breastfeeding for at least six months as recommended by the World Health Organization, the gender of the child, and the maternal socioeconomic status as the most significant confounding factors affecting the relationship between breastfeeding and child cognitive development. It analysed the effect of exclusive breastfeeding on neurocognitive development during the child’s first year of life since existing literature showed that cognitive development difference could be observed in the first childhood between children who have been breastfed and those who are formula fed.

2.4 Summary
This chapter reviews literature on the effects of exclusive breastfeeding on the cognitive development of babies in the first 12 months of their life. A number of researches have been done on the subject matter but most of it have concentrated on the school going age all the way to 18 years. The breastfeeding and cognitive development literature has been rife with a lot of confounders. The available literature has failed to define the nature of the relationship between exclusive breastfeeding and certain maternal characteristics like the maternal IQ, socioeconomic status, educational level amongst others with regard to cognitive development. It has not been easy for research to establish whether the observed association is causal or consequential because exclusive breastfeeding is done by mother with the aforementioned characteristics. A study by Kramer et al. (2008), found that exclusive breastfeeding and breastfeeding for longer duration increased a child’s IQ. However, the association between breastfeeding and IQ increase would only be established by the time the child was six years old. Few of these studies have focused on the benefits that exclusive breastfeeding has on the neurocognitive development of children in their 1st year of life.

A few studies have dissociated breastfeeding with child’s development. According to a large prospective study done by Der et al. (2006), breastfeeding had no effect on a child’s intelligence. This study was faulted for considering only children who were breastfed and not exclusively breastfed. The study hence failed to investigate cognitive development in children who were exclusively breastfed. Although there are many confounders, there seem to be a consistent though small difference in cognitive development of children who are exclusively breastfed. This difference persists despite control of the confounding variables.
CHAPTER 3

RESEARCH METHODOLOGY

3.1 Introduction

The section describes the procedure and strategies that were used in conducting the study. These are the research design, location of study, target population, sampling and sampling techniques, research instruments, data collection and data analysis techniques.

3.2 Research Design

The study adopted a descriptive survey design where both qualitative and quantitative data were generated. Orodho (2009) defines a survey as a method of collecting information by interviewing or administering a questionnaire to a sample of individuals. The study used an ex post facto, design which is suitable for a study that investigates the effect of some treatment administered to the subjects as compared to the control group. However most of the data was collected from the mothers and children mobilized by community health workers.

3.3 Research site

This study was based in Kahawa West ward in Nairobi County. The three sites included Kamae, Kiwanja and Soweto slums which are situated in the same catchment area.

3.4 Population

The research population comprised mothers and babies clustered into two categories. The first group consisted of mothers of children who were exclusively breastfed for at least 6 months and the second were mothers with children who were not exclusively breastfed or formula fed. The age range was between 10 to 14 months. The mothers and their babies were from the catchment area of Kahawa west comprising the slums of Soweto, Kamae and Kiwanja.
The mothers were able to communicate in either English or Kiswahili as captured by their standard of education in the questionnaire.

3.5 Study Sample

The sample comprised 180 babies aged 10-14 months. Since the research was interested in the first year of life, this age range gave an average age of 12 months. This included 100 babies who were exclusively breastfed for at least six months and another 80 babies who were either formula fed or not exclusively breastfed. This gave us 90% response rate. The sample size was arrived at after considering the design and scope of the study. Data was generated while interviewing the mothers and also administering the Bailey’s screening test to their babies. A sample of 100 exclusively breastfed and 80 of those who were not exclusively breastfed was used. The participants were identified during the interview from the existing clusters as per the mother child booklets. The clusters were identified through interviewing of the mothers and also pre-existing information in the mother-child booklets in which this information was recorded. Whereas the initial intention was to use Kahawa Health center as the meeting point, the mobilization was done by the community health workers attached to Kahawa Health Center and the Soweto Social Hall was used instead. This was because it was convenient and avoided any clash with the other activities in the Health Center. The only private clinic which was used to identify the study participants was Ogwedhi Health Clinic. These children were assessed for their cognitive development at the commencement of research at between 10-14 months old. They were also assessed for any health or nutritional concerns using their health records. The mothers in both the experimental and control groups were recruited after considering variables like age, educational levels, and nutritional status across the two groups. To avoid contamination of the two groups, their recruitment was done on different days and the appointments staggered to avoid either groups being interviewed or assessed on the same day in the same social hall or clinic.
3.6 Measurement

We used the Bailey’s scales of infant development (BSID) to assess the babies’ cognitive development after the process of recruitment was over.

3.7 Sampling technique

We used purposive sampling method to obtain our sample population from the sampling frame. Purposive sampling is described as a random selection of sampling units within the segment of the population with the most information on the characteristic of interest (Bernard 2002, Lewis & Shephard, 2006). The sampling frame consisted of mothers who were breastfeeding children between the age ranges of 10 to 14 months. From this frame purposive sampling was done for those who exclusively breastfed their babies and those who did not or formula fed their babies. There were two groups of babies. The first group was babies who were exclusively breastfed for the first 6 months and the second cluster was for babies who were not exclusively breastfed or otherwise formula fed. This was ensured through the mother child booklets from the maternal child health clinics (MCH). Mothers were also interviewed orally to seek further clarification on the status on type of feeding they used. (The research was conducted in the Kamae, Kiwanja and Soweto slum in Nairobi area.) These areas were ideal because the mothers from here attended the aforementioned local clinics where exclusive breastfeeding was encouraged and mothers taught during routine clinic days to embrace exclusive breastfeeding.

Nonparametric bootstrap was proposed in estimating location parameters and the corresponding variances. An estimate of bias and a measure of variance of the point estimate are computed using the Monte Carlo method. In statistics bootstrapping is any test or metric that relies on random sampling. Bootstrapping allows assigning measures of accuracy defined in terms of bias, variance, confidence levels, prediction error or some other such measure to sample estimates (Ritter, 2010). This technique allows estimation of the sampling distribution.
of almost any statistic using random sampling methods. Non parametric tests also referred to as distribution free; do not make assumptions on the distribution of data values. The tests are usually based on the ranks of the values other than the values themselves. Monte Carlo method basically refers to a situation in which data is repeatedly created randomly in some way. The data is then acted upon in a specific manner and some results are collected. This strategy could be used to estimate some quantity, like in the bootstrap, but also to theoretically investigate some general characteristic of an estimator which is hard to derive analytically.

3.8 Research Instruments

Questionnaire

The research instrument was a questionnaire (with open ended and close ended questions). The questionnaire (Appendix 1) attached, which was administered to mothers in order to determine pattern of exclusive breastfeeding and formula feeding of the infants who were breastfed exclusively for six months and are between 10-14 months old. A similar cohort of non-exclusively breastfed babies were also assessed at the same age and time. The questionnaire inquired whether or not they breastfed and at what point they formula fed and non-breast milk liquids introduced.

Bayley’s Scale for Infant Development

The Bayley’s cognitive and motor development scale for infants (BSID) between 1-42 months was used to assess the babies’ cognition between 10 and 14 months. Consent was obtained from the participating mother and assent on behalf of their babies. BSID is within the acceptable range of Cronbach’s alpha. Cronbach's alpha is an index of reliability associated with the variation accounted for by the true score of the "underlying construct." Construct is the hypothetical variable that is being measured (Hatcher, 1994).
Alpha coefficient ranges in value from 0 to 1 and may be used to describe the reliability of factors extracted from dichotomous (that is, questions with two possible answers) and/or multi-point formatted questionnaires or scales (i.e., rating scale: 1 = poor, 5 = excellent). The higher the score, the more reliable the generated scale is. In statistics Cronbach's alpha is used as a lower bound estimate of the reliability of a psychometric test (Ritter, 2010).

In trying to ascertain the validity and reliability of BSID, (Rijlaarsdam and Verhulst, 2012) in a study sample of 3406 families and their children (median age = 3.1 months, range = 1.6–6.0), used exploratory factor analysis to identify latent constructs, Cronbach’s alpha was used as a measure of internal consistency, and convergent validity was evaluated against family sociodemographic characteristics. Inter-observer agreement was investigated in a sub-sample of the respondents (n = 124). The results supported good psychometric properties of the instrument based on: (a) exploratory factor analysis yielding three meaningful latent constructs, (b) Cronbach’s alphas ranging from $a = 0.66$ to $a = 0.90$, (c) inter-observer agreement ranging from $r = 0.75$ to $r = 0.91$, and (d) associations between the instrument and socio-demographic characteristics in the expected direction [e.g. Odds Ratio for low income = 15.24, 95% confidence interval]. It is therefore a valid and reliable tool to be used in this study.

3.9 Piloting

After designing the questionnaires, piloting of the questionnaires on the mothers was done to those who exclusively breastfed and those who did not or were formula fed. Using five clients at Ogwedhi Health Clinic, piloting helped establish whether questions measured what they were supposed to, checked whether the wording was clear, whether the questions provoked responses and whether the respondents interpreted all the questions in the same way.
3.9.1 Data analysis

After collection of questionnaires and the responses to the interview guides, the researcher read them through to ascertain their number and whether all the items responded. The instrument generated both quantitative and qualitative data. The quantitative data was analyzed using the descriptive statistics. That is, frequencies, means and standard deviation. To determine correlation, Pearson’s coefficient of correlation method was used.

The quantitative data analysis was done with the aid of SPSS version 20, a computer programme commonly used in educational and social sciences research. Cognitive assessment data was reported both quantitatively and qualitatively in line with the study objectives. The results were analyzed using frequency distribution tables. The BSID scores were analyzed using the BSID manual during the assessment. The abridged manual which covers the cognitive domain of children 1-42 months of age was used. Although some of the research questions were addressed during the scoring of Bayley’s screening test, further analysis was done qualitatively to provide in depth analysis of the findings.

3.9.2 Summary.

This chapter titled research methodology described the procedures and strategies used while conducting the studies. The study used the qualitative and quantitative research method where data collection was done through interviewing and assessment of the children using Bayley,s Scale for infant development and scores recorded. The expost facto design was used where 180 children in the age range of 10-14 months,100 of which were exclusively breastfed for at least six months and the remaining 80 who were either formulae fed or had mixed feeding involving breastfeeding and other foodstuffs were assessed for cognitive development. The
research site was in the Kahawa west Ward in Nairobi County specifically Kamae, Kiwanja and Soweto slums.

The research instruments for the study comprised a questionnaire for mothers and BSID tool for children in the age range of 10-14 months. Only section B and C of the tool was used because of the age specification of children to be assessed for cognitive development. Data analysis was done quantitively using SPSS version 20. Qualitative analysis was done alongside the former where it was necessary so as to give in-depth understanding of the findings.

CHAPTER 4

RESULTS AND FINDINGS

4.1 Introduction

This chapter presents an analysis of data and the presentation of the findings with regards to the responses given from the Bayley’s screening test. The Bayley’s cognitive and motor development scale for infants (BSID) was used to assess the cognition of babies between 10 and 14 months. Consent to participate was obtained from the participating mothers.
4.2 Background Information of the Mothers

Two groups of mothers were targeted: one group was mothers of children who were exclusively breastfed for at least 6 months and the second was mothers with children who were not exclusively breastfed (i.e. the mother introduced the children to formula food before 6 months). The mothers and their babies were from a catchment area in Kahawa West comprising of Soweto, Kamae and Kiwanja slums. This is a slum area and the mothers were generally from the low socio-economic status. The mothers were able to communicate in either English or Kiswahili as captured by their standard of education in the questionnaire. A total of 180 responses were received representing a 90% response rate.

4.2.1 Age of the Respondents

Table 4.1 shows that about a third (29.4%) of the respondents were below 30 years, a further 70% were between 30-50 years.

<table>
<thead>
<tr>
<th>Age of the Respondents</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Below 30 Years</td>
<td>53</td>
<td>29.4</td>
</tr>
<tr>
<td>30-50 Years</td>
<td>127</td>
<td>70.6</td>
</tr>
<tr>
<td>Total</td>
<td>180</td>
<td>100</td>
</tr>
</tbody>
</table>

4.2.2 Level of Education
When participants were asked about their highest education level, 4% of the respondents had attained post-secondary school education and above (Table 4.2). A further 10% had attained primary level education and a vast majority (86%) had only secondary school level education.

Table 4.2: Level of Education

<table>
<thead>
<tr>
<th>Level of Education</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary</td>
<td>18</td>
<td>10</td>
</tr>
<tr>
<td>Secondary</td>
<td>155</td>
<td>86</td>
</tr>
<tr>
<td>College and above.</td>
<td>7</td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
<td>180</td>
<td>100</td>
</tr>
</tbody>
</table>

4.2.3 Number of Children

The participants were further asked about the number of children each had. The results have been present on Table 4.3. Some 45% of the respondents had between 1-2 children, 40% had between 2-3 children while 15% of the respondents had 5-6 children.

Table 4.3: Number of Children

<table>
<thead>
<tr>
<th>No. of children</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-2</td>
<td>81</td>
<td>45</td>
</tr>
<tr>
<td>3-4</td>
<td>72</td>
<td>40</td>
</tr>
<tr>
<td>5-6</td>
<td>27</td>
<td>15</td>
</tr>
<tr>
<td>Total</td>
<td>180</td>
<td>100</td>
</tr>
</tbody>
</table>
4.2.4 Breastfeeding Mothers

The participants were asked if they ever breastfed their babies and the results have been presented below. All the respondents’ had breastfed their children. This is an indication that all women involved in the study did breastfeed their children.

4.2.5 Age when Mother Stopped Breastfeeding

At the time of the study, some of the mothers had stopped breastfeeding. Table 4.4 shows that 5% of the respondents stopped breastfeeding their children between 0-6 months while 12% of the respondents stopped breastfeeding their children between 6-12 months as 86% stopped breastfeeding their children above 1 year. This could suggest that most women in Kenya do breastfeed their children for more than 1 year.

<table>
<thead>
<tr>
<th>Age when Mother Stopped Breastfeeding</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-6 Months</td>
<td>5</td>
<td>2.8</td>
</tr>
<tr>
<td>6-12 Months</td>
<td>21</td>
<td>11.7</td>
</tr>
<tr>
<td>Above 1 Year</td>
<td>154</td>
<td>85.6</td>
</tr>
<tr>
<td>Total</td>
<td>180</td>
<td>100</td>
</tr>
</tbody>
</table>

4.2.6 Age of the Baby when Introducing Baby Formula or natural foods.

Table 4.5 shows that 2.8% of the respondents introduced formula food to their children between 0-6 months while 11.7% of the respondents introduced formula food between 6-12 months and 85.6% introduced formula food or natural food above 1 year. This could suggest
that most women in Kenya do introduce formula food or mixed feeding when their babies are more than 12 months old.

Table 4.5: Age of the Baby when Introducing Baby Formula/other foods

<table>
<thead>
<tr>
<th>Age of the Baby when Introducing Baby Formula</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-6 Months</td>
<td>5</td>
<td>2.8</td>
</tr>
<tr>
<td>6-12 Months</td>
<td>21</td>
<td>11.7</td>
</tr>
<tr>
<td>Above 1 Year</td>
<td>154</td>
<td>85.6</td>
</tr>
<tr>
<td>Total</td>
<td>180</td>
<td>100</td>
</tr>
</tbody>
</table>

4.2.7 Currently Feeding the Baby with Formula

The study sought to determine which mothers were exclusively breast feeding their children. Table 4.6 shows that 44.4% of the respondents still formula feed or use mixed feeding approaches for their children while 55.6% of the respondents were breast feeding exclusively.

Table 4.6: Currently Feeding the Baby with Formula

<table>
<thead>
<tr>
<th>Currently Feeding the Baby with Formula</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>80</td>
<td>44.4</td>
</tr>
<tr>
<td>Yes</td>
<td>100</td>
<td>55.6</td>
</tr>
<tr>
<td>Total</td>
<td>180</td>
<td>100</td>
</tr>
</tbody>
</table>

4.2.8 Neurocognitive outcomes of children

Children’s cognitive functioning was measured using the Bayley’s Scale. The mean cognitive functioning score for children between 7 and 12 months was $M= 2.59$ and standard deviation was $SD= 0.56$, while the mean cognitive score for children between 13 and 24 months was $M=$
4.00 and SD= 0.88. These mean scores of M= 2.59 for the children aged 7-12 months and M= 4.0 for the ones who are between 13-14 months are above the average of M= 1.5 (for 7-12 months) and M= 2.5 (for 13-14 months) suggesting absence of mental retardation according to BSID classification. BSID has three risk categories in its scores. Children scoring below average are at risk of retardation unless appropriate interventions are put in place; average scores are considered as emerging and above average are considered as competent.

4.3 Effect of exclusive breastfeeding on neurocognitive development during the 1st year of life

The first objective of the study was to assess the effect of exclusive breastfeeding on neurocognitive development during the 1st year of life. The mean cognitive scores for children that were exclusively breastfed during the 1st year of life were (M= 1.444, SD= 0.5) compared to those who were not exclusively breastfed (M=1.556, SD=0.5). An analysis of variance (ANOVA) comparing these groups found that there was no significant difference in the cognitive functioning of the exclusively breastfed \[F (1, 179)= 0.088, p= 0.767\].

4.4 Influence of socio-economic status on Breastfeeding and Cognitive Development

The second objective of the study was to determine whether socio-economic status is related to (a) breastfeeding and (b) cognitive development of a child. (However, the mothers of the children in the sample were from the same social economic status). As a result of this, it was not possible to measure how this influenced the breastfeeding and also cognitive development for lack of comparison group. as a positive relationship for both exclusively breastfed and formula or mixed feeding.
4.5 Gender Difference and Cognitive Development

The third objective of the study was to assess if there is any gender difference in cognitive development during the first year of life among the children. The analysis of variance (ANOVA) done comparing the two groups (male and female), in the age categories (for 7-12 months) and [for 13-14 months] was $F[(1,180)=0.147], p=0.997$. This means that the results did not reveal any significant differences in the levels of cognitive functioning in either male or female. (Refer Appendix 8 on pp.76 for detailed analysis of individual scores).

4.6 Chapter Summary

This chapter presented an analysis of the findings with regard to the responses given from the Bayley screening test. The Bailey’s cognitive and motor development scale for infants (BSID) between 1-42 months was used to assess the babies’ cognition between 10 and 14 months. It has also provided the biodata from the mother and the nature of breastfeeding which they adopted for their children. Consent was obtained from the participating mothers. BSID was within the acceptable range of Cronbach’s alpha. The next chapter presents a summary of findings, discussions, conclusions and recommendations.
CHAPTER FIVE

DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS FOR FURTHER RESEARCH

5.1 Introduction

This chapter contains four main sections that are listed as follows: summary of the findings followed by discussions of the study, conclusions based on the findings and finally recommendations for further studies. The four areas of Chapter Five are all aligned with the three research objectives outlined in the first chapter.

5.2 Summary of the findings

The study revealed that the mean score for cognitive functioning of exclusively breastfed babies was not significant during the 1st year of life as compared to those who were breastfed and formula fed. (1.444 vs. 1.556). The study further failed to establish whether there was any relationship between socioeconomic status and breastfeeding and also cognitive development because the mothers were from the same socioeconomic status, which did not make it possible to compare the outcomes. Finally in assessing if there was any gender difference in cognitive development during the first year of life among the children the results did not reveal any significant difference in the levels of cognitive functioning in either male or female children.

5.3 Discussion

The first objective of the study was to assess the effect of exclusive breastfeeding on neurocognitive development during the 1st year of life. The study revealed that the mean scores for cognitive functioning for exclusively breastfed was not significant compared to the
formula fed or those who practiced mixed feeding during the 1st year of life (1.444 vs. 1.556),

The findings disagree with Wieslaw et al. (2011), whose analysis on cognitive development in Poland found out that there was a relationship between exclusive breastfeeding in infancy and long term cognitive benefit, the study findings revealed that exclusive breastfeeding in infancy for 6 months or longer was associated with an average 3.8 point higher gain in IQ score during the 7th year follow-up. The study findings failed to confirm that exclusive breastfeeding in infancy enhances cognitive ability of the children. Possibility of confounding factors in this research could be attributed to the difficulty of ascertaining the extent of breastfeeding which took place amongst the formula fed and other types of feeding. It is also possible that in the first year of life measuring cognitive development requires more precise methods of detecting changes.

The study also disagreed with a meta-analysis by Angelsen (2001) which concluded that breast feeding is associated with significantly higher scores for cognitive development than was formula feeding, after adjustment for confounding factors. This meta-analysis included mainly studies that compared children who had been breast fed with children who were exclusively formula fed (Angelsen et al., 2001). However, these studies have not gone without criticisms. Their critics have cited a number of laws. A significant one being, majority of these studies were done in developed countries. What about the women on the other end of the spectrum, who live in poorer countries and come from rural areas, where achieving education may be a challenge. For this paper, the focus was how exclusive breastfeeding impact on the cognitive development of infants who were only 1 year old, and will be using mothers that live in Kahawa West Ward.

Finally, this study has disagreed with many studies that have been done to show the impact of breastfeeding on child cognitive development. One of these studies was done by Oddy & Kendall,( 2003). Previous studies on the impacts of breastfeeding focused on
neurocognitive development for children born with low birth-weight (Vohr, 2006). A study by Kremer et al. (2008), found that exclusive breastfeeding and breastfeeding for a longer duration increased a child’s IQ. However, the association between breastfeeding and IQ increase would only be established by the time the child was six years old. Few of these studies have focused on the benefits that exclusive breastfeeding has on the neurocognitive development of children in their 1st year of life. It may appear like real cognitive outcomes can only be determined at the school going age.

The second objective of the study was to determine whether socio-economic status has any influence on (a) Breastfeeding and (b) cognitive development of a child. The study could not ascertain the relationship between socioeconomic status (SES) and cognitive development, and SES and breastfeeding because all the mothers in the study were from the same socioeconomic (lower socioeconomic status). This made it impossible to compare the results.

Finally the third objective of the study was to assess if there is any gender difference in cognitive development during the first year of life among the children. Using ANOVA to analyze the scores between the two groups, it showed that there was no significant difference in the cognitive functioning of the children in terms of their gender. The study failed to find any association between exclusive breastfeeding and cognitive development as had been revealed by many clinical studies which showed that breastfed children score high on cognitive function tests than those fed on infant formula or mixed feeding. However, controversy is evident especially concerning whether the cognitive development benefits result from breastfeeding alone. The effect of confounding factors such as maternal education, IQ, and socioeconomic status remain the major criticism of breastfeeding studies. Many studies also suffer from traditional design, inadequate psychometric measurements, limited generalizability and small sample. These studies also disregard the different effects of exclusive breastfeeding and the combined breast-and-bottle feeding is practiced. These faults threaten the reliability of
the results. A study by Rademeyer and Jacklyn (2013) with South African children to evaluate the performance of black South African urban infants on the Bayley Scales of Infant Development III, showed that SA (South Africa) scores were statistically, significantly higher than the US norms. Clinically, however, the difference was found to be small when the variability of development was considered. We therefore used BSID based on previous results with the African children. It is important to note that our research is interested in the cognitive development as opposed to social development.

5.4 Summary, Recommendation and Conclusions

This chapter is a summary of all the processes of this research from the research questions, the objectives, methodology, data collection and analysis and the outcome of the research. It also contains the discussion of the research findings according to the research objectives. Towards the end of this chapter recommendations from the findings and further research have been explained and finally the conclusions from the findings are also reported.

The first objective of the study was to assess the effect of exclusive breastfeeding on neurocognitive development during the 1st year of life. The study concludes that the cognitive functioning scores for the exclusively breastfed babies were not significant during the 1st year of life as compared to those who were formula fed. The study further concludes that the relationship between socio-economic status and breastfeeding, as well as cognitive development was not possible to measure as a result of the mothers coming the same socioeconomic status leaving no room for comparison. The study also concludes that there was no gender difference in cognitive development during the first year of life among the children. Although the cognitive development of girls appeared to be higher than the boys, further analysis using ANOVA found that in fact, the difference was insignificant. It remains controversial due to the several confounding variables. Again no studies have successfully
isolated the gender factor either male or female to conclusively confirm the extent of the influence.

This study failed to concur with most studies which show that exclusive breastfeeding during infancy may have beneficial effects on a child’s cognitive development. The association between exclusive breastfeeding and cognitive development in children in these studies is subject to bias towards confounding factors. This research used exclusive breastfeeding for at least six months as recommended by the World Health Organization, the gender of the child, and the maternal socioeconomic status as the most significant confounding factors affecting the relationship between breastfeeding and child cognitive development. It analyzed the effect of exclusive breastfeeding on neurocognitive development during the child’s first year of life since existing literature shows that cognitive development difference may be observed in the early childhood between children who have been breastfed and those who are formula fed.

5.5 Recommendations for further studies

The study acknowledges that indeed a cross-sectional study design, which simultaneously evaluates cause and effect, is limited for not making it possible to evaluate whether the level of child’s cognitive development derives from the stimulation of the variables outlined previously. In this regard therefore longitudinal designs are recommended for further investigating causality relations on the matter hereunder examination. It has outlined the need of hierarchical approaches comprising a larger number of predictive variables, both distal and proximal, aiming at clarifying the effect of the family socio economic status, maternal IQ and education on child’s cognitive development.

Further recommendations for study should try to work with children from different socioeconomic status. This may shed light on the effects of socioecomic status on the cognitive development of the children. In addition to the aforementioned, I also recommend the use of a
different tool adapted for local use as opposed to Bayley’s screening test, which although has been successfully used in Nigeria and Malawi, no purposeful adaptation has been done make it fully compliant to the local needs.

5.6 Chapter Summary

The chapter summarizes the findings of the research and discusses the outcomes in relation to the objectives of the research. It also endeavors to compare the outcomes with what other researchers have done in the area of exclusive breastfeeding and cognitive development. The first objective of the study was to find out whether exclusive breastfeeding could influence cognitive development in the first year of life. No significant difference was found between the babies who were exclusively breastfed and those who were formula fed. The second objective was whether the socioeconomic status had any influence on the cognitive development of the babies. This objective was not possible to assess because all the mothers in the research belonged to same socioeconomic status and therefore comparison could not be done. The third and last objective intended to assess whether gender could influence cognitive development in the first year of life. The research did not find any significant difference in the cognitive functioning between the female and male children.

The study recommends a longitudinal method of research as an option for future attempts to understand the relationship between exclusive breast feeding and cognitive development. This will most probably address the cause and effect between the variables being investigated. Other recommendations from the research findings include the use of different tool for assessing the children or alternatively adapting the Bayley’s scale to the local needs of the children.

The study then concludes that gender may not be a factor in terms of cognitive development in the first year of life and also that the exclusive breastfeeding though
recommended by WHO, does not seem to make a difference in the children’s cognitive functioning. It was however noted from other researchers that this difference is apparent at the school-going age. This period gives a lot of room for the interplay of other variables and hence makes it even more controversial to attach any positive development to only one variable.
REFERENCES


Division of Reproductive Health; National Center for Chronic Disease Prevention and Health Promotion, 2016.


APPENDICES

APPENDIX 1: QUESTIONNAIRE FOR MOTHERS.
PLEASE FILL OUT THIS QUESTIONNAIRE AND TICK WHERE APPROPRIATE:

1. What age group (years?) do you belong to? (PLEASE TICK)
   - Below 30
   - 30-50
   - 50 and above

2. What is your level of education?
   I. Primary level
   II. Secondary level
   III. Tertiary level
   Any other, please specify--

3. What is your source of income?

4. How many children do you have?

5. Have you ever breastfed your baby?  YES NO

6. How old was your baby when you stopped breastfeeding? --

7. Are you still breastfeeding your baby? YES NO

8. How old is the baby?

9. How old was your baby when you introduced formula fed or other food? --

10. Are you still feeding your baby formula feeds or any other? YES ☐
11. Have you been treated for any serious illness during pregnancy and after giving birth?

12. If so, what was the illness?
28th January 2017,

USIU-A/IRB/17/S02

Ambrose Ondiek Ngere,
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IRB-RESEARCH APPROVAL.

The USIU-A IRB has reviewed and granted ethical approval for the research proposal titled ‘Effects of exclusive breastfeeding on cognitive development during early childhood in Kahawa West Ward, Nairobi, Kenya.’ The approval is for six months from the date of IRB. Please submit a completed copy of the study to the IRB office, soft copy is acceptable.

You are advised to follow the approved methodology and report to the IRB any serious, unexpected and related adverse events and potential unanticipated problems involving risks to subjects or others.

Should you or study participants have any queries regarding IRB’s consideration of this project, please contact irb@usiuc.ac.ke.

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