

**ASSOCIATING MATERNAL DEPRESSION TO STUNTING AND LATER
COGNITIVE DEFICITS IN CHILDREN- A CASE OF KITUI, KENYA**

BY

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DECLARATION

This research project is my original work and has not been presented for any award in this or any other institution.

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DEDICATION

This dissertation is dedicated to my husband Lemmy Mwenda for the support and encouragement during the project.

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ABBREVIATIONS AND ACRONYMS

ECD	-	Early Childhood Development Centers
HINI	-	High Impact Nutrition Intervention
KABC- 2	-	Kauffman Assessment Battery- Second Edition
MCH	-	Maternal and Child Health
MDG	-	Millennium Development Goals
PHQ-9	-	Patient Health Questionnaire
SES	-	Socio Economic Status
UNICEF	-	United Nations Children Education Fund
WHO	-	World Health Organization

OPERATIONAL DEFINITION OF TERMS

Kauffman Assessment Battery- Second Edition- PHQ-9 -	The tool which will be used to assess cognitions in the children. An interview or self administered tool to score for maternal depression.
Social support-	Is marital satisfaction levels, closeness with at least one adult of either sex and a subjective feeling of feeling appreciated.
Stunting -	Linear growth retardation as scored using WHO reference cards.
Women empowerment-	For this study women empowerment will be defined as a woman's education level, ability to make purchasing decisions, ability to use family planning methods, ability to join a women economic group and whether they are consulted in making some decisions in the house.

ABSTRACT

Maternal depressive symptoms are negatively associated with early child development and quality of parenting across different cultures and socioeconomic groups. A study conducted in Bangladesh revealed that maternal depressive symptoms were associated with infant stunting, perhaps related to unresponsive care giving. The association between stunting, maternal depression and cognitive deficits of children has not been comprehensively studied in Kenya.

Literature revealed that the risk factors of maternal depression, such as poverty, low education, high stress, lack of empowerment, and poor social support are also risk factors for poor child development. Most of these risk factors are present in many low and middle income countries and they have adverse effects on both maternal and child health outcomes.

The purpose of this research study was to be to study the link between stunting, maternal depression and later cognitive deficits amongst children between 4- 6 years attending early child hood education (ECD) in Kitui. The study was guided by two key research questions is there a link between maternal depression and stunting? Are stunted children more likely to have cognitive deficits compared to stunted children?

The research study adopted a case- control design and the population of the study was all children attending ECD in Kitui County. The sample size was calculated with an alpha value of 0.05 and power 80%. The sampling method stratified proportionate sampling. The total sample size was 168.

Stunting was measured by taking the height and age of children participating in the study which was then scored using the WHO reference. KABC- 2 was used to test

intelligence of all the children taking place in the study. Mothers of children sampled in the study were tested for depression using PHQ 9-Swahili. For all mothers who were found to be currently depressed supplemental questions to score past depression when the child in the study was one and two years old were asked. Data on risk factors for maternal depression and stunting was collected using a researcher designed questionnaire.

The results showed that global intelligence test scores of the stunted children were lower than the scores of the non stunted children. When comparing the global intelligence scores of the stunted and non stunted children the results showed the group mean of the non stunted children was 69.8 while the group mean of the stunted children was 50.7. A chi-square test was further carried out to determine how the global intelligence scores between the stunted children (cases) and the non stunted children (control) compared. The scores of the stunted children were significantly lower compared to those of the control group at $p < 0.001$. The study also showed that there was a higher prevalence of severe depression among mothers whose children were stunted at 13.4% as compared to rates of 4.1% among mothers whose children were not stunted.

Discussion: based on these findings, we can conclude that stunted children are more likely to have depressed mothers than non stunted children. 67.9 % of mothers with stunted children had mild depression as compared to only 28.4% of the non stunted children. The study also showed that the more severe the stunting the more the association with severe depression on the mother. Comparison between mothers with children with moderate stunting and those with severe stunting also showed higher prevalence among severely stunted (-3SD) at 17.1% as compared to 12.8% among the moderate stunted (-2SD).

Conclusion: In most societies mothers are the primary providers of nutrition and care to young children. Therefore maternal depressive symptoms are likely to be negatively associated with early child development and quality of parenting across different cultures and socioeconomic groups. Child nutrition programmes that are aimed at dealing with stunting should include an element of the management and treatment of maternal depression. .

CHAPTER ONE

1.0 INTRODUCTION

Serious depression in parents and caregivers has been found to affect far more than the adults who are ill (Center on the Developing Child at Harvard University, 2009). A study conducted in Bangladesh revealed further evidence of the high incidence of maternal depressive symptoms in many low-income and middle-income countries. The effects of maternal depressive symptoms on associated early child development and quality of parenting has not been studied across the different cultures and socioeconomic groups in Kenya. This research study hopes to add to the body of knowledge by studying the association of maternal depressive and infant stunting, then going further and studying the association of stunting to cognitive development in children 4 to 6 years old in Kitui Kenya.

The study will also provide added literature on the risk factors for maternal depression, such as poverty, low education, high stress, lack of empowerment, and poor social support and how these same risk factors also account for poor child development. The study aims to provide additional knowledge on the relation between maternal depression and compromised early child development. Similar relations both multilevel and cumulative have been found in similar studies in other low and middle income countries (Walker, et al., 2011).

CHAPTER TWO: LITERATURE REVIEW

2.1 INTRODUCTION

2.1.1 Maternal Depression

About 14% of the global burden of disease has been attributed to neuropsychiatric disorders, mostly due to the chronically disabling nature of depression and other common mental disorders, alcohol-use and substance-use disorders, and psychoses (Prince, et al., 2007). Perinatal mental disorders are associated with increased risk of psychological and developmental disturbances in children (Stein, et al., 2014). The postpartum period was found to add additional risk to women with rates of major depressive disorder raised slightly in the postnatal period relative to women who are not pregnant. Postpartum depression affects about 15% of women. (Herba, 2014) Little is known about maternal depression in countries of low and middle income, although in a review of 47 studies spanning pregnancy and the postnatal period, common maternal mental health disorders (including depression) were noted in 19.8% of women. A longitudinal study conducted in South Africa to investigate the association between symptoms of postnatal maternal depression and children's psychological development at age 10 years found that children whose mothers had symptoms of depression at 6 months postpartum were more than twice as likely as children whose mothers did not have postnatal depression to have psychological problems at age 10 years (Verkuijl, Richter, Norris, Stein, Avan, & Ramchandani, 2014). There is however, limited information on these associated risk factors in the Kenyan context. Studies have shown that some of the factors whose effects can be modified include parenting quality, social (including partner) and material support.

This research study sought to analyze the causal effect between these risks factors on maternal depression and stunting.

Maternal depressive disorders have been found to be a principal source of disability worldwide, particularly among women in low-income countries (Rahman et al., 2008). The societal burden of maternal depressive disorders extends beyond women to the next generation by increasing the risk of problems related to growth and development among infants of depressed mothers. Infants are particularly vulnerable because they are completely dependent on their caregivers, and their nutritional demands are high to support their rapid growth and development (Prince, et al., 2007). Most of the studies conducted emphasized the importance of treating maternal depression and helping mother's with the associated care giving difficulties.

Maternal depression adversely affects women's health and well-being, with symptoms such as depressed mood, tiredness, insomnia, low self-esteem, and a lack of energy and interest in the environment. Maternal depression has been investigated as a risk factor for impaired caretaking capacity to provide sensitive, responsive, and stimulating care, which is important for infants' and children's psychological development, intellectual competence, psychosocial functioning, rate of psychiatric morbidity and physical well-being (World Health Organization, 2009)

Maternal depressive symptoms are negatively associated with early child development and quality of parenting across different cultures and socioeconomic groups. In most societies, mothers are the primary providers of nutrition and care to young children. This is a demanding task, and poor physical or mental health in

mothers might be expected to have adverse consequences on their children's health, nutrition and psychological well-being. Ironically child nutrition programmes do not adequately address maternal mental health (Rahman, Iqbal, Bunn, Love, & Harrington, 2008).

Infants who experience growth faltering early in life that is severe or prolonged enough to cause stunting (length-for-age < -2 z scores) are at risk of lasting cognitive and academic deficits (Berkman, Lescano, Gilman, & Lopez, 2002). Despite the vulnerability that occurs during infancy, the evidence linking maternal depressive symptoms with infant growth is mixed. A study conducted in India concluded that major depression in the postpartum period, current major depression and low maternal intelligence were associated with malnutrition in the child. The interactions between current maternal depression and low birth weight and between postpartum depression and low maternal intelligence were statistically significant in the study. Other studies conducted in Asia and Africa has revealed mixed results. A review of studies in Pakistan, Vietnam, Brazil and Nigeria have shown worse growth among infants of mothers with depressive symptoms than in infants of mothers with few symptoms while in contrast, studies conducted in the same regions but in South Africa, Peru, Ethiopia, and Jamaica have shown no significant differences in infant growth related to maternal depressive symptoms. However comparisons across studies have been difficult because the studies varied in design; only 4 of the 13 studies that have been quoted in this research project report were longitudinal, several studies either did not adjust for potential confounders had minimal adjustment, and there was limited attention to the potential mechanisms linking maternal depressive symptoms with poor infant growth.

These effects of maternal depression do not necessarily remit when maternal mood improves. There is consistent evidence of poorer cognitive development in preschool-age children of mothers who were depressed postnatally (Santos, Matijasevich, Domingues, Aluísio, & Fernando, 2010). *Young boys whose mothers were depressed postnatally were found to have poorer cognitive development and to display more antisocial behaviour, over activity and distractibility compared with boys whose mothers were not postnatally depressed* (World Health Organization, 2009)

Another study conducted among Filipino children assessed the relationship between stunting in the first 2 years of life and later cognitive development. The Filipino study focused on the significance of severity, timing and persistence of early stunting. The sample included > 2000 Filipino children who were administered a cognitive ability test at ages 8 and 11 years. *The study found that children stunted between birth and age 2 years had significantly lower test scores than non stunted children, especially when stunting was severe.* Another study conducted in Bangladesh found that depressive symptoms were related to poverty and to social and environmental conditions, such as low education, and that there was synergy between maternal depressive symptoms and mothers' perceptions of their infant as irritable. Maternal depressive symptoms were associated with infant stunting, perhaps related to unresponsive care giving (Black, et al., 2007).

Poor maternal mental health has become the subject of attention and concern because of the high rates of depression in mothers with small children. A meta-analytic study focusing on data from developed countries assessed women for depression during pregnancy or the first year post-partum showed that as many as 19.2% of women have a depressive episode during the first 3 months post-partum, most of these episodes having onset after delivery (Santos, Matijasevich, Domingues, Aluísio, & Fernando,

2010). Investigations undertaken in resource-poor countries found very high rates of depression, generally 2 to 3 times higher than those observed in industrialized countries (Rahman et al, 2004). Recent systematic reviews have shown higher prevalence of common perinatal mental disorders among women from low- and lower-middle-income countries, where the weighted mean prevalence of these disorders was found to be 15.6% in pregnant women and 19.8% in women who had recently given birth. (Rahman, et al., 2013)

2.1. 2 Stunting and Child Development

Child growth is a process with a multi-factorial determination, involving genetic and environmental factors (food availability, feeding practices, health and morbidity, besides general child care) that act by promoting or restricting the individual inherent potential for growth. Post-natal maternal depression may contribute to the risk of growth impairment and illness through several ways, including early cessation of breastfeeding and inadvertent reduced maternal attention to and care of children's needs (World Health Organization, 2009). Depression after childbirth, through its negative impact on the mother's interpersonal functioning, disrupts the quality and sensitivity of the mother-infant interaction. This can have adverse effects on the emotional, cognitive and social development of the infant. Postnatal depression reduces the sensitivity, warmth, acceptance and responsiveness of the mother to her infant.

The foundations of brain architecture are laid down early in life through dynamic interactions of genetic, biological, psychosocial influences and child behavior. Biological and psychosocial influences affect the timing and pattern of genetic expression and this can alter brainstructure and function and behaviour. Through

bidirectional effects, children's behaviour affects brain development directly and by modifying the effects of biological and psychosocial influences (Walker, et al., 2011).

Childhood risks associated with poverty, such as lack of stimulation or excessive stress, affect brain development, result in dysregulation of the hypothalamic–pituitary–adrenocortical system, and change electrical activity of the brain related to efficiency of cognitive processing. The influence of risks can begin prenatally because the fetal brain can be influenced by exogenous factors that produce maternal stress.

Three translational processes influence how risk factors and stress affects brain and behavioural development: the extent and nature of deficits depend on timing, co-occurring and cumulative influences, and differential reactivity. Risks often co-occur and persist, leading to exposure to multiple and cumulative risks. For example, maternal depression increases risk of low birthweight (LBW), risk of stunting and insecure attachment. Because of differential reactivity, the effect of risks on behaviour might vary by individual or environmental characteristics. Under-nutrition in infancy and early childhood is thought to adversely affect cognitive development, although evidence of lasting effects is not well established (Walker, et al., 2011). Risk factors for maternal depression, such as poverty, low education, high stress, lack of empowerment, and poor social support are also risk factors for poor child development. For example, family poverty is a risk factor that leads to developmental inequality. Its timing, dose and differential reactivity influence how individual's exposure to risk and protective factors translate into individual differences in brain function and structure. In turn brain function and structure influence the degree of differential reactivity that is the CNS (Central Nervous System) neuro-transmitters,

stress- linked autonomic and hormonal endocrine system which all determine the development of a child.

Extrinsic and environmental influences have maximum effect on brain and behavioural development at age specific sensitive periods. The infant and caregiver relationship depend on the quality and availability of care giving early in life. Co-occurring or cumulative influences influence biological and behavioural development. When stress is cumulative or severe, the risk of adverse long term physiological and behavioural consequences is substantial. Early exposure to stress might compromise a child's ability to benefit from a supportive environment or increase their susceptibility to later stressors.

New information also extends the long-term outcomes associated with stunting, including reduced likelihood of formal employment at age 20–22 years in the Philippines and poorer psychological functioning in Jamaican adolescents (Walker, et al., 2011). Timing of growth faltering seems important. In Guatemala, growth and development were related up to age 24 months but not from 24 to 36 months. In a study investigating the associations of pre-natal and post-natal trajectories in both weight and length/height through the first 5 years of life, with cognitive ability and mental health at 6.5 years of age among healthy children; their results suggest that among healthy children, faster growth from the pre-natal period through age 5 years is positively associated with cognitive ability, whereas faster growth in the pre-natal period and infancy is positively associated with mental health at early school age (Seungmi, Tilling, Martin, Davies, & Ben-Shlom, 2011). Duration might also change the effect because Peruvian children stunted at age 6–18 months, but not at 4·5–6 years, did not differ from children who were not stunted at either age in vocabulary and quantitative test scores at 4·5–6 years. Children stunted at both ages had

significantly lower scores. The timing of catch-up growth is unknown and might have happened within the first 2 years of life (Walker, et al., 2011).

2.1.2 Risk factors for stunting and maternal depression

A study conducted in Nigeria on the prevalence of and risk factors for stunting among school children and adolescents in Abeokuta, South West Nigeria found that the long-term consequences of stunting include short stature, reduced capacity of work, and increased risk of poor reproductive performance (Senbanjo, Kazeem, Olumuyiwa, & Olisamedua, 2011).

There is no study conducted in Kenya linking stunting and maternal depression with cognitive deficits in children. This study used the Kauffman Assessment Battery to test intelligence among children sampled into the study. Studies to test the validity of the Kauffman Assessment Battery as a tool to test intelligence have been conducted in Uganda and South Africa. Both studies found the tool to be appropriate for black African children (Bangirana, et al., 2009) and (Skuy, Taylor, O'Carroll, Fridjhon, & Rosenthal, 2000).

Linear growth retardation or stunting is estimated to affect 34% of children younger than 5 years in low-income and middle-income countries. Although successful interventions exist at each level in nutrition programme implementation in Kenya, there has been limited focus on stunting and maternal depression in long term management of chronic malnutrition. Investments in this area have been slow and few integrated programs exist. However evidence from existing intervention trials conducted in other countries indicate the need to promote early mother-child interaction as a model for interrupting the intergenerational consequences associated with maternal depression.

This study analyzed the link between stunting, maternal depression and cognitions of children 4-6 years attending ECD training. It is hoped that the study results will provide a resource to policy makers and implementers in NGOs, mental health department and the government of Kenya. It is hoped that the results of this study will lead to a better understanding of the association of stunting, maternal depression and cognitions of children and will refocus support to combating the effects of chronic malnutrition and maternal mental health as children grow up to be adults and their mental development is important to a country's development.

2.2 RATIONALE

Any community, nation or continent can never hope to develop to its full capacity if its children cannot. Chronic and severe maternal depression has potentially far-reaching harmful effects on families and children. Its widespread occurrence can undermine the future prosperity and well being of society as a whole. When children grow up in an environment of mental illness the development of their brains may be seriously weakened, with implications for their ability to learn.

There is a heavy burden of chronic malnutrition in the larger Kitui community which is linked to insufficient food supply, inadequate access to food, insufficient purchasing power, inappropriate demand patterns, inequitable distribution of food within the county, inequitable allocation to individuals within families, and/or poor utilization of food. A nutrition survey conducted in Kitui in 2012 revealed stunting rates of 47.5%. Children who are stunted complete fewer years of schooling. This may be due to the fact that stunted children are known to enroll late in school

(Partnership for Child Development, 1999) because they have not grown enough to enroll or it may also be because they drop out earlier. This may lead to fewer years of education of stunted children when compared to tall children.

Considering the severe effects, stunting has received far too little attention for far too long. A stunted child is nearly five times more likely to die from diarrhea than a non-stunted child because of the physiological changes in a stunted body (Lake, 2012). Stunting is also associated with impaired brain development. A typical stunted brain has fewer cells. The cells themselves are somewhat smaller, and the interconnection between them is more limited. This means lasting impaired functioning, which leads in turn to significantly reduced learning. The long-term consequences of stunting include short stature, reduced capacity of work, and increased risk of poor reproductive performance (Senbanjo, Kazeem, Olumuyiwa, & Olisamedua, 2011).

From review of studies relevant to Kenya the link between stunting and maternal depression has not been analysed nor efforts to deal with it implemented. Routine checks at health facilities in Kitui providing HINI (High Impact Nutrition Intervention) including the management of severe acute malnutrition indicate that there are documented cases of depressed mothers with children receiving nutrition care unable to follow up the required number of visits for their children treatment. This further compounds the nutrition status of the child as do to the mothers mental health, they do not bring their child to receive the full package of treatment required to heal.

Although a large body of data linking stunting with mental development is in existent from various countries, no study had been conducted in Kenya. This study provided an opportunity to generate data on the effect of stunting on mental development that

can provide a resource to policy makers both in the government and non governmental bodies, provide a reference in making decisions and align policy to influence a change of trend in Kitui, and by extension other parts of Kenya where stunting is a problem. The study also provides a framework for other researchers and agencies working in primary health to replicate the same regionally and nationally. The Kauffman Assessment Battery has been used in South Africa, Uganda and in Kilifi Kenya providing a wealth of data on the test reliability and validity. This research has provided yet another opportunity to evaluate its use and effectiveness in the Kenyan context and further opportunity for research in the area of intelligence testing in Kenya.

2.3 HYPOTHESIS/ STUDY QUESTIONS

- i. Stunted children are more likely to have cognitive deficits than non stunted children.
- ii. Stunted children are more likely to have depressed mothers than non stunted children.

2.4 OBJECTIVES OF THE STUDY

a) Broad Objective

The purpose of this study was to investigate the link between stunting, maternal depression and cognitive deficits of children 4-6 years.

b) Specific Objectives

- i. To investigate whether stunting leads to cognitive impairment of children 4- 6 years attending ECD training in Kitui, Kenya.
- ii. To investigate whether there is a causal association between maternal depression and stunting.

- iii. To investigate the extent to which risk factors for maternal depression and stunting, such as low socioeconomic status (SES), poor education, lack of empowerment and poor social support are also risk factors for stunting.

CHAPTER THREE: STUDY DESIGN AND METHODOLOGY

3.1 INTRODUCTION

a) Study design

The study was a case control study.

b) Study area description

The study was conducted in Kitui, Kenya. Kitui is located in the Eastern part of Kenya. It borders Machakos and Makueni districts to the west, Mwingi to the north, Tana River to the east and TaitaTaveta to the South.Kitui country comprises of the greater Kitui district, (Kitui North and Kitui South) and the greater Mwingi district (Mwingi and Kyuso districts) with a population of 1,012,709. (Ministry of State for Planning, National Development and Vision 2030, 2010). Administratively there are 16 districts in Kitui County; 10 districts (formerly divisions of) Kitui Central, Nzambani, Kisasi, Katulani, Mutito, Lower Yatta, Matinyani and Kitui West were involved in the study. The study was carried out in Kitui due to the very high prevalence of stunting in the area. Numerous nutrition interventions exist in the area but there is little focus on stunting and its long term effects on the life of the children. The link between stunting and cognitive development and stunting and maternal depression has in this regard not been investigated in the area.

c) Study population

The study population was children aged 4- 6 years attending ECD training in Kitui. The inclusion / exclusion criterion for the children was: children age 4- 6 years. Children who do not include this age group will not be included.

d) Sample size determination and calculation

The sample size was calculated with an alpha value of 0.05 and power 80%. The ratio of sample size for control to cases was 1: 1. From the literature a meta-analysis of 17 recent studies found that mothers with depressive symptoms were 40 percent more likely to have underweight or height-stunted children than mothers who were not depressed (American Psychological Association, 2011/2012). Therefore 40% was used as the measure of cases (stunted) that have the exposure (depression). The prevalence of maternal depression in the general population in middle and low income countries is 15- 28%. For this study 20% was used as the prevalence in Kenya. Therefore 20% was the proportion of exposure in controls (non-stunted). Sample size was calculated using the Open Epi programme (Open Epi, 2013). A total sample size of 168 (Kesley) that is 84 cases and 84 controls is adequate to provide significant result with a power of 80%.

e) Sampling method

Stratified proportion sampling was used in selecting the district and ECD centres to allow inclusion of districts with different socio- economic status (peri urban and rural) (agricultural vs agro pastoral) as this is an important research aim. This process allowed selection of all regions in Kitui North. Kitui North selected for the study as it has more districts (10) as compared to Kitui South which has 6. There are also more ECD centres in Kitui North at a total of 604 compared to a total of 351. All the 10 districts in Kitui North were sampled in the study. The table below illustrates how the ECD centers were allocated in Kitui North for the study. Using proportionate sampling, a factor of 25 was used to get a proportionate number of centers per each district as the ECD centers are not evenly distributed.

Table 3.1 : ECD Centers – Kitui North

		ECDs	Obtained by dividing by a factor of 25	Obtained by divided by a factor of 7
No.	District Name	No.	Number of centers to be selected per district	No of children to be proportionately selected for the study
1	Kitui Central	102	4	28
2	Kitui West	110	4	28
3	Lower Yatta	92	4	28
4	Mutito	144	6	42
5	Kisasi	48	2	14
6	Katulani	33	1	7
7	Nzambani	25	1	7
8	Matinyani	50	2	14
	Total Kitui North	604		
		Total Study Sample	24	168

Stratified sampling allowed the researcher to achieve greater precision than a simple random sample and also guaranteed better coverage of the population. After the selection of the ECD centres was done for each of the districts a total of 24 centres were selected and by multiplying by a factor of 7 the total sample size of the study of 168 children was reached. The factor 7 was used to determine how many children

were selected per district. This has been shown on the above table. Kitui South was used to pilot the K-ABC 2, PHQ-9 and also screening of the children.

f) Definition of cases and controls

Cases were children aged between 4 and 6 years who were stunted while controls were children of the same age who were not stunted. Children (cases) were screened for stunting (Stunting height-for-age z-score (HAZ) of <-2 standard deviation (SD). Severe stunting HAZ of <-3 SD) of the World Health Organization reference. Controls were non stunted children of the same age group. All mothers who consented for their children to be in the study also participated in the study.

g) Recruitment and consenting procedures

Recruitment of children was done in the ECD centers. Only children age 4- 6 years participated in the study. Three recruiters, two nurses and a nutritionist were trained prior to data collection. The recruiters were trained on measuring of stunting using WHO height for age reference. Depending on the results of whether the child was stunted or not they were recruited into the study and assigned into cases (stunted) or controls (non-stunted) Assent was obtained from the children before administration of KABC- 2. The cognitive testing was done by the researcher. Mothers of the children who had been recruited into the study were then contacted through the teachers in the ECD centres. Consent was obtained from them before participation in the study. The mothers were assessed for depression using the PHQ-9 questionnaire and also interviews on the risk factors for maternal depression and stunting. The researcher tested the cognitions of the children using KABC- 2.

h) Data collection procedures

Standing height was taken using standard height boards provided by UNICEF and Ministry of Health in Kitui. Two measures were taken by two different data collectors. Data on the child's age was collected and recorded. Stunting was defined as height-for-age z-score (HAZ) of <-2 standard deviation (SD) of the World Health Organization reference. Severe stunting was defined as HAZ of <-3 SD. All the children in a selected school who were aged 4- 6 years were screened for stunting. The children were then assigned into cases (stunted children) and controls (non stunted children). The children were asked to randomly stand in a line. The children were assigned random numbers 1 to nth where nth was the last child on the line. The same numbers were assigned for the cases and controls. The first child on the line was picked for study; once consent and assent has been obtained the child was selected for study. When the first child declined then the next child, number two was picked. When the first child was selected for the study every 3rd child was then be picked to participate in the study. When the 3rd child declined then the next child 4th was picked. The procedure was repeated until the required sample size in the centre was used. This approach was used for both the cases and controls. Kauffman Assessment Battery for Children- 11 (K- ABC- 11) was used to test intelligence. To assess the effect of stunting on the cognitions of the children the test scores of the two groups of children sampled were compared. It is reportedly a relatively nondiscriminatory test of intellectual functioning. A study conducted in South Africa compared the performance of 21 black and 35 white third-grade South African children on the K-ABC and the Wechsler IntelligenceScale-Revised (WISC-R) at two schools for children with learning problems (Skuy, Taylor, O'Carroll ., Fridjhon, & Rosenthal, 2000).

They found that while the WISC-R Verbal and Full Scale IQ of black children were significantly lower than that of whites, there was no significant difference between these groups on the K-ABC. Teachers' ratings for white and black pupils were acceptably concordant with students' performance on the K-ABC but not on the WISC-R. Support is thus provided for the usefulness of the K-ABC as a relatively nondiscriminatory alternative to the WISC-R for South African children. A preliminary examination to test the construct validity of the KABC- 11 in Ugandan children with a history of cerebral malaria (Bangirana, et al., 2009) found that the KABC- 11 truly measured the intelligence of the Ugandan children and that the standardized administration involving translation and back translation of instructions and relevant culturally sensitive modifications the tool improved markedly. Since the children are school going, the instructions was translated into Swahili and back translated into English by a different translator to aid in explaining to children who's English was poor. There is no documentation of the validation of the KABC- 11 in the context of Africa neither of its use in Kenya. The study analyzed construct validity of the KABC- 11 in the study to aid future researchers in its use.

Mothers of children who were sampled into the study were tested for depression using the PHQ 9 (Swahili). The PHQ 9 has been validated in Kenya and found to be a tool that is appropriate in scoring depression. Results from the validation study found construct validity was supported by a strong association between PHQ-9 and general health rating, a single major factor with loadings exceeding 0.50, item-total correlations exceeding 0.37 and (4) a pattern of item means similar to US validation studies (Monahan, et al., 2008). The Swahili version available was translated to

Kikamba and back translated to Swahili by different translators. Mothers were given a choice on whether to be administered the Swahili or Kikamba version. Research assistants were trained on the administration of PHQ- 9. Supplemental questions were attached to the PHQ-9 by the researcher to score present and past depression. The supplemental questions asked the mother whether they had experienced the symptoms described in the questionnaire when the child was age 1 and when the child was age 2. A local calendar of events was designed and used to aid the mothers recall birth date, when their child was age one and when their child was age two.

i) Variables

The independent variable (exposure) in this study was maternal depression. There were two dependent variables (outcomes): stunting and cognitive deficits of the children. The researcher analyzed the association between stunting and maternal depression then stunting and global intelligence. Confounders that likely affected the outcome of the study were the socio economic status of the households, maternal education and social support as they are linked to depression. To control for the cofounders data were collected from children of different socio economic status and also with mothers of different education status. Data collected was stored in a locked cupboard and soft copy data was password protected.

j) Materials

Standard height boards as provided by UNICEF/ MOH in Kitui were used to measure height. A questionnaire to collect demographic and socio economic status data was used. PHQ 9 Swahili which was back translated to Kikamba was used to assess for maternal depression and KABC- 11 was used to test for intelligence.

k) Training procedures

The 3 recruiters were trained on taking standing height measurements using standard height boards, filling in the socio economic and demographic questionnaire including stunting data. They were also were trained on collection of depression data using the PHQ-9 both using the Swahili and the Kikamba translated version. Recruiters were also trained on collecting consent and assent from the mothers and the children respectively.

3.2 CONSIDERATIONS

a) Consent explanation

A written consent was sought from the Ministry of Early Childhood Development Education in Kitui and also from the participating ECD centers. Informed consent from the study population was sought by the researcher. Since the study group was children, the consent was sort from their mothers. However, assent was obtained from the children before any data was collected.

b) Compensation for participants

Mothers who participated in the study were provided with transport reimbursement from the school to their homes. All the children attending ECD training in the selected schools were provided with milk regardless of whether they were selected for the study or not. No other compensation was provided for participating in the study.

c) Study risks

The study potentially exposed the mothers to distress during the screening of depression. The researcher who is a trained clinical psychologist provided psychological support to mothers as need be. Mothers who were found to be depressed were referred to the Kitui district hospital for support. Children who were

found to be stunted were referred to the nearest health facility or mobile outreach centre for management and support.

d) Study benefits

The study objectives were to determine the link between stunting, maternal depression and cognitive deficits in children aged 4-6 years. This was communicated to the study participants. The study benefited mothers by alerting them of the link between stunting and depression and encouraging them to seek preventative care for themselves and the children early enough. It also provided data on the effect of stunting on mental development that can be used as a resource to policy makers both in the government and non governmental bodies, provide a reference in programmatic decisions and align policy to influence a change of trend in Kitui and by extension other parts of Kenya where stunting is a problem. This study provided a framework for other researchers and agencies working in primary health to replicate the same regionally and nationally. The Kauffman Assessment Battery has been used in South Africa but has never been used in Kenya before. This research provided an opportunity to evaluate its use and effectiveness in the Kenyan context and this will provide further opportunity for research in the area of intelligence testing in Kenya.

e) Confidentiality

The researcher ensured confidentiality of participants as no information such as names, mobile numbers which identify the respondent was collected. Study codes on completed questionnaires were used. Questionnaires were kept in a locked cabinet whose access was by the primary researcher only.

CHAPTER FOUR: DATA PRESENTATION AND ANALYSIS

4.1 INTRODUCTION

This chapter details the findings of the study and the discussion with respect to the objectives of the study. The aim of the study was to establish the link between stunting, maternal depression and cognitive deficits amongst children between 4- 6 years attending early child hood education (ECD) in Kitui. The results have been presented in order of the objectives i.e. to investigate whether stunting leads to cognitive impairment of children 4- 6 years attending ECD training in Kitui, Kenya, to investigate whether there is a causal association between maternal depression and stunting, and to investigate the extent to which risk factors for maternal depression and stunting, such as low socioeconomic status (SES), poor education, lack of empowerment and poor social support are also risk factors for stunting.

4.2 RESPONSE RATE

The targeted number of respondents was 168. A total of 148 respondents took part in the study. This represented a response rate of 85.7 percent. 5 of the children selected were lost to follow up as it was their fathers who responded, 13 of them were discontinued while administering the KABC- 11 after meeting the discontinuing criteria in administering the test and 2 of the children's mothers declined to participate in the study after giving initial consent.

Table 4.2.0 Socio – Demographic Characteristics of Stunted and Non Stunted

Children

	Overall		Control (non stunted group)		Stunted	
	N	%	N	%	N	%
All	148					
Male	70	47.3	45	58.4	25	35.2
Female	78	52.7	32	41.6	46	64.8
Age of child						
4 years	46	31.1	31	21	15	10
5 years	96	64.9	48	32.4	48	32.4
6 years	6	4	2	1.3	4	2.7
Age of mother						
20 – 29	31	20.9	16	10.8	15	10.1
30 – 39	72	48.6	34	23	38	25.6
40 – 49	39	26.4	25	16.9	14	9.5
50 – 59	6	4.1	0	0	4	2.7
Level of education of mother						
None	13	8.8	4	2.7	9	6
Primary school	99	66.9	58	39.1	41	27.7

Secondary school	26	17.6	18	12.2	8	5.4
polytechnic	7	4.7	6	4.1	1	0.7
College	3	2	3	2	0	0
Level of Education of Spouse						
None	7	5.2	0	0	7	5.2
Primary school	94	70	55	41	39	29
Secondary school	21	15.8	13	9.7	8	6.1
Poly technical or equivalent	8	6	6	4.5	1.5	20
College	4	3	4	3	0	0
Marital Status						
N/A (Didn't answer)	5	3.4	3	2	2	1.4
Never Married	9	6.1	4	2.7	5	3.4
Now Married	130	87.8	64	43.2	66	44.6
Separated	4	2.7	0	0	4	2.7
Employment of mother						
Has never worked in paid employment	4	2.7	0	0	4	2.7
Not in paid employment	96	64.9	53	35.8	43	29.1
Others	16	10.8	8	5.4	8	5.4
Skilled Casual Laborer	10	6.8	8	6	2	0.8

Unskilled Casual Laborer	22	14.9	11	7.4	11	7.4
Occupation of Spouse						
Civil Servant	4	3	4	3	0	0
Don't know	2	1.5	1	0.75	1	0.75
Not in paid employment	19	14.2	7	5.2	12	9
Pastor	1	0.7	1	0.7	0	0
Self Employed (farmer)	4	3	2	1.5	2	1,5
Skilled Casual Labourer	18	13.4	13	9.7	5	3.7
Unskilled Casual Laborer	78	58.2	37	27.6	41	30.6
Vendor (Bodaboda employed)	4	3	4	3	0	0
Vendor (Sells Vegetables)	4	3	4	3	0	0
Net Monthly Income						
11,000 to 20,000	17	11.5	12	70.6	5	29.4
3,000 to 10,000	83	56.1	45	54.2	38	45.8
Below 3,000	44	29.7	13	29.5	31	70.5
No income	4	2.7	3	75	1	25
Type of House						
Bungalow	0	0	0	0	0	0
Double room	84	56.8	39	46.4	45	53.6
One bedroom	20	13.5	14	70	6	30

Single room	44	29.7	24	54.5	20	45.5
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Table 4.2.0 above provides a summary of all the socio demographic characteristics of the study participants.

4.2.1 Global Intelligence Scores for Stunted and Non Stunted Children

The researcher was keen to know how the experimental (cases) and the control groups scored on the general intelligence testing. A descriptive analysis was considered adequate for this purpose. The measures used were descriptive statistics which included the mean, median, standard deviation, range and measures of skewness.

Table 4.2.1 Description of Global Intelligence Scores for Stunted and Non Stunted Children

	N	Mean	95% CI	P(T-test)
Non Stunted	77	69.7	67.7-71.6	8.8
Stunted	71	50.7	49.2-52.1	5.9

The non stunted children n= 77 had a mean of 69.7 (95% confidence interval, CI: 67.7-71.6) and the stunted children n = 71 had a mean of 50.7(95% confidence interval, CI : 49.2-52.1)

Table 4.2.2 One-Sample T test for KABC Sub tests scores for all children

Subtest	N	Mean	SD	T	Mean Difference	95% Confidence Interval
Triangles	148	4.15	2.60	t(147)=27.16 p<.0001	5.08	4.70- 5.44
Atlantis	148	4.74	2.12	t(147)=57.16 p<.0001	5.26	5.11-5.36
Word Order	148	5.14	4.06	t(147)=16.86 p<.0001	7.47	6.60- 8.34
Conceptual Thinking	148	5.63	2.00	t(147)=36.02 p<.0001	7.18	6.80- 7.60
Rebus	148	3.37	1.01	t(147)=59.48 p<.0001	5.23	5.06- 5.40

Rover	6	5.00	3.22	t(5)=.001 p=1.00	7.17	7.00-8.05
Expressive vocabulary	148	7.00	2.6	t(147)=17.43 p<.0001	5.91	5.24- 6.58
Face Recognition	46	7.17	2.40	t(45)=15.34 p<.0001	6.28	6.13-7.85
Pattern recall	148	8.80	2.90	t(147)=37.73 p<.0001	9.02	8.55- 9.50
Riddles	148	8.65	2.31	t(147)=46.59 p<.0001	9.00	8.62- 9.40
Number Recall	148	6.72	1.87	t(147)=112.04 p<.0001	7.65	7.00-8.43

Table 4.2.2 above shows paired t test results for all the subtests of KABC administered to the children.

A chi square test on whether there were significant differences on the global intelligence scores of stunted and non stunted children was also carried out. The global intelligence scores of the non stunted children significantly differed from those of stunted children $\chi^2 (11, N=148) = 33.40, p=.0001$

4.3 STUNTING AND MATERNAL DEPRESSION

The second objective of the study was to establish if there was a link between stunted growth and maternal depression. This was assessed using PHQ9 and socio demographic questionnaire that collected information on causes of stunting and maternal stress.

The mean depression score for all the mothers participating in the study was 9.73 with a SD of 5.28. For every mother who was found to be depressed, information on past or recall depression was also collected. 119 mothers were taken through the PhQ 9 again to score past depression. 60.7% of mothers who had current mild depression did not have past depression, 73.1% of those with moderate depression had recall depression and 23.1% of those with current severe depression also had past severe depression.

There was a significant relationship between current depression and past depression

$\chi^2 (2, N=148) = 32.98, p=.0001$

Table 4.3.0 Prevalence of maternal depression among all mothers participating in study

Depression Classification	N	%
None	29	20%
Mild depression	46	31%
Moderate	45	30.4%
Moderate Severe	20	13.6
Severe	8	5.4%

The above table shows the prevalence of maternal depression among all the mothers participating in the study.

Table 4.3.1 Prevalence of Maternal Depression and Stunting

Depression Classification Using PHQ- 9	Stunting Level			
	Stunted	Non Stunted	Moderate stunting (- 2SD)	Severe stunting (- 3SD)
None	11	18	7	4
	7.4%	12.1%	63.6%	36.4%
Mild	25	21	12	13
	16.9%	14.1%	48%	52%
Moderate	22	23	12	10
	14.9%	15.5%	54.5%	45.5%
Moderate Severe	11	9	5	6
	7.4%	6%	45.5%	54.5%
Severe	5	3	3	2
	3.3%	2.4%	7.7%	5.7%

4.3.1 Associating stunting with cognitive development

Another objective of the research study was to determine if stunting and cognitive development would be correlated. The parameters for measuring this objective were test scores on cognitive abilities of the learners which were assessed using the Kauffman Assessment Battery 11 (KABC 11). The researcher sought to find out if there were significant differences in the scores obtained by stunted children and those that were not stunted. The raw scores were then standardized using KABC manual for various sub tests. A chi-square test was carried out to determine how the scores

between the experimental group and the control group compared. There was significant difference between global intelligence scores of non stunted children and those stunted children $\chi^2 (11, N=148)= 33.40, p= .0001$

4.3.2 Associating Risk Factors for Maternal Depression with Risk Factors for Stunting

The second objective of the study was to determine the risk factors for maternal depression and stunting. Literature review showed that risk factors for maternal depression and stunting, such as low socioeconomic status (SES), poor education, lack of empowerment and poor social support are also risk factors for stunting. Data was collected on these broad risk factors. A regression analysis was then carried out to determine which of the factors had a significant causal relationship with depression. The results are as shown below in table 4.3.2

Table 4.3.2 Regression Analysis of Risk Factors Associated With Depression and Stunting

Depression	R	Adjusted R Square	Prob.
Happy with marriage	.375 ^a	.128	.001
Education level of father	.454 ^b	.183	.000
Household income	.503 ^c	.221	.000
Mother's employment status	.545 ^d	.256	.000
Mother's education	.519 ^e	.237	.000
If involved in family financial decisions	.570 ^f	.285	.000
Social support	.622 ^g	.341	.000

Anova analysis of the risk factors of depression and stunting was further carried out. Social support significantly predicted maternal depression scores and also explained a significant proportion of variance in depression scores. $F(5, 168) = 8.35, p = .0001$.

Table 4.3.3 Regression Model Summary for global intelligence score and maternal depression

Regression	B	Std. Error	Beta	T	Sig.
Current Depression	14.905	2.342		6.366	.000
Global Intelligence	-.088	.039	-.183	-2.248	.026

CHAPTER FIVE: SUMMARY OF FINDINGS, DISCUSSION, CONCLUSION AND RECOMMENDATION

5.1 INTRODUCTION

This chapter summarizes the key research findings from the study objectives and also discusses the results of related studies which have been conducted in the past.

5.2 SUMMARY OF THE FINDINGS

Kitui County has the second highest prevalence of stunting in Kenya at 45.8 & (KDHS, 2014/150. The researcher collected socio demographic information from all the study participants, the results of these have been presented in table 4.2.0

The findings from the study reveal that as expected there were more non-stunted children 52% as compared to those who were stunted that's 48% of the children. There were 52.7% female respondents compared 47.3% male respondents. The proportions were considered as adequate presentations of both genders in the study.

The age of the respondents was important in the study because the objective of the study was to establish the link between stunting, cognitive abilities and maternal depression in the early formative years of children especially below 5 years. Data on the age of children was obtained from class registers provided by the teachers and verified with individual parents. The total N for children's age was $N=148(M =4.73, SD=5.30)$

One objectives of the research study was to determine if stunting and cognitive development would be positively correlated. There is research evidence that stunted children are more likely to have cognitive defects than non-stunted children therefore

this was our guiding hypothesis. The parameters for measuring this objective was test scores on cognitive abilities of the children assessed using the Kauffman Assessment Battery 11 (KABC 11). The raw scores for various subtests were then standardized using KABC manual.

The researcher was keen to know how the cases and the control groups scored on the general intelligence testing. A descriptive analysis of the test scores per stunted and non-stunted group was first conducted.

The group mean of the global intelligence scores of the non-stunted children was 69.17 (SD= 8.7) while the group mean for the stunted children was 50.71 (SD= 5.87)

It was noted that the skewness for global score for the stunted children was negative (-0.586), while the non stunted children had a score of positive 0.78. This implied that there were more learners from the stunted children whose scores were below the group mean compared to the non stunted children. The stunted children therefore had more extreme scores below the group mean compared to the non stunted group.

The findings also revealed that there was more variability within the control group compared with the experimental group. The standard deviation for the control group was 8.7 while the same for the experimental group was 5.87. It is therefore statistically correct to conclude that there exists less variability in cognitive abilities for learners with stunted growth compared to learners with normal growth.

A chi square test on whether there were significant differences on the global intelligence scores of stunted and non stunted children was also carried out. The global intelligence scores of the non stunted children significantly differed from those of stunted children $\chi^2 (11, N=148) = 33.40, p=.0001$. The same results were obtained

for the 12 sub tests that were administered. It's only the Rover sub tests which was administered to children 6 years old (N= 6) where there was found to be no statistically significant difference between the test scores of the stunted children and the non- stunted children. This could have been attributed to the small sample size for this sub test. Only 6 children qualified for this test of which 4 were stunted and 2 non-stunted.

The study also measured the level of depression using PHQ 9 and then compared the prevalence of depression between mothers of children who were stunted and those who were not stunted. The study showed that there were more mothers i.e. N=18 (12.1%) without depression who also did not have stunted children as compared to N= 11 (7.4%) who did not have depression but had stunted children. Conversely 5 (3.3%) of mothers with severe depression had stunted children as compared to 2.4% who had severe depression but did not have stunted children.

The mean depression score for all the mothers participating in the study was 9.73 with a SD of 5.28. 119 mothers (80.4%) were taken through the PhQ 9 again to score past depression. 60.7% of mothers who had current mild depression did not have past depression, 73.1% of those with moderate depression had recall depression and 23.1% of those with current severe depression also had past severe depression.

There was a significant relationship between current depression and past depression

$$\chi^2 (2, N=148) = 32.98, p = .0001$$

The last objective of the study was to assess whether the risk factors for maternal depression were also risk factors for stunting. To determine this regression analysis was carried out. The following factors were found to be significant predictors of

maternal depression: whether the mother reported to be happy with her marriage or not, education level of the spouse, household income, whether mother was employed or not, mother's education and whether she was involved in major financial decision or not. The biggest risk factor for depression according to the study was lack of social support. The results of the regression analysis can be found in Table 4.3.2

5.3 DISCUSSION OF THE FINDINGS

The CHC model of KABC was used to assess the children and therefore determined the sub tests to be administered. 11 sub tests were administered in total. Face recognition test was only administered to children 3 years and over subtest to children 6 years old. Various subtests measured various learner abilities for example in the number recall subtest, the children repeated a series of numbers in the same sequence as the researcher said them, with series ranging in length from two to nine numbers. This test enabled the researcher to measure the memory span of the children.

According to this study the KABC 2 was found to be a sufficient tool to test the cognitions of the children attending ECDE training in Kitui. This is similar to other studies conducted in the region using KABC 2. A study conducted in South Africa compared the performance of 21 black and 35 white third-grade South African children on the K-ABC and the Wechsler Intelligence Scale-Revised (WISC-R) at two schools for children with learning problems (Skuy, Taylor, O'Carroll ., Fridjhon, & Rosenthal, 2000). They found that while the WISC-R Verbal and Full Scale IQ of black children were significantly lower than that of whites, there was no significant difference between these groups on the K-ABC. Teachers' ratings for white and black pupils were acceptably concordant with students' performance on the K-ABC but not

on the WISC-R. Support is thus provided for the usefulness of the K-ABC as a relatively nondiscriminatory alternative to the WISC-R for South African children. A preliminary examination to test the construct validity of the KABC- 11 in Ugandan children with a history of cerebral malaria (Bangirana, et al., 2009) found that the KABC- 11 truly measured the intelligence of the Ugandan children and that the standardized administration involving translation and back translation of instructions and relevant culturally sensitive modifications the tool improved markedly.

The study findings also showed that the more severe the stunting, the more the child's cognitive abilities were affected. The non-stunted children had higher average scores compared to both the moderate and severe stunted children. For example in the riddles subtest there were 77.8% of non stunted children scoring between 11- 13 which were the highest scores compared to 11 % from the stunted children. The severely stunted children scored on average lower than the moderate and the control group.

A similar study conducted in 1999 among Filipino children to assess the relationship between stunting in the first 2 years of life and later cognitive development. The study focused on the significance of severity, timing and persistence of early stunting. The sample included > 2000 Filipino children who were administered a cognitive ability test at ages 8 and 11 years. The study showed that children stunted between birth and age 2 years had significantly lower test scores than non stunted children, especially when stunting was severe. (Mendez & Adair, 1999)

The second objective of the research study was to establish if there was a link between stunted growth and maternal depression. This was assessed using PHQ9 and

socio demographic questionnaire that collected information on causes of stunting and maternal stress. According to the UNICEF conceptual framework on the causes of malnutrition one of the immediate causes of malnutrition is care practices. The assumption is that when a mother is depressed this would interfere with her ability to take care of her child, provide psychological stimulation and even feeding the child which would in turn interfere with the child's growth and development and consequently lead to stunting.

The research study found that there was a correlation between depression and stunting. There were more mothers who did not have depression and also had children who were not stunted as compared to mothers without depression but had stunted children. Conversely mothers who had depression (mild, moderate severe and severe) were more likely to have stunted children.

A study conducted in Bangladesh in 2007 also found that depressive symptoms were related to poverty and to social and environmental conditions, such as low education, and that there was synergy between maternal depressive symptoms and mothers' perceptions of their infant as irritable. Maternal depressive symptoms were associated with infant stunting, perhaps related to unresponsive care giving (Black, et al., 2007).

The research study found 7 risk factors as the risk factors for depression among mothers who participated in the study. These factors were happiness in marriage, education of spouse, household income, mother's employment, mothers education, whether mother was involved by spouse in major financial decision making. The most significant predictor of depression was found to be social support. Meta analysis of other studies conducted in low and middle income countries also found social support

significantly predicted depression scores, $b = -.34$, $t(225) = 6.53$, $p < .001$. Social support also explained a significant proportion of variance in depression scores, $R^2 = .12$, $F(1, 225) = 42.64$, $p < .001$.

Other studies in middle and low income countries have also found that extrinsic and environmental influences have maximum effect on brain and behavioural development at age specific sensitive periods. Family poverty was also found to be a risk factor that leads to developmental inequality. Its timing, dose and differential reactivity influence how individual's exposure to risk and protective factors translate into individual differences in brain function and structure (Berkman, Lescano, Gilman, & Lopez, 2002).

5.4 CONCLUSION

Based on the findings of the study it was concluded that chronic and severe maternal depression affects child development in terms of nutrition and mental development especially in the early age. This has potentially far-reaching harmful effects on families and children.

Reduced household income and mother's education were some of the factors which were found to be significant predictors of maternal depression. It is therefore recommended that food security interventions in the semi arid area of Kitui target vulnerable households to mitigate the worry that comes with an inability for caregivers to provide for their families. Support for women education opportunities, and support for their roles as society members and mothers, including screening and treatment of depression is very important in contributing towards the growth and development of children.

5.5 RECOMMENDATION

1. Although successful interventions exist at each level in nutrition programme implementation in Kitui, there has been limited focus on stunting and maternal depression in long term management of chronic malnutrition. Investments in this area have been slow and few integrated programs exist. There is need to scale up.
2. There is a heavy burden of chronic malnutrition in the larger Kitui community which is linked to insufficient food supply, inadequate access to food, insufficient purchasing power, inappropriate demand patterns, inequitable distribution of food within the county, inequitable allocation to individuals within families, and/or poor utilization of food. There is need to advocate for a multisectoral stakeholder collaboration driven by a political will that acknowledges the integral role that nutrition plays in ensuring a healthy population and productive workforce. An opportunity exists in the devolved government functions.
3. There is need to promote early mother-child interaction as a model for interrupting the intergenerational consequences associated with maternal depression.
4. This study has provided an opportunity to generate data on the effect of stunting on mental development that will hopefully provide a resource to policy makers both in the government and non governmental bodies, provide a reference in making decisions and align policy to influence a change of trend in Kitui.

5.7 LIMITATIONS OF THE STUDY

To some extent, language barrier affected the scoring of some of the subtests especially expressive vocabulary where some children were giving answers in Kikamba and these had to be back translated. Also there was recall bias in scoring past depression as the second PhQ 9 test was offered a short while after scoring for present depression which may have influenced the mothers answers. However the researcher did provide a break by administering the socio economics questionnaire first before scoring for the second PhQ9. The study design was also only able to show a link between stunting, maternal depression and cognitive deficits in children. To really test for association a cohort study in future would be more effective.

5.7.1 Areas for further study

1. Study of the social support systems in Kitui which can support mothers with depression or prevent some from sinking into depression.
2. Whether cognitive deficits as a result of stunting can be reversed- longitudinal study.
3. A cohort study to follow up the long term consequences of depression and stunting and whether treatment of depression will result in a change in child intelligence and nutritional status.

Table 5.1: Research Time Frame

		Jan	Feb	Mar	Apr	May	Jun	Jul
#	Activity							
1.1	Research Proposal preparation and submission							
1.2	Approval by Kenyatta National Hospital Ethics Committee							
1.3	Data collection							
2.2	Data analysis							
2.3	Report writing							
2.4	Results presentation							
2.5	Submission of report							

Table 5.2 Research Budget

No	Item Description	Unit Cost	Total Cost (Kes)
1	Kenyatta National Hospital Ethics Research Committee Fee	2,000	2,000
2	Training of 3 recruiters (2 nurses, 1 nutritionist)- 2 days	3,500	7,000
3	KABC-II Complete Kit - Includes 4 Easels, 1 Manual, all necessary Stimulus and Manipulative Materials, 25 Record Forms, Soft-Sided Nylon Briefcase	80,475	80,475
4	KABC-II ASSIST CD-ROM Mac/Win Kit-	25,230	25,230
5	KABC-II Training Video	12,354	12,354
6	Essentials of KABC-II Assessment	3,389	3,389
7	Pretesting/ piloting of tools and research questionnaire- Kitui South	6,000	6,000
8	Translation of research tools PHQ-9/ KABC-11 from Swahili/ English to Kikamba	500 (per page)	20,000
9	Printing and photocopy of questionnaires- 200 copies	1 (per page)	2000
10	Travel to Kitui and within the districts (fuel)	20,000	20,000
11	Allowance for recruiters 3 pax- 14 days	800	33,600
12	Accommodation in Kitui- 21 days	1,000	21,000
13	Milk- for children in participating ECD centres- 300	35	10,500
14	Height Boards- 3	2,500	7,500
15	Communication- Internet and Airtime for researcher and 3 recruiters	2,000	6,000
16	Data analysis- programmes and statistician payments	20,000	20,000
17	Contingency	5000	5,000
	Total Budget		282,048

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**APPENDIX 1 –FORM A: APPLICATION FOR AUTHORITY TO CONDUCT
RESEARCH IN KENYA**

I declare that the information supplied is true and accurate to the best of my knowledge.

I commit that upon completion of the above research, a report will be submitted to the Department of Early Childhood Education and feedback provided to the participating schools centres.

Signature of Supervisor 1: _____

Signature of Supervisor 2: _____

Signature of Applicant: _____

Date: _____

APPENDIX 2 - INFORMED CONSENT LETTER FOR MOTHERS

Hello

My name is

Title: We are conducting a study titled: **Linking childhood stunting to maternal depression and later cognitive deficits in children- a case of Kitui, Kenya.** The Principal Investigator of the study is Emiliana Mbelenga of the Department of Psychiatry, School of Medicine, and University of Nairobi.

Background: You and your child are being invited to take part in this research study. Before you decide to participate and also include your child in this study, it is important that you understand why the research is being done and what it will involve. Please ask the researcher if there is anything that is not clear or if you need more information.

Objectives of the study: The purpose of this study is to test for a link between delayed physical development, maternal depression and intelligence in children aged 4-6 years who are attending early childhood development training in Kitui. Your expected time commitment for this study is 10 minutes including obtaining of consent. It will take 2-5 minutes to administer the questionnaire. The expected time commitment for your child is 25- 35 minutes.

Risks: The risks of this study are minimal and are similar to those you experience when disclosing health related information at the health centre. And for your child are similar to taking the routine academic examinations at school. You or your child may however

decline to answer any or all questions and you or your child may terminate your involvement at any time if you choose.

Benefit: There will be no direct benefit to you for your participation in this study. However a packet of milk will be provided to your child and other children in his/ or her school. We hope that the information obtained from this study may help you seek early intervention for depression and will also help you in caring for your child/ children since your mental health has a direct link to how you raise them.

Confidentiality: You and your child's responses will be anonymous and we will not take any information that will reveal your or his/ her identity. Every effort will be made by the researcher to preserve your confidentiality including your child's identity by assigning code names/numbers for participants that will be used on all researcher notes and documents.

Notes and any other identifying participant information will be kept in a locked file cabinet in the personal possession of the researcher. When no longer necessary for research, all materials will be destroyed. The researcher and the members of the researcher's committee will review the researcher's collected data. Information from this research will be used solely for the purpose of this study and any publications that may result from this study. Participant data will be kept confidential except in cases where the researcher is legally obligated to report specific incidents. These incidents include, but may not be limited to, incidents of abuse and suicide risk.

Approval: This research has been approved by the department of Psychiatry, University of Nairobi and by the University of Nairobi/ Kenyatta National Hospital Research Ethics Board. If you have questions regarding your rights as a research subject, or if problems

arise which you do not feel you can discuss with the Investigator, please contact the Institutional Review Board Office at Kenyatta National Hospital.

Voluntarism: Your participation in this study is voluntary. It is up to you to decide whether or not to take part in this study. If you do decide to take part in this study, you will be asked to sign a consent form. If you and your child decide to take part in this study, you are still free to withdraw at any time and without giving a reason.. This will not affect the relationship you have with the researcher.

There may be risks that are not anticipated. However every effort will be made to minimize any risks. There are no costs to you or your child for your participation in this study and there is no monetary compensation to you or your child for your participation in this study.

Should you have any questions about the research or any related matters, please contact the researcher at 0722 421 323 or KNH/ERC Prof A Guantai Tel.....

Consent:

By signing this consent form, I confirm that I have read and understood the information and have had the opportunity to ask questions. I understand that my and my child's participation is voluntary and that I am free to withdraw at any time, without giving a reason and without cost. I voluntarily agree to take part in this study.

Signature _____ Date _____

Witness _____ Date _____

APPENDIX 3 - CHILD ASSENT FORM

Hello.....

My name is.....

I would like to request you to be part of a research I am conducting in your school. It is part of my Masters Degree study. It will involve my team and I measuring your height 3 times, collecting information on your age and asking you to solve a series of puzzles. They are fun to do any many children your age find them enjoyable. If you are unable to solve one puzzle we move on to the next one. The entire exercise will take between 25-35minutes. You will only take part because you want to and can stop at any time. There will be no problem if you say no and that you do not wish to be part of this research. If you say no, we will not ask you any further questions. If you wish to participate and complete this exercise, we will give each of your classmates a packet of milk. Even if you decline from participating in this study we will still offer you the packet of milk.

Would you like to participate?

Name of Child:

**APPENDIX 6 - SOCIO ECONOMIC STATUS QUESTIONNAIRE FOR
MOTHERS**

Socio Demographic Questionnaire for Mothers

Part A: to be filled in before scoring PHQ-9

- | | | | | |
|--|--|--------------------------------------|--|-------|
| <p>1. In what year were you born?</p> | <p>3. How old is your husband?</p> | _____ | | |
| | <p>4. How many children do you have?</p> | _____ | | |
| <p>2. What is your marital status?</p> | | | | |
| <p>Now married</p> | <table border="1" style="width: 100px; height: 30px; border-collapse: collapse;"> <tr><td style="width: 100%; height: 30px;"></td></tr> </table> | | <p>5. How many of your children are below 5 years?</p> | _____ |
| | | | | |
| <p>Widowed</p> | <table border="1" style="width: 100px; height: 30px; border-collapse: collapse;"> <tr><td style="width: 100%; height: 30px;"></td></tr> </table> | | | |
| | | | | |
| <p>Divorced</p> | <table border="1" style="width: 100px; height: 30px; border-collapse: collapse;"> <tr><td style="width: 100%; height: 30px;"></td></tr> </table> | | <p>6. How old were you when you got married?</p> | _____ |
| | | | | |
| <p>Separated</p> | <table border="1" style="width: 100px; height: 30px; border-collapse: collapse;"> <tr><td style="width: 100%; height: 30px;"></td></tr> </table> | | | |
| | | | | |
| <p>Never married</p> | <table border="1" style="width: 100px; height: 30px; border-collapse: collapse;"> <tr><td style="width: 100%; height: 30px;"></td></tr> </table> | | <p>7. What is the spousal age difference?</p> | _____ |
| | | | | |
| | | <p>(To be filled by interviewer)</p> | | |

8. What is the highest level of schooling you completed?

- | | | | |
|--|--|--|--|
| <p>a) None</p> | | <table border="1" style="width: 100px; height: 30px; border-collapse: collapse;"> <tr><td style="width: 100%; height: 30px;"></td></tr> </table> | |
| | | | |
| <p>b) Primary school</p> | | <table border="1" style="width: 100px; height: 30px; border-collapse: collapse;"> <tr><td style="width: 100%; height: 30px;"></td></tr> </table> | |
| | | | |
| <p>c) Secondary school</p> | | <table border="1" style="width: 100px; height: 30px; border-collapse: collapse;"> <tr><td style="width: 100%; height: 30px;"></td></tr> </table> | |
| | | | |
| <p>d) Poly-technical or equivalent</p> | | <table border="1" style="width: 100px; height: 30px; border-collapse: collapse;"> <tr><td style="width: 100%; height: 30px;"></td></tr> </table> | |
| | | | |
| <p>e) College</p> | | <table border="1" style="width: 100px; height: 30px; border-collapse: collapse;"> <tr><td style="width: 100%; height: 30px;"></td></tr> </table> | |
| | | | |
| <p>f) University</p> | | <table border="1" style="width: 100px; height: 30px; border-collapse: collapse;"> <tr><td style="width: 100%; height: 30px;"></td></tr> </table> | |
| | | | |

g) Post graduate

--

9. What is the highest level of schooling you husband completed?

- a) None
- b) Primary school
- c) Secondary school
- d) Poly-technical or equivalent
- e) College
- f) University
- g) Post graduate

10. Which of the following statements about occupational status apply to you?

- a) Not in paid employment
- b) Unskilled Casual Laborer
- c) Skilled Casual Labourer
- d) Self Employed
- e) Vendor
- f) Employee
- g) Civil Servant
- h) Other.....Specify

11. If you are presently not in paid employment, did you ever work in paid employment before?

Yes

No

If yes, since when are you no longer in paid employment:

Since ____|____(month) 20____|____(year)

12. How many months during the past five years were you without paid work?

Do not ask if has never been in paid employment:

____|____(months without work)

13. Which of the following statements about occupational status apply to your partner?

- a) Not in paid employment
- b) Unskilled Casual Laborer
- c) Skilled Casual Labourer
- d) Self Employed
- e) Vendor

- f) Employee
- g) Civil Servant
- h) Other.....Specify

14. What is the net household monthly income?

- a) Below 3000
- b) 3000-10,000
- c) 11,000- 20,000
- d) 21,000- 30,000
- e) 31,000- 40,000
- f) 41,000-50,000
- g) 51,000- 60,000
- h) 61,000-70,000
- i) 71,000-80,000
- j) 81,000-90,000
- k) 91,000- 100,000
- l) Above 100,000

15. What type of house do you live in?

- a) Traditional hut
- b) Single room
- c) Double room
- d) One bedroom
- e) Bangalore
- f) Maisonnet

16. Do you own your home or do you pay rent?

- Own
- Rent

If rented, how much per month? _____

17. How many of the following do you own? (If they do not own any score 0)

- a) Goats _____ Number _____
- b) Sheep _____ Number _____
- c) Cows _____ Number _____
- d) Donkeys _____ Number _____
- e) Other _____ Number _____

Women Empowerment

18. Are you involved in deciding what food is purchased in the house?
 Yes No

19. Are you in a women economic group such as Chama, merry go round?

Yes No

20. Are you free to save and keep some money for yourself?

Yes No

21. Does your spouse involve you in deciding when to sell livestock?

Yes No

22. Are you involved in deciding how many children you have?

Yes No

23. Are you the one that decides whether to be on a family planning method?

Yes No

24. When you are unwell, are you free to go to the hospital or does your spouse give you permission?

I am free to go

My spouse gives permission

Social Support

25. Are you happy with your marriage?

Yes Somewhat No

26. What has been the most upsetting experience for you in your marriage?

27. Do you feel torn between your spouse and your parents?

Yes Somewhat No

28. Are you happy with your relationship with your in laws?

Yes Somewhat No

29. Who could you really count on to help you in a crisis even if they will have to go out of their way to do so?

30. Who do you feel really appreciates you as a person?

Part B

To be asked after scoring PHQ 9

1. Did you experience these symptoms we have discussed when your child was aged:

a) 1 year Yes No
 _____ _____ _____

2. Did you experience these symptoms we have discussed when your child was aged:

a) 2 years Yes No
 _____ _____ _____

If yes in Qn 1 and 2 above: Use a **new** PHQ- 9 form. Interviewer to use the provided local calendar of events to help the mother recall when their child was age 1 if they cannot recall a calendar year. For the first question on the PHQ- 9 ask the mother “think back to the time your child was age 1 did you experience the following symptoms?”
Do the same for all the questions on the PHQ- 9. Once completed follow the same procedure if the answer to question 2 is yes.

3. Have you ever sought medical interventions for these symptoms?

Yes No

If No, give a

reason _____

Thank the interviewee and close.