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Exclusive breastfeeding and intellectual functions of pre-school children in rivers state, Nigeria

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Abstract
This paper investigated the influence of exclusive breastfeeding on intellectual functions of pre-school children in Rivers State, to recognize symbols, perform mathematical skills and arrange building blocks, as well as to fix missing parts of a puzzle. The ex-post facto design was employed for the study. Population of the study was 7,414 nursery three children found in 572 public early childhood care development centres in Rivers State. The sample size for the study was 741 children (534 non-exclusively breastfed and 207 exclusively breastfed), representing about 10% of the target population. Simple random sampling technique was used to obtain the sample size. A 15 items test for intellectual functions in nursery three school children (TIFNTSC) for data collection was developed by the researcher. Two experts validated the instrument for face and content adequacy. The instrument was scored based on the number of mark or marks awarded to each item of the research questions. Three research questions were posed and answered, using mean and standard deviation, while the null hypotheses were tested using independent t-test statistics. The results of the findings of the study showed that exclusive breastfeeding has significant influence on intellectual functions of pre-school children in Rivers State. The findings of the study further revealed that exclusive breastfeeding has a good number of benefits to the child, the mother, the family and the government. Based on these findings, recommendations were made, among which were that the government should encourage mothers through officials of hospital management board, clinics and traditional birth attendants to practice exclusive breastfeeding; and that school counsellors should intensify their counselling to parents on the benefits of exclusive breastfeeding. This will help reduce infant mortality rate, dehydration, enhance management of diarrhea and promotion of recovery; as well as enhance children's intellectual functions.

Keywords: exclusive breastfeeding, intellectual functions, pre-school children

Introduction

There has been no successful human endeavour without the application of intellectual function. The mathematical operations and technological advancement widely enjoyed today are products of exhibition of intellectual functions put together and formulated by some individuals. Intellectual functions as applied to this study refer to the ability of the individual to process information, reason, remember and proffer solution to any given problem. Intellectual functions can also be said to be the ability of the individual to recognize symbols, perform mathematical skills, arrange building blocks and fix parts of missing puzzles. Intellectual functions also include verbal and spatial working memory, attention, taste, verbal knowledge, motor speed and visuospatial ability.

From the beginning of human history, babies were breastfed. A woman who was either unable or unwilling to breastfeed her baby usually adopted a surrogate mother, a wet nurse, to do it. At first, it was the prerogative of the upper-class women who were too busy to breastfeed because of their work schedule. The custom of wet-nursing spread by the Middle Ages to the working class in cities and villages, and persisted in some places until the early 20th century (Papalia, Olds & Feldman, 2006) [13]. This marvelous food (breast milk) has been considered crucial to the child upbringing (Aguay and Clark, as cited in Seidu, 2013) [15].

Breastfeeding is the act of feeding the baby with the mother's milk. Breastfeeding could be partial or exclusive. Partial breastfeeding refers to the act of breastfeeding the baby alongside complementary foods such as water and artificial baby milk. Exclusive breastfeeding then refers to the act of breastfeeding the infant without addition of water and other liquid or solid food for the first four to six months after birth. Exclusive breastfeeding gives infants a definite advantage in terms of nutrition, attachment and bonding. Human milk contains high level of Docosa Hexaenoic Acid (DHA) and other bioactive components essential to the brain development of infants. DHA is present in human milk and absent in cow's milk and engineered infant formula. Human milk is species-specific and all substitute feeding preparations differ markedly from it; making it (human milk) uniquely superior to infant feeding (Quinn, O'Callaghan, Williams, Najman, Anderson & Bor as cited in Amadi-Ali, 2015) [2].

The correlation between exclusive breastfeeding and intellectual functions has been observed in many studies as postulated Maculloh (2007). Human milk-fed premature infants receive significant benefits with respect to host protection and improved developmental outcomes compared with formula-fed premature infants (Burby, 2005) [5]. Burby (2005) [5] asserted that exclusive breastfeeding is important in the management of diarrhea; prevention of dehydration; promotion of recovery; beneficial to the psychological; physical; social and intellectual development of the infant and the mother.

Geoff, Batty and Deary (2006) [9] carried out a prospective study on the effect of breastfeeding on intelligence in

children in New Zealand. Findings of their study revealed that most of the association between breastfeeding and cognitive development was the result of maternal intelligence. Hence the study concluded that there is a stronger link between maternal intelligence which is transferred to the child through breastfeeding and the child's I.Q.

Quinn, et al as cited in Amadi-Ali (2015) [2] who carried out a cohort study on effect of breastfeeding on child development at 5 years in the United States of America (USA) found that children who were exclusively breastfed for up to 3 months scored an average of 4-5 points higher on all psychometric tests when compared to those infants who were not breastfed exclusively. The findings of the study also confirmed that children who were fed a mixture of formula and breast milk achieved lower total intelligence quotient (IQ) scores than those who were fed breast milk exclusively.

The World Health Organization (WHO, 2012) [18] reported that of the 6.9 million under five children who died globally in 2011, an estimated one million lives could have been saved by simple and accessible practice of exclusive breastfeeding. Breastfeeding has been very critical; not only to the physiology, growth and overall well-being of neonates; but also for the physical and health of mothers (Stuart-Macadam & Dettwyler as cited in Seidu, 2013). Indeed, scarcely does a society exist without some form of infant breastfeeding; for it is one of the practices among human societies that transcend the boundaries of time and place. Breastfeeding has been a method of feeding to which infants have not only adapted but lived on for most of human existence on earth. It was also in the curse of several centuries, significantly practiced, respected, and the primary attractor of many artistic works such as paintings, drawings and sculptures (Tonz, 2000; Sellen, 2009) [16].

Since the 1990's, there has been renewed vigour in advocacy for optimal breastfeeding of infants, by experts and feminist groups (law, 2000; Galtry, 2003; Smith, 2004) [16]. The advocacy, which was largely prompted by decline in the levels of infant breastfeeding owing to the aggressive promotion of mothers' milk as the ideal means of feeding babies, culminated in the formal launching of the Baby Friendly Hospital Initiative (BFHI) through a collaboration of the World Health Organization (WHO) and United Nations International Children's Emergency Fund (UNICEF). The initiative, which has been adopted by 160 countries including Nigeria, seeks to promote, support and protect the practice of breastfeeding exclusively for the first 6 (six) months of a child's life, and breastfeeding alongside supplementary foods for up to two years. The premise of the advocacy and the resulting institutional response, is the over arching discourse of the universal beneficence of breastfeeding for babies' mothers and the society at large.

Breast milk without doubt, contains the nutrients a baby needs in the right proportions, and they are a form that is very easily absorbed. Breast milk is easily digested; and it is less likely to cause stomach upsets or diarrhea; it helps protect the baby from infections because antibodies are passed into the milk; and the baby will be less vulnerable to coughs and colds than bottle-fed babies.

Exclusive breastfeeding has been recognized as an important public health tool for the primary prevention of child mortality. In resource limited settings where poor and sub-optimal breastfeeding practices frequently result to child malnutrition, which is a major cause of more than half of all deaths, exclusive breastfeeding is regarded as imperative for infants' survival (Sokol, Wieslaw, Perera, Jankowski, Butscher, Mronz, Flak, Kaim, Lisowska-Miszezyk, Skarupa & Sowa as cited in Amadi-Ali, 2015) [2].

Furthermore, Sokol et al as cited in Amadi-Ali (2015) [2] studied the effect of exclusive breastfeeding on the development of children's cognitive function in the Krakov prospective birth cohort in Poland. The study came up with the findings that children who were exclusively breastfed for 3 months had an Intelligence Quotient (IQ) of 2.1 points higher than those who were not exclusively breastfed. Those exclusively breastfed for more than 6 months were found to have an IQ of 3.8 points higher.

Similarly, Avshalom, Williams, Kim-Cohen, Craig, Milne, Poulton, Schalkwyk, Taylor, Wets & Moffitt (2007) who carried out a study on moderation of breastfeeding effects in the IQ by genetic variation in fatty acid metabolism in Australia discovered that infants who were exclusively breastfed have higher levels of both to support optimal growth and development for approximately the first six months of life; and provides continuing protection against diarrhea and respiratory tract infections.

Department of Health (2003) [8] informs that babies fed with non-human milk were even more likely to fall ill and die. In spite of the aforementioned significance of exclusive breastfeeding, it seems that some people in Rivers State are still lukewarm to whole-heartedly embrace the practice; hence, the conduct of this study.

Exclusive breastfeeding and pre-school children's intellectual functions to recognize symbols

A study was carried out by Cunha and Heckman (2010) [7] on the influence of exclusive breastfeeding on the cognitive development of pre-school children. The findings of their study revealed that children who were exclusively breastfed for 6 weeks out-performed their non-exclusively breastfed for 6 weeks counterparts in recognition of symbols, reading, writing, mathematical skills and oral response at age 5. Almudena (2012) [1] confirms that exclusively breastfed children develop superiority in recognition of symbols and communication skills over non-exclusively breastfed children.

Exclusive breastfeeding and intellectual functions of pre-school children to perform mathematical skills

Butte, Lopez-Alarcon and Garza (2002) [6] postulate that exclusive breastfeeding is strongly related to better performance of children in mathematics at all ages from the time of school entry to age 14. It was also remarked that the cognitive outcomes seem to depend on the duration of breastfeeding; emphasizing that children breastfed exclusively for 4-6 months or more do better than children breastfed exclusively for less than four months.

Rogan and Gladen (2003) share a contrary opinion concerning exclusive breastfeeding and children's intelligence quotient scores in Mathematics and English. They contend that the difference in intelligence quotient scores of exclusively breastfed children and their counterparts were marginally significant for English and not for Mathematics. In their opinion, there is no significant difference between the intellectual functions of exclusively breastfed and non-exclusively breastfed children in mathematics.

Exclusive breastfeeding and pre-school children's intellectual functions to arrange building blocks and fix in missing parts of puzzles

It is believed by Uauy and de Andreca (2005) that exclusive breastfeeding is positively associated with intelligence quotient scores; hence, exclusively breastfed children out-score non-exclusively breastfed children's intellectual functions in fixing of missing parts of puzzles and in arranging of building blocks. Although, Nsirim (a pediatrician, personal communication, April, 2014) who also believes that exclusive breastfeeding is a strong contributing factor to children's intellectual ability to arrange and fix parts of objects; recommends that children's intelligence should not be dependent upon exclusive breastfeeding. Nsirim further added that children among other things need adults' encouragements, assistance, reinforcement and motivation for the development of their potentials. This recommendation conforms with Vygotsky socio-cognitive development theory (1896-1934) as cited in Bee & Boyd (2007), which suggests in his zone of proximal development (ZPD) that the assistance of an adult or an older child or sibling could help a less knowledged child become more skilled in even ever harder tasks. This is otherwise known as scaffolding.

Statement of the Problem

It was reported by Department of Health (2003) that estimates of over one million (1m) children die each year from diarrhea, respiratory diseases and other infections because they are not adequately breastfed. Besides, many more children suffer from unnecessary illness that they would not have contracted if they were exclusively breastfed. The World Health Organization (WHO) in conjunction with the United Nations Children Emergency Fund (UNICEF), have therefore, recommended exclusive breastfeeding from birth to the first 6 months of life, and sustained breastfeeding together with adequate complementary foods up to two years of age and beyond (WHO & UNICEF, 2012).

In Nigeria however, and especially in Rivers State, the rate of bottle-feeding is as high as 30%. Some mothers still refuse to embrace the practice of exclusive breastfeeding because they do not want to lose the shape of their breasts and go out of fashion. Others refuse to practice exclusive breastfeeding because of their businesses and jobs; while others refuse to embrace it because of academic and career pursuits. This then means that the recommendations of WHO and UNICEF, Department of Health and Baby Friendly Hospitals Initiative concerning exclusive breastfeeding are neglected. It may not be out of place to note that even though a good number of these mothers are literates and have knowledge of exclusive breastfeeding, they are not willing to accept baby-friendly initiatives. Predicted on this fact, it becomes pertinent to determine how exclusive breastfeeding could influence the intellectual functions of pre-school children in Rivers State; hence, this study.

Purpose of the Study

The major purpose of this study is to ascertain the influence of exclusive breastfeeding on intellectual functions of pre-school children in Rivers State of Nigeria. Specifically, the objectives of the study are to:

1. Determine if pre-school children who were exclusively breastfed and those who were not, differ in their intellectual functions to recognize symbols.
2. Ascertain if pre-school children who were exclusively breastfed and those who were not, differ in their intellectual functions to perform mathematical skills of counting, addition and subtraction.
3. Investigate if pre-school children who were exclusively breastfed and those who were not, differ in their intellectual functions to arrange building blocks and fixing in missing parts of puzzles.

Research Questions

The following research questions are posed to guide the study:

1. How do pre-school children who were exclusively breastfed differ from those who were not, in their intellectual functions to recognize symbols?
2. To what extent do pre-school children who were exclusively breastfed differ from those who were not, in their intellectual functions to perform mathematical skills?
3. To what extent do pre-school children who were exclusively breastfed and those who were not, differ in their intellectual functions to arrange building blocks and fixing missing parts of puzzles?

Hypotheses

The following null hypotheses are tested to further guide the study at 0.05 level of significance.

$H0_1$: There is no significant difference in the mean performance of pre-school children who were exclusively breastfed and those who were not, in their intellectual functions to recognize symbols.

$H0_2$: There is no significant difference in the mean performance of pre-school children who were exclusively breastfed and those who were not, in their intellectual functions to perform mathematical skills.

$H0_3$: There is no significant difference in the mean performance of pre-school children who were exclusively breastfed and those who were not, in their intellectual functions to arrange building blocks and fix in missing parts of puzzles.

Methodology

Research Design

This study adopted the ex-post facto design. The design was deemed appropriate for the study because the intellectual functions of nursery three children who were exclusively breastfed and those who were not, was compared. Moreso, the ex-post facto design was employed because the variables have already occurred and cannot be manipulated.

Population of the Study

7,414 nursery three children found in 572 public early childhood care development education centres constituted the target population (Rivers State Universal Basic Education Board, 2017/2018).

Sample and sampling technique

741 nursery three children representing about 10% of the total population made up the sample size for the study. The 741 nursery three children were found in 57 centres. Simple random sampling technique with balloting by picking 'yes' or 'no' was employed in drawing the sample size. Those

that picked 'yes' were selected, while those that picked 'no' were dropped.

The sampling was done after eliciting responses on the mode of the children's breastfeeding from their parents. The parents of the children were contacted through a checklist that was sent to them through their children. Nursery three children were used because at this level they are naïve, can read, write and are dependably truthful. Moreover, five years was assumed not to be a long period for parents to forget the mode of their children's breastfeeding. Those breastfed for 4 to 6 months without liquid or solid foods other than breast milk were grouped as exclusively breastfed; while those breastfed for less than 4 months alongside complementary foods were grouped as nonexclusively breastfed. Those fed with only cow milk and complementary foods were not considered during the sampling. Gender was not also considered during the sampling however, there were 367 males and 375 females. Both males and females were given equal chance of being selected.

Instrument for Data Collection

Instrument for data collection is the researcher-developed 15 test items titled: "Test for Intellectual Functions in Nursery Three Children (TIFNTC)" that was used to test the extent exclusive breastfeeding has influence on the intellectual functions of nursery school children in recognition of symbols; mathematical skills and fixing of building blocks and missing parts of puzzles. This was adopted from the Stanford – Binet's intellectual scale tests modeled 1916, and illustrated by Berk (2007 The instrument was divided into two sections. Section A dealt with the demographic data of the child; while section B dealt with the 15 items test. Items 1-5 represented tests for recognition of symbols, used to answer research question one; items 6-10 represented tests for performing mathematical skills, used to answer research question two; while items 11-15 represented tests for arranging of building blocks and fixing of puzzles, used to answer research question three. The instrument was scored pupil by pupil and item by item

Validation of the Instrument

Copies of the instrument were given to experts in early childhood and primary education for face and content validity. Their corrections and comments were used to improve the final version of the instrument.

Reliability of the Instrument

To ascertain the reliability of the instrument, a test re-test exercise was carried out in Imo State, using 30 respondents. Pearson Product Moment Correlation (PPMC) was used to analyze the data that were generated to determine the reliability coefficient (r) which yielded an index of 0.72. Based on this result, the instrument was considered reliable

Administration of the Instrument for the study.

The instrument was administered to nursery three children who were exclusively breastfed and non-exclusively breastfed; with the help of trained research assistants. Instructions on how to respond to the instrument were read out to the children; while the children responded to the instrument by answering the test questions. The checklist given to the children's parents were retrieved within three days; while the test items administered to the children were retrieved on the spot to ensure no attrition. This made it possible for one hundred percent of retrieval of the test instrument.

Method of Data Analysis

Mean ($\bar{x}$) and Standard Deviation (SD) were used to answer the research questions; whereas independent t-test was employed for the statistical analysis of the null hypotheses at 0.05 level of significance.

Data Analysis

Hypothesis 1

There is no significant difference in the mean performance of pre-school children (nursery three) who were exclusively breastfed and those who were not; in their intellectual functions to recognize symbols.

Table 1: t-test analysis of the difference in the mean performance of nursery three children who were exclusively breastfed and those who werenot in their intellectual function store cognize symbols

Variables	N	$\bar{x}$	SD	df	t-cal	t-crit	Remark
Exclusively breastfed	207	3.74	0.04	740	2.01	1.96	Significant
non-exclusively breastfed	534	2.56	0.01				

N = 741 *significant P < .05, d f = 740

The data in table 1 above shows that the table calculated value 2.01 is greater than the critical value of 1.96. This implies that there is significant difference in the mean performance of exclusively breastfed children and non-exclusively breastfed in their intellectual functions to recognize symbols; hence the nullhypothesis is rejected.

Hypothesis 2

There is no significant difference in the mean performance of nursery three children who were exclusively breastfed and those who were not; in their intellectual functions to perform mathematical skills.

Table 2: t-test analysis of the difference in the mean performance of pre-school children who were exclusively breastfed and those who were no; in their functions perform mathe matical skills

Variables	N	$\bar{x}$	SD	df	t-cal	t-crit	Remark
Exclusively breastfed	207	3.96	0.5	740	3.36	1.96	Significant
non-exclusively breastfed	534	1.95	0.2				

N = 741 *significant P < .05, d f = 740

Data in table 2 indicates that the calculated table value of 3.96 is greater than the critical table value of 1.96 at 0.05 level of significance and 740 degree of freedom. The null hypothesis therefore is rejected, meaning that there is difference in the intellectual functions of pre-school children who were breastfed and those who were not, in performing mathematical skills.

Hypothesis 3

There is no significant difference in the mean performance of nursery three children who were exclusively breastfed and those who were not; in their intellectual functions to arrange building blocks and fix in missing parts of puzzles.

Table 3: t-test analysis of the mean performance of pre-school children who were exclusively breastfed and those who were not; in their intellectual function stoarrange building blocks and fix in missing parts of puzzles

Variables	N	$\bar{x}$	SD	df	t-cal	t-crit	Remark
Exclusively breastfed	207	11.51	6.19	740	4.11	1.96	Significant
non-exclusively breastfed	534	6.09	3.03				

N = 741 *significant P < .05, d f = 740

It is revealed on table 3 above that the table calculated value of 4.11 is greater than the critical table calculated value of 1.96. This entails that there is significant difference in the mean performance and intellectual functions of pre-school children who were exclusively breastfed and those who were not; in their ability to arrange building blocks and fix missing parts of puzzles. The alternative hypothesis is retained while the null hypothesis is rejected.

Discussion of Findings

The finding of the study in hypothesis 1, table 1 showed that there is significant difference in the mean performance of pre-school children who were exclusively breastfed and those who were not; in their intellectual functions to recognize symbols. Those who were exclusively breastfed outperformed their non-exclusively breastfed counterparts in recognition of symbols. The above finding lends credence to the study Of Cunha and Heckman (2010) [7], and Almudena (2012) [1].

Who confirmed that exclusively breastfed children develop superiority over their non-exclusively breastfed counterparts in their intellectual functions to recognize symbols and in communication skills.

The result emerging from analyzing hypothesis 2, table 2 indicates that there is a significant difference in the mean performance of pre-school children who were exclusively breastfed and those who were not; in their intellectual functions to perform mathematical skills. The above finding is in absolute agreement with the findings of Butte, Lopez, Alarcon and Garza (2002) [6] who postulate that exclusive breastfeeding is related to better performance of children in mathematics at all ages from the time of school entry to age 14. Conversely, Rogan and Gladen share a different opinion about exclusive breastfeeding and children's intelligence quotient scores in Mathematics and English. They contend that the difference in intelligence quotient scores of exclusively breastfed children and their non-exclusively breastfed counterparts were marginally significant for English and not for mathematics.

The result obtained from analyzing hypothesis 3, table 3 indicates that there is significant difference in the mean performance of pre-school children who were exclusively breastfed and those who were not; in their intellectual functions to arrange building blocks and missing parts of puzzles. This finding is in consonance with Uauy and de Andreca (2005) [17] who believed that exclusive breastfeeding is positively associated with intelligence scores; hence, exclusively breastfed children out-score non-exclusively breastfed children's intellectual functions in arranging building blocks and fixing missing parts of puzzles. Nsirim (personal communication, April, 2014) who also is in agreement with the above finding, resolved to the belief that children among other things need adults' encouragements, assistance, reinforcement and motivation to enable them develop their potentials.

Conclusion

Based on the findings of the study, the following conclusion is hereby drawn:

Exclusive breastfeeding should be practiced by every mother for its social, emotional, psychological, intellectual advantages, as well as the promotion of health of the child.

Recommendations

Following the findings of the study and the conclusion made, the underlisted recommendations are made:

1. Exclusive breastfeeding should be practiced by every mother (except where the mother is ill with infectious and contagious diseases such as HIV/AIDS, cancer, leprosy, ebola, among others) as the study proved that there is significant difference between the intellectual functions of pre-school children who were exclusively breastfed and those who were not, in Rivers State.
2. Officials of Hospital Management Board should frequently organize seminars and make efforts in sensitizing nursing mothers to practice exclusive breastfeeding.
3. Officials of Community Health should intensify community campaign to inform pregnant women and nursing mothers that exclusively breastfed children have better performance in general intellectual abilities; as such they should practice exclusive breastfeeding.
4. Officials of State Ministry of Health should reach out to the Traditional Birth Attendants (TBAs) with the benefits of exclusive breastfeeding so that they will encourage pregnant women and nursing mothers to embrace and practice exclusive breastfeeding.
5. Youths who are preparing for marriage should be pre-informed about the benefits of exclusive breastfeeding.
6. School counselors, head teachers and caregivers should ensure an advocacy to parents in their Parents/Teachers Association (PTA) meetings on the need for exclusive breastfeeding as the practice improves cognitive development; and a front burner in motor and

intellectual functions of pre-school children.

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