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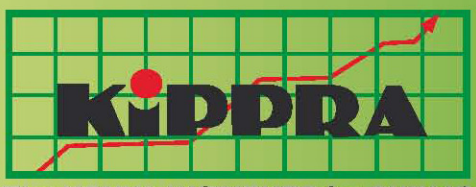

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Effects of Household Food Expenditure on Child Nutritional Status in Kenya

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Effects of Household Food Expenditure on Child Nutritional Status in Kenya

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Kenya Institute for Public Policy
Research and Analysis

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This paper is produced under the KIPPRA Young Professionals (YPs) programme. The programme targets young scholars from the public and private sector, who undertake an intensive one-year course on public policy research and analysis, and during which they write a research paper on a selected public policy issue, with supervision from senior researchers at the Institute.

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Abstract

This study examines the effect of household food expenditure on child nutritional status in Kenya for children between 6 and 60 months. Household food budget share is used instead of household food expenditure to capture poverty and income aspects of the households, an issue that cannot be well articulated by the former. Using the Kenya Integrated Household Budget Survey (KIHBS) 2005/2006, this study uses the Instrumental Variable (IV) probit approach to examine the underlying relationships. Household food budget share and participation in child growth clinic is found to be endogenous.

After correcting for endogeneity, the results reveal that the higher the household food budget share, the higher the chances of a child being malnourished. As a measure of poverty, it shows that malnutrition affects the poor who spend a greater share of their budget on food. The results also show that malnutrition increases with age. Exclusive breast-feeding reduces chances of child malnutrition, and participation in child growth monitoring clinic reduces malnutrition. Secondary level of education for mothers helps to reduce malnutrition, and single motherhood, either by choice or circumstances (death, divorce or separation), increases chances of child malnutrition.

In terms of policy, the study recommends an integrated strategy that improves child participation in growth monitoring clinic, which should also incorporate lessons on child nutrition. There is need to refocus government efforts in ensuring a minimum of secondary education for girls. Optimal exclusive breast-feeding can be achieved through facilitation of community-based promotion efforts supported by government procedures and government subsidy of food prices to bring down the food budget share. This will not only make food available for households, but also improve household welfare in terms of schooling and health care.

Abbreviations and Acronyms

BMI	Body Mass Index
CPI	Consumer Price Index
CoK	Constitution of Kenya
FAO	Food and Agriculture Organization
GAM	Global Acute Malnutrition
GoK	Government of Kenya
HAZ	Height for Age Z Scores
KDHS	Kenya Demographic and Health survey
KIHBS	Kenya Integrated Household Budget Survey
KNBS	Kenya National Bureau of Statistics
MDGs	Millennium Development Goals
PPR	Purchase Price Rise
UNICEF	United Nations Children and Education Fund
WHO	World Health Organization
WHZ	Weight for Height Z Scores
Z-score	The deviation of an individual's value from the median value of a reference population, divided by the standard deviation of the reference population.
2SLS	Two-Stage Least Squares

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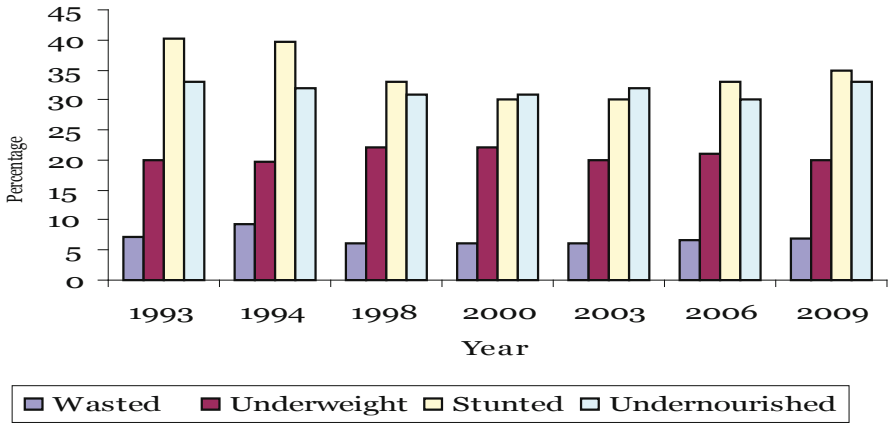
1. Introduction

The World Health Organization–WHO (2005) defines malnutrition as the cellular imbalance between the supply of nutrients and energy and the body's demand for them to ensure growth, maintenance, and specific functions. It refers to all deviations from adequate and optimal nutritional status in infants, children and adults. In children, malnutrition manifests as underweight, stunting and severely undernourished (wasting).

Malnutrition is a major cause of death in children below five years of age in Kenya. During childhood, malnutrition affects growth potential and cognitive, motor and socio-emotional development. In adulthood, the accumulated effects of long-term malnutrition can be a reduction in a worker's productivity, an increased burden of illness, and absenteeism in the workplace (United Nations Children and Education Fund–UNICEF, 1998). These may reduce a person's lifetime earning potential and ability to contribute to the national economy. In a country such as Kenya, this would undermine the Vision 2030 ambition of becoming a middle income economy, meeting the Millennium Development Goals (MDGs), and the national food and nutritional security policy objectives.

Malnutrition among children in Kenya is high and has not shown any significant improvement in the last decade (Figure 1.1). For example, in 1998, 33 per cent of children under five years were stunted, 22 per cent underweight, and 6 per cent severely malnourished (wasted). In 2003, 30 per cent were stunted, 20 per cent underweight and 6 per cent severely malnourished; and in 2006, 33 per cent were stunted and 21 per cent underweight. Additionally, an estimated 1.8 million children (30%) are classified as chronically undernourished (Kenya National Bureau of Statistics–KNBS, 2010).

Figure 1 1: Prevalence of children malnutrition in Kenya 1993-2009



Source: World Bank (2012)

Food intake is one of the important factors that affects nutritional status of people in general and children in particular, and it is mainly determined by the household's budget allocation on food (household food budget share). Food expenditure represents a big share of total household expenditure for low income families in Kenya, and is a significant budget item even for the higher income families. According to the 2005/06 Kenya Integrated Household and Budget Survey (KIHBS), 46 per cent of Kenyans are poor, hence have a higher food budget share. Poor households in both rural and urban areas spend 74 per cent and 57 per cent, respectively, compared to non-poor households 63 per cent and 44 per cent, respectively (Kenya National Bureau of Statistics–KNBS, 2007).

In recent years, more particularly 2011, there has been a rising trend in food prices globally and in Kenya (KNBS, 2011). Given that most poor households spend a greater share of their income on food, the increasing food prices are likely to impact negatively on the Kenyan people, particularly child nutritional status, which is already declining. This is in line with Maxwell and Smith (1992) who found that households that spend high proportions of their income on food are vulnerable to food insecurity, because they have limited reserve for meeting their food needs when they encounter shocks. For example, increase in food prices and lack of resources to grow or purchase sufficient food and means that their diet, in most cases, is deficient in energy and nutrients.

Given budget constraints and a fixed household income, increases in food prices lead to reduced household purchasing power, which then reduces food purchases and consumption, and increases inadequate dietary intake, which can cause malnutrition. In turn, disease susceptibility rises due to poor nutritional status. Greater workloads (to increase income) undermine care and feeding practices, resulting in poorer health and nutrition status. Reduced expenditure on health leads to insufficient health care and an unhealthy environment, and hence less adequate treatment of disease and poor health status (UNICEF, 2008).

Past studies have shown that households' most widespread coping mechanism amidst rising food prices is reducing food consumption, eating cheaper foods with reduced levels of nutritional value, and consuming less food per meal, or skipping meals (whole days in some cases) (Brinkman and Hendrix, 2010; Compton, Wiggins and Keats, 2010). Such coping strategies may lead to food insufficiency, culminating into low micronutrient and caloric deficiencies in the body, with detrimental consequences on people's health. The effect is, however, heavier among pregnant or lactating women, and children below five years, who are more vulnerable than others to becoming malnourished.

Therefore, examining the effect of household food expenditure (a proxy of food prices) on child nutritional status in a country with 46 per cent of the population living in poverty in the face of rising food prices, is of key and immediate concern.

1.1 Problem Statement

Malnutrition data shows no significant improvement in child nutritional status over the last decade in Kenya (KNBS, 2010). About 1.8 million children (30%) under five years are chronically undernourished. Also, Kenya has a high fertility rate and population for children under five is always on the rise. Meanwhile, poverty levels are quite high (46%), constraining household budgets. In the face of the current rising food prices, malnutrition is likely to worsen.

As a consequence of malnutrition, children under five years are likely to have impaired immune systems, poor cognitive development, low productivity to sustain the development of Kenya into a middle income country, and increased susceptibility to diet-related chronic diseases later in life, leading to increased disease burden. Additionally, malnourished female children are likely to grow into malnourished young women who are more likely to face birth complications, and give birth to babies who are undernourished, and thus worsening the situation (UNICEF, 2008).

While an attempt to address malnutrition in Kenya has been made through many channels, including the development of national food and nutrition security policy, the goal of reducing child malnutrition is still far from being fulfilled in the face of increasing food prices, and a high percentage of the population is living in poverty.

1.2 Objectives of the Study

The main objective of this study is to investigate the effects of household food expenditure on child nutritional status in Kenya. The specific objectives are to:

(i) Examine whether and how household food expenditure affects child nutritional status in Kenya

(ii) Find out factors that affect child nutritional status in Kenya

(iii) Provide policy recommendations

1.3 Research Questions

(i) How does household food expenditure affect child nutritional status in Kenya?

(ii) What are the factors affecting child nutritional status in Kenya?

(iii) How does the effect of household food expenditure on child nutritional status in Kenya inform the country's efforts in improving child nutritional status?

1.4 Justification

This study is motivated by four main developments in policy and research circles. First, the fact that by 2030, the children born between 2005 and 2011 would be entering the country's labour market to sustain the development of the country as a middle income country. Therefore, safeguarding their health through improved nutritional status today will greatly impact on productivity then. Literature supports investment on children by showing that under-nutrition in young children contributes to a country's overall disease burden than in adolescence or adulthood. To curb future human capital deficits and to reduce the overall disease burden, it is important to invest in this future labour force today through appropriate and informed policy.

Second, prevalence of underweight children (under five years of age) and the proportion of population below minimum level of dietary energy consumption are the United Nations indicators for achieving MDG 1, which Kenya is committed to. In Kenya, food expenditure represents a significant share of total household expenditure for low income families, and is a significant budget item for the higher income families too. Therefore, it is important to understand its effect on child nutritional status in order to help design appropriate interventions for reducing the high child malnutrition in Kenya.

Additionally, while food prices are always volatile, recent rapid increases are of great magnitude with adverse effects on the population and a threat to filling existing gaps identified in the health sector in Vision 2030. Food price increases also affect the people's "right to food," which "entails an obligation of the state to respect, protect and fulfill access to adequate food for all its people at all times." The Constitution of Kenya enshrines the right to food:

> "Every person has the right to accessible and adequate housing, to be free from hunger, and to have adequate food in acceptable quality. Every child has a right to basic nutrition and health care."

Finally, managing malnutrition in a country with 46 per cent of its population living in poverty, in the face of rising food prices, requires a deeper understanding and designing of appropriate policy. Specifically, it calls for understanding of how household food expenditure affects nutritional status. This paper examines how household food expenditure affects child nutritional status, and informs on what the current and possible future food price increases posit for Kenya in terms of child nutritional status.

2. Literature Review

2.1 Introduction

Understanding the determinants of child nutritional status, more specifically the role played by household food expenditure on child nutrition, is important for implementing efficient and effective existing food security as well as a nutrition policy. This section provides a selective review of the theoretical and empirical literature on the relationship between household food expenditure and child nutrition. The vast bulk of this literature is concerned with countries outside Kenya.

2.2 Theoretical Literature

Theoretical models of the relationship between household food expenditure and child nutrition generally follow one or two approaches; the theory of household production of health, and human capital. This study follows household production of health approach. In this approach, nutritional status is a proxy of health and it is considered a human capital, which results from long term nutrition.

The modern literature on the approach was initiated by Becker (1965). According to this study, households combine time and market goods to produce more basic commodities that directly enter their utility function. In the same argument, Grossman (1972) formulated a formal model to analyze health capital, treating health as a form of human capital and health status reflects the stock of this capital. On estimation, Grossman (1972) concluded that health is a form of human capital (health capital) and individuals derive both consumption (health provides utility) as well as production benefits (health increases earnings) from it.

Following Grossman (1972), poor health in childhood depresses the formation of human capital because much of a person's physiological and cognitive development happens in childhood and human capital investments should be made early in life. Nationally, Behrman (2009) shows that early life health increases return to human capital, which further increases a person's future income. The study attributes the increase in human capital affects lifetime income both directly and through investments.

2.3 Effects of Food Expenditure on Child Nutritional Status

The basic idea is that much of the literature on the effects of food expenditure on child nutritional status is focused on the mechanics of food prices on nutrition.

Food security is an issue of supreme importance in this context, especially to people who are suffering from persistent hunger, malnutrition and also to others who are at the risk of doing so in the future due to rising food prices. Whereas food security is a widely debated issue, studies linking food expenditure and child nutritional status are limited.

High food prices cause real household purchasing power to fall when incomes are constant (Timmer, Falcon and Pearson, 1983). This drop in real incomes causes the expenditures on most goods to reduce with the exception of superior commodities. In summary, this study demonstrates two effects of change in relative prices of food: income and substitution effect. As prices go up, amounts of food purchased tend to reduce as a price change reduces the purchasing power of nominal income (income effect). On the other hand, substitution effect is where a price change alters the quantity demanded of food and its substitutes.

Recent work on child nutrition in Kenya includes that of Kabubo-Mariara, Ndenge and Domisiano (2008), who used pooled sample of the 1998 and 2003 Kenya Demographic and Health Survey datasets to analyze the determinants of children nutritional status (those aged less than 36 months). The results from applying survey regressions indicated that older children, those of multiple births, boys, and those of higher birth orders are more likely to suffer malnutrition than their counterparts. The study also found that household size adversely affects children nutritional status, which improves with the age of the mother. The height and education of the mother also improves children's nutritional status. However, this study did not consider food prices as a determinant of children's nutritional status.

Evidence in the same direction is also found in Zambia. Masiye et al. (2010) investigated the determinants of child nutritional status for children between 3 to 59 months, using a cross-sectional survey data conducted in 2006. Their results show that household expenditure is a leading determinant of nutritional status of a child. Also, parental education affects child nutrition. They argue that children become more malnourished as they get older than 18 months, and show that rural children are more likely to suffer from poor nutrition than urban counterparts.

Still focusing on the continental studies, a study by Hartwig (2002) on short-run effects of the 2002 food crisis in Malawi shows that reduced access to food means that a vulnerable population already spending up to two-thirds of their household income on food rationalizes consumption to prioritize calorie-rich but nutritionally poor foods. This coping mechanism results in a pattern of initial decline in dietary quality, followed by reduced quantities of diet as remaining resources approach depletion, heralding an increase in micronutrient malnutrition.

Moving from Africa, Nguyen and Nguyen (2009) tested the potential risk factors in Vietnam for children between 6 and 36 months. Using underweight, stunting and wasting, they find region of residence, ethnic group, mother's occupation, household size, mother's BMI, number of children in a family, weight at birth, time of initiation of breast-feeding and duration of exclusive breast-feeding to significantly relate to child malnutrition. Unlike other studies, they found that mother's education level and children having diarrhoea in the last two weeks of per capita family income were not significantly related to child malnutrition. Among the significant variables, low birth weight and duration of exclusive breast feeding (that is breast-feeding children for less than six months) are found to be the most important risk factors. With regard to age and sex, their results indicated that the risk of malnutrition increases with age, and it is more prevalent in boys than girls.

In a related work in Malaysia for children between 0 and 60 months, Khor et al. (2009) investigated the determinants of child nutritional status. The key finding is that prevalence for underweight increases with age. Children who are not exclusively breastfed for six months are more likely to be underweight. Additionally, they found that maternal knowledge improves child nutritional status.

According to a study investigating how changes in rice price affects child underweight in Bangladesh (Harriet, Lynnda and Martin, 2008), macroecomic food policies have the potential of reducing malnutrition among children. Specifically, rice expenditure is positively correlated with the percentage of underweight children. As rice expenditure declines, households spend more on non-rice foods.

Along similar lines, Robert and Nolan (2008) studied the impact of world food price crisis on nutrition in China. In their study, they show that the overall nutritional impact of the world food prices increases with small impact because households are able to substitute to cheaper foods and, to an extent, shift from non-food to food expenditures. This study, however, focused on the short-term effects.

In a more recent work, Brinkman and Hendrix (2010) investigated the impact of the crises on food consumption, nutrition, and health through risk analysis and simulations. Taking a nutritional economics approach and applying regression analysis using the food consumption score on nutritional status and health, they find that dietary diversity, quality, and quantity decline with rising food prices, placing vulnerable populations at increased risk of malnutrition.

Available evidence from the Asian economic crisis as well as from Africa by Bloom et al. (2005) and Webb (2010) shows that as food prices increase, households first reduce consumption of more expensive food items, typically animal source foods (meat, poultry, eggs, fish, and milk), and fruits and vegetables that are good sources of high-quality nutrients. This is followed by a reduction on the size and frequency of meals. With this coping mechanism, households' nutritional status reduces, with the greatest impact being felt among children below five years. Research by the World Food Programme (WFP) on household level food security assessments conducted in 2008 found similar evidence as well as reductions in health care visits or health expenditures, increased school drop-outs, and sale of assets as a result of increased food prices.

A study on Young Lives (an International Study of Childhood Poverty) in the United States indicates that high food prices will impact on children in two ways (Dercon, 2008): first, the short-run impact of family budgets. The constraint on family budget would not only lead to less food being available or cheaper food being purchased, but also to less funds for non-food items such as health and education. Second, it will have a long-term impact on children's health, psycho-social well-being and their educational achievements.

Ivanic and Martin (2008) argue that higher prices of food lead to higher levels of undernourishment as poor net consumers find themselves unable to purchase the minimum amount of calories, nutrients and proteins required for their day-to-day activities. Higher food prices have two main effects on net buyers of food (food consumers): an income effect decreases purchasing power of poor households, and a substitution effect shifts to less nutritious food. The poor have no choice but to reduce their overall food consumption in response to higher prices from levels that are already too low. For those households that are close to subsistence and are already consuming the cheapest sources of calories (for example, less nutritious food), the substitution possibilities are more limited.

Additionally, higher food prices also typically induce lower spending on non-food items (such as education and health), lower food consumption, especially meat, dairy products and fish, and shifts to lower-priced and/or lower quality food. In addition to lower caloric intake, lower consumption of vitamins and minerals increases micronutrient deficiencies and adds to under-nutrition.

2.4 Overview of Literature

There is no specific literature attempting to link household food expenditure and children nutritional status directly. However, literature on the topic often focuses on food prices and nutrition. Additionally, most of the studies have not

focused their attention on children. The literature on the effects of household food expenditure on child nutrition suggests that high food prices impact on health and nutrition in various ways. The starting point is that with a given budget constraint and a fixed household income, increases in food prices lead to reduced food purchases, consumption, and increases inadequate dietary intakes, which can cause malnutrition.

It is evident that in the presence of high food prices, most households reduce their food consumption to eating cheaper foods with reduced levels of nutritional value and consuming less food per meal, or skipping meals. Such coping strategies lead to food insufficiency, culminating into low micronutrient and caloric deficiencies in the body with detrimental consequences on people's health. The effect is, however, heavier among pregnant or lactating women, and children below five years, who are more vulnerable to malnourishment.

Higher food prices induce lower spending on non-food items (such as education and health), lower food consumption, and shifts to lower priced and/or lower quality food. It is not only because of higher food prices that nutrition is affected, but poverty also contributes to the menace. Specifically, poor households are found to spend a greater percentage of their income on food.

Whereas it is possible for higher income households to substitute highly-priced foods with low priced ones, poor households are close to subsistence and are already consuming the cheapest sources of calories (for example, less nutritious food), thus their substitution possibilities are more limited, making them to suffer most during price increases.

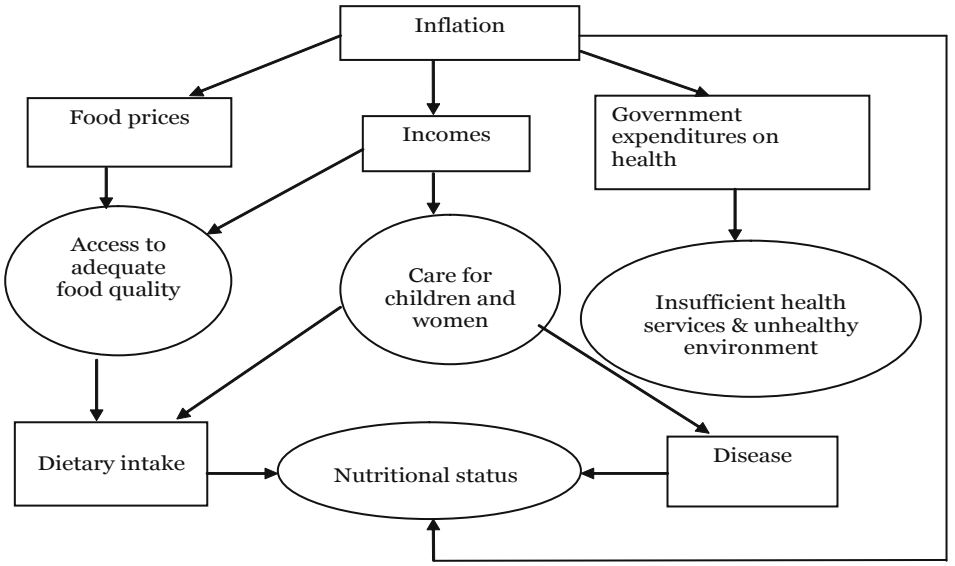
3. Methodology and Data

In this section, the study considers in more detail some simple theoretical models explaining the relationship between household food expenditure and child nutrition based on literature in section 2. Using the household production of health approach, this section starts by presenting a conceptual framework.

3.1 Conceptual Framework

To present the mechanisms through which household food expenditure impacts on child nutritional status, UNICEF's (2008) study on the status of child malnutrition is adopted. According to this study, high food prices impact on health and nutrition in various ways. Given budget constraints and a fixed household income, increases in food prices lead to reduced food purchases and consumption, as well as increases in inadequate dietary intakes that can cause malnutrition. In turn, this heightens susceptibility to disease, leading to a poor health status. Greater workloads (to increase income) undermine care and feeding practices, resulting in poorer health and nutrition status. Reduced expenditures on health lead to insufficient health care and an unhealthy environment, hence less adequate treatment of disease and poor health status (UNICEF, 2008). This description is presented in a conceptual framework in line with the UNICEF's 1998 model of malnutrition (Figure 3.1).

Figure 3.1: Conceptual framework for the analysis



Adopted from UNICEF (2008)

3.2 Analytical Framework

In the theory of household production of health, anthropometry provides the most important indicators of children's nutritional status. Height and weight are often used as a proxy for early life and nutrition. Height-for-age (stunting), weight-for-age (underweight), weight-for-height (wasting) and BMI have been comprehensively used in anthropometry. The height-for-age is an indicator of linear growth retardation and cumulative growth deficits. It reflects long-term failure to receive adequate nutrition, and it is also affected by recurrent and chronic illness. It does not vary according to the recent dietary intake.

Weight-for-height is an indicator of current nutritional status of the child and represents failure to receive adequate nutrition or an episode of illness in the recent past. Weight-for-age is a composite index of height-for-age and weight-for-height. It takes into account both acute and chronic malnutrition. Though BMI is the most useful measure of malnutrition in adults, in children it captures short-run nutritional status. Low BMI is correlated with an increased risk of premature death, and is an early indicator of future chronic health problems.

Based on literature in section two, this study assumes a simple household production function model. The model is slightly modified from the original Becker (1965) household production function model. In the household production function model, households are assumed to maximize their utility function subject to constraints.

To outline the effects of household food expenditure on child nutritional status in Kenya, the model used in a study by Kabubo-Mariara, Ndenge and Domisiano (2008) is used with modifications. In this study, child nutritional status H_i, the output of a production function is thought of as being generated by child characteristics X_i-age, birth order and gender; household characteristics, X_{hi} paternal education, household food expenditure, and household assets; and other variables X_{ci} are included to capture whether the child had diarrhoea, fever, or respiratory infections. Therefore, the reduced nutritional production function is:

$$Hi = h(Xi, Xhi, Xci, \in i) \quad \ldots\ldots(1)$$

where H_i is a measure of child nutritional status (BMI), X_i a vector of child specific characteristics, X_{hi} a vector of household specific characteristics, X_{ci} a vector of other variables, and ε_i is the disturbance error term.

From the above equation, we can write the equation in a linear form as:

$$H = X\beta + Vi \quad \ldots\ldots(2)$$

where $X= (X_i, X_{hi}, X_{ci})$ and V_i is a random error term that represents the unobserved individual, household and other variables that affect child nutritional outcomes, and it is assumed to be uncorrelated with the X variables. β are the corresponding vectors of coefficients.

3.3 Empirical Approach

The variable for child nutritional status is presented as a bivariate variable; that is, the variable takes two different outcomes: poor nutritional status and good nutritional status. When dealing with bivariate variables, ordinary least squares (OLS) regression model is not appropriate as their estimators of $E(Y_i/X_i)$ are not bound by 0 and 1, the error term is not normally distributed and the variances of the disturbances are heteroskedastic (Gujarati, 2004). For bivariate dependent variables, it is more appropriate to use binomial probit model, which assumes a non-linear distribution of the data and normal distribution of the error term ε_i.

From the above equation, $H = X\beta + Vi$.....(2)

where H represents the probability of a child being malnourished (poor child nutritional status), X representing the explanatory variables, β_s are the corresponding coefficients to be estimated and V_i represents vector of error terms. From linear probability model, the probit model gives the probability of being malnourished.

$$\Pr ob\left(yi = \frac{e^{x\beta}}{1+e^{x\beta}} \right) = F(X\beta) \quad \text{.....(3)}$$

$$\Pr ob(goodnutrition) = \Pr ob(poornutrition)\frac{e^{x\beta}}{1+e^{x\beta}} = F(X\beta) \quad \text{.....(4)}$$

For estimation, maximum likelihood model will be used:

$$L = \pi \frac{e^{X\beta}}{1+e^{Xi\beta}} \pi j \frac{1}{1+e^{Xj\beta}} \quad \text{.....(5)}$$

where *i* refers to children with good nutritional status and *j* malnourished children.

Therefore, the formula given for the probit model is:

$$L = \frac{\Pr ob(PoorNutririonalStatus)}{\Pr ob(GoodNutritionalStatus} = X\beta \quad \text{.....(6)}$$

where *L* is the maximum likelihood.

3.4 Data and Variables

3.4.1 Data

In order to analyze the effects of household food expenditure on child nutritional status, the study used cross-sectional data collated in Kenya by KNBS for a period of 12 months starting 16 May 2005 to April 2006. The KIHBS covers data on household member roster; education; health, fertility and household deaths; water, sanitation and energy use; consumption of food over the past one week; regular non-food item expenditures-past one month; agriculture holding and output; livestock; household enterprises, transfers; other income; recent shocks to household welfare and credit. The survey is representative at national, regional and rural-urban level.

The survey was conducted in 1,343 randomly selected clusters across all the 70 districts in Kenya and comprised 861 rural and 482 urban clusters. Following a listing exercise, 10 households were randomly selected with equal probability in each cluster, resulting to a total sample size of 13,430 households.

Child health and anthropometry constitute child health dataset among several fields in the database. The study did not use the full KIHBS data available, but merged the child health dataset for children between 6 and 60 months with other relevant data on household socio-economic variables and parental characteristics containing information on household member information, education, aggregate consumption and weekly expenditure. The combined dataset includes 7,577 observations from 13,158 households.

The unit of observation is a child aged 6 to 60 months. For each child, information is available on his/her weight in kilogrammes, height in centimetres, months of exclusive breastfeeding, immunization, age in months, place of delivery, gender, participation in growth monitoring clinic, community nutrition programmes and whether a child had diarrhoea in the last two weeks preceding the survey. The data file for each child is linked with other relevant files containing data on household-level conditions and parental characteristics. Key variables such as food prices, BMI for-age and child nutritional status were also derived by dividing body mass in kilogrammes by height in metres squared (kg/m^2).

3.4.2 Dependent variable

BMI for age was used as the dependent variable. Though BMI is a most useful measure of malnutrition in adults, it can be used in children because it is a good indicator of short-run nutritional status, hence it serves as a reasonable proxy for individual well-being. The study did not use the two commonly used anthropometric measures of a child's nutritional status weight-for-height (a

measure of wasting) and height-for-age (a measure of stunting) because the data used had no information on the date of birth of children, and presence or absence of oedema that would aid in their calculation.

The use of BMI as a measure of child nutritional status is supported by other past studies (Khor et al., 2009; Tee et al., 2002 and Lekhraj et al., 2007). According to the study by Khor et al. (2009), weight-for-height (stunting) is not a good anthropometric measurement compared to BMI for age because it is a less pertinent indicator of nutritional status for normal situations. Since the calculation of BMI is based on two simple measures: height and weight, it is less susceptible to measurement error than other anthropometric indicators. Additionally, the inaccuracy that arises with BMI measure for not accounting for weight that comes from muscle instead of fat especially from athletes, muscular people and pregnant women is not a problem among children (Ismail and Vickneswary, 1999).

BMI calculations use height and weight to come up with a number that can be used to determine if a person is underweight, healthy, overweight or obese. BMI-for- age for children are described differently from normal adults. According to the growth chart developed by the Centre for Disease Control and Prevention (CDC), BMI lower than the 5^{th} percentile is defined as underweight, BMI between 5^{th} and 85^{th} percentile is defined as normal weight, BMI between 85^{th} percentile and 95^{th} percentile is defined as overweight, and BMI more than 95^{th} percentile is defined as obese (de Onis, 2004). For this study, the variable for child nutritional status is a binary variable; that is, a child is described to have either good nutritional status if he/she has normal weight or poor nutritional status if he/she is underweight, overweight or obese.

3.4.3 Explanatory variables

This study includes household level, child level and community characteristics. It uses food budget share rather than the household per capita expenditure used in past studies (Masiye et al., 2010) to capture both aspects of poverty and income levels of households. Food budget share is calculated by dividing the household food expenditure by total household expenditure. It is expected that poor households spend more of their budget share on food and that as poverty increases, child nutritional status deteriorates. On the other hand, income affects the composition of household food basket, food quality and quantity.

Parental education is another factor considered to affect the nutritional status of children. The basic hypothesis is that education, especially maternal education, improves child nutritional status *ceteris paribus*. This study used a dummy for mother's highest educational qualification (none, primary, secondary, tertiary and above). This is in line with past studies that have found the mother's education to

impact more on child nutritional status than the father's (Frost, Forste and Haas, 2005; Thomas, Strauss, and Henriques, 1991).

Other included variables are household health expenditure, household size, dummies of gender, region of residence, duration of exclusive breast-feeding, marital status, participating in growth monitoring clinic, immunization against childhood diseases, and whether a child had diarrhoea or not. Household size is

Table 3 1: Variable descriptions

Variable	Description
Age	Child's age.
Age squared	Child's age in months squared.
Sex	Child's gender: 1 is for male; 0 is for female.
BMI	Child's Body Mass Index.
Bodywt/cntstat	Bodyweight category: 0 for underweight; 1 for normal weight; and 2 for overweight.
hfdbs	The total household budget that is allocated food consumption (purchased and auto-consumption).
Debf	Whether a child is exclusively breastfed-0 for less than six months; and 1 for six months and more.
rururb	Area of residence in terms of rural and urban areas-0 for rural; and 1 for urban.
Hedq	Highest educational qualification attained by the child's mother -0 for none; 1 for primary; 2 for secondary and 3 for tertiary (certificate, diploma and university).
Pod	Place of delivery-0 for home; and 1 for hospital (dispensary, clinic, maternity home and health centre).
Fdp	Food prices for food consumed by household.
Imz	Vaccination to prevent childhood diseases-0 for non vaccination; and 1 for vaccination.
Pcp	Participation in community programmes -0 for no; and 1 for yes.
Pgmc	Participation in growth monitoring clinic -0 for no; and 1 for yes.
oponae	Operation of non agricultural income generating activities -0 for no; and 1 for yes.
cnstat	Child's nutritional status-0 for poor nutrition, and 1 for good nutrition.
mstat	Marital status of the child's parent/guardian: 0 for single (never married); 1 for married but divorced, widowed or separated; and 2 for married.
Lvsop	Household's ownership of livestock -0 for no; and 1 for yes.

used to capture the aspect of fertility; that is, large household size implies higher fertility, which is also associated with poverty. From literature, boys are generally prone to malnutrition compared to girls when all other factors are held constant (Wagstaff, Doorslaer and Watanabe, 2003).

3.5 Estimation and Testing Methods

In the model, it is possible that food budget share, participation in growth monitoring clinic, household health expenditure and household size may be endogenous. The study deals with this possibility in two ways. First, endogeneity test is done for each of the variables. Second, if the test results confirm endogeneity, the study uses Instrumental Variable (IV) probit approach to address the problem.

4. Estimation Results and Discussions

The estimation results can be classified into three groups: the descriptive statistics for each variable used; the baseline results; and the estimation results after correcting for endogeneity (Instrumental Variable Probit approach). The descriptive statistics for the key variables used in the estimation are presented in Table 4.1, while baseline results and the estimation results after correcting for endogeneity are presented in Tables 4.2 and 4.3, respectively.

4.1 Descriptive Statistics

The descriptive statistics of the sample are presented in Table 4.1. BMI among Kenyan children aged 6 to 60 months are shown separately for rural and urban areas. BMI was calculated by dividing body mass in kilogrammes by height in metres squared (kg/m^2).

The results demonstrate that most of the children both in rural and urban areas are healthy. For example, majority of the children are having a BMI of 17.17, which is above that of underweight children, which is 14.00 and below. In terms of rural-urban variation in children's BMI, there is no significant difference. BMI decreases with age from 6 to 60 months for both rural and urban households. This could be because children find it hard to have sufficient diet to enable their nutrition unlike when they are young and other foods supplement breast milk.

Based on children's BMI explained in the introductory part of this section, on overall, about 35 per cent of children in Kenya are underweight; 44 per cent have normal weight; 11 per cent are overweight and the remaining 10 per cent obese. Differentiating these results in terms of area of residence does not give different results. However, rural children are more slightly underweight compared to urban children (35.79% and 34.58%, respectively), while urban children are more overweight and obese than rural children (11.95% and 10.31% for overweight; and 9.96% and 9.77% for obesity for urban and rural children, respectively). These results are in line with the findings of Lekhraj et al. (2007) who found that the prevalence of obesity was slightly higher in urban areas (12%) compared to rural areas (11.3%) in Malaysia.

In this analysis, nutritional status of children is used as a dependent variable, where a child is described to have good nutritional status if he/she has normal weight and poor nutritional status if he/she is underweight, overweight or/and obese. In terms of this, the results show that overall, 44 per cent of children between 6 and 60 months in Kenya have poor nutritional status; that is, they are underweight, overweight and obese, while 56 per cent have good nutritional

Table 4 1: Descriptive statistics of sample, selected variables

Variable	**Rural**			**Urban**	**Overall**			
	N	Mean (95%CI)	N	Mean (95% CI)	Mean (95% CI)			
BMI for-age (Kg/m²)								
6-12 months	546	26.83 (± 13.77)	268	25.43(± 9.67)	26.13 (± 11.72)			
13-24 months	904	21.65 (± 10.18)	458	20.87 (± 9.60)	21.26 (± 9.89)			
25-36 months	928	16.46 (± 6.11)	457	17.55 (± 12.43)	17.05 (±9.27)			
37-48 months	901	14.02 (± 5.32)	485	13.83 (± 4.84)	13.93 (± 5.08)			
49-60 months	702	12.35 (± 4.47)	325	11.97 (± 3.91)	12.11 (± 4.19)			
Overall	5093	17.78 (± 9.65)	2484	17.57 (± 9.83)	17.68 (± 9.24)			
Bodyweight (%)								
Underweight	1380	35.79	715	34.58	34.98			
Normal weight	1744	43.94	878	43.70	43.78			
Overweight	477	10.31	206	11.95	11.40			
Obese	390	9.77	199	9.96	9.83			
Food budget share (ratio)								
Food budget share	5093	0.5032 (± 0.32)	2484	0.2264 (± 0.28)	0.41(± 0.33)			
Child nutritional status (%)								
Poor nutritional status	2,247	56.30	1120	56.06	56.22			
Good nutritional status	1,744	43.70	878	43.94	43.78			
Monthly household food expenditure (Ksh)	5,093	2144.0 (±1700.3)	2484	5383.60	3206.0			
Household size (No.)	5,093	5 (±3)	2484	4 (±2)	5 (±3)			
Duration of exclusive breastfeeding (months)	4,923	3.2	2402	3.1	3.2			
Household health expenditure (Ksh)	5,093		887.10	2484	1468.60	1077.80		
Participation in community programmes	5,091	Yes	No		Yes	No	Yes	No
		86.36	13.64		82.02	17.98	84.93	15.07
Child immunization (%)	5,091	Yes	No	2484	Yes	No	Yes	No
		91.63	08.47		91.47	08.53	91.58	08.42
Child participation in growth monitoring clinic	5,091	Yes	No	2484	Yes	No	Yes	No
		89.61	10.39		88.65	11.35	89.29	10.71

Note: Standard deviation in parenthesis

Source: Author's estimates based on the data

status. By region of residence, the results are the same with only decimal point differences.

Household food budget share reveals an interesting finding. Rural households' food budget share is 0.50, while the urban one is 0.22. These results imply that for rural households in Kenya, 50 per cent of their total spending goes to food (purchased and auto-consumption), while urban households spend 22 per cent of their total spending on food. Overall, a larger portion of households' budget is spent on food (41%). This is quite high and depicts high poverty level in the country, as it shows that most households spend a greater proportion of their income on food. Related to this is the household food expenditure which, on average, households spend Ksh 3,206 monthly, about Ksh 106 daily on food (purchased and auto-consumption per household).

By region, there is substantial rural-urban variation household food expenditure. For example, rural households spend Ksh 2,484, while their urban counterparts spend Ksh 5,383.60. Though the rural households spend less on food compared to the urban households, this represents a greater percentage of their total spending, a pointer that poverty could be more serious in the rural than urban areas.

Household health expenditure also exhibits the same characteristics. Households spend Ksh 887.10 and Ksh 1,468.60 for rural and urban households, respectively. Household size varies from four among urban households to five among rural households. Even with the government's campaign on exclusive breast-feeding for six months, most women exclusively breast-feed their children for only three months. Compared to the urban households, women residing in rural areas exclusively breast-feed their children for about three weeks longer.

Majority of the children participate in child growth monitoring clinic, community programmes and are also immunized against childhood diseases such as polio and measles. For example, 91.6 per cent of children in the rural areas were immunized against childhood diseases, 86.36 per cent of the rural children participated in child growth monitoring clinic, while 89.6 per cent participated in community programmes. On the other hand, 91.5 per cent of urban children were immunized and 88.7 per cent participated in child growth monitoring clinic.

4.2 Determinants of Child Nutritional Status in Kenya

4.2.1 Baseline results

The baseline results are presented in Table 4.2. These estimation results do not take into consideration the endogeneity problems, but take into account issues of heterogeneity and lack of normality by presenting robust results.

4.2.2 Results after correcting for endogeneity

Using IV procedure to eliminate the bias induced by measurement error and possible endogeneity of household food budget share, participation in child growth monitoring clinic, household size, child immunization and health expenditure, the estimation results are presented in Table 4.3. Before using IV, tests for endogeneity of the suspected endogenous variables were done by first running reduced form models using all the exogenous variables in each case. The results for endogeneity confirm that food budget share and participation in child growth monitoring clinic are the only endogenous variables from the suspected ones. From the baseline results in Table 4.2, household food budget share, age of child in months, age of child squared, participation in child growth monitoring clinic, having diarrhoea, male child, rural residence, exclusive breast-feeding, secondary level dummy of highest educational qualification and marital status

Table 4.2: Baseline results

Variable	Coefficient	Standard error	t-statistic	Probability
Food budget share	2.132249	.9477791	2.25	0.024 **
Age	.0648923	.0116096	5.59	0.000 ***
Age squared	-.0010985	.000172	-6.39	0.000 ***
Immunization	-.0088881	.1146077	-0.08	0.938
Diarrhoea	-.2028219	.1087654	-1.86	0.062 *
Gender-Male	.1317743	.0674167	1.95	0.051 **
Household size	.0168526	.012258	1.37	0.169
Rural residence	.1891761	.0822364	2.30	0.021 **
Health expenditure	8.32e-06	.0000116	0.72	0.474
Exclusive breastfeeding	-.1567189	.0828543	-1.89	0.059 *
Growth monitoring clinic	-.2223994	.0961552	-2.31	0.021 **
Primary education	-.0975276	.084915	-1.15	0.251
Secondary education	-.2466694	.1197343	-2.06	0.039 **
Tertiary and above	-.0209031	.1267663	-0.16	0.869
Single after marriage	.1367449	.0711115	1.92	0.054 **
Single	.3081565	.1192456	2.58	0.010 ***
Constant	-1.170411	.2242823	-5.22	0.000
Note: Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1				

Source: Author's from the data analyzed

Table 4.3: Estimation results after correcting for endogeneity

Variable	Coefficient	Standard Error	t-statistic	Probability
Food budget share	25.80388	11.41694	2.26	0.024 **
Age	.0202796	.0065818	3.08	0.002 ***
Age squared	-.0003584	.0000966	-3.71	0.000 ***
Immunization	.0499279	.1063455	0.47	0.639
Diarrhea	-.0479605	.0559302	-0.86	0.391
Gender-male	-.0100483	.041394	-0.24	0.808
Household size	-.0011049	.0069858	-0.16	0.874
Rural residence	-.0119383	.2624286	-0.05	0.964
Health expend	-2.19e-06	7.29e-06	-0.30	0.764
Exclusive breastfeeding	-.0984186	.0487151	-2.02	0.044 **
Growth monitoring clinic	-.1026261	.048546	-2.11	0.035 **
Primary education	.0079881	.0490244	0.16	0.871
Secondary education	-.2472898	.1198751	-2.06	0.039 **
Tertiary and above	.0928675	.0727224	1.28	0.202
Single after marriage	.0914062	.0540941	1.69	0.092 *
Single	.1619544	.0705129	2.30	0.022 **
Constant	-1.153994	.2388949	-4.83	0.000
Note: Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1				

are significant, while immunization, household size, health expenditure, primary and tertiary and above level dummy of highest educational qualification are insignificant. Of the significant variables, age and age squared are significant at 1 per cent; household food budget share, male child, rural residence, participation in growth monitoring clinic, marital status and secondary level dummy of highest educational qualification are significant at 5 per cent; and exclusive breast-feeding is significant at 10 per cent.

In the second stage after correcting for endogeneity in Table 4.3, household food budget share, age, age squared, exclusive breast-feeding, participation in child growth monitoring clinic, secondary level dummy of highest educational qualification, and marital status survive. Other significant variables in equation one such as male gender, having diarrhoea and rural residence cease to be significant. The study therefore interprets only the significant variables in Table 4.3.

Overall, the results reported in Table 4.3 uncover a number of interesting findings. One main finding is that household food budget share affects child nutritional status in Kenya. The results show that the higher the household food budget share, the higher the chances of a child being malnourished. Since household food budget share is a measure of poverty, this result suggests that when poverty level increases, child nutritional status worsens. This argument is also supported by the descriptive statistics in Table 4.1, where the poor spend a greater share of their income on food. Despite higher spending on food, the low income households still suffer more from malnutrition. This indicates that there is a likelihood of food price increase, which denies the poor households the ability to substitute food towards less expensive varieties as they are likely to be already consuming the cheapest food sources. This finding is consistent with previous findings in Zambia, Ethiopia and Malawi (Masiye et al., 2010; Luc, 2001; and Renate, 2008).

In terms of the effect of age on child nutritional status, the positive coefficient shows that malnutrition increases with age, suggesting that younger children have better nutritional status than older children. The result could be because young children's food is supplemented by breast milk, which is rich in nutrients. However, as they grow, they are more exposed to lack of/poor quality diet, hence more prone to malnutrition. Similar results were found for Vietnam children between 6 and 36 months (Nguyen and Nguyen, 2009). The negative coefficient of the square of age suggests that the effect of age is convex, implying that the effect of malnutrition increases with age though at a certain stage in life, malnutrition's effect seems to be small.

It is also important to bring out a key message of the results reported in Table 4.3, which is that exclusive breast-feeding matters: children who are exclusively breast-fed for six months as per the WHO recommendation are less likely to suffer from malnutrition compared to their counterparts who are exclusively breastfed for less months. This finding emphasizes the nutritional role played by breast milk. However, from the descriptive statistics, a lot more effort needs to be put towards this as, on average, most mothers only breast-feed their children exclusively for three months (perhaps this explains why malnutrition rates among children are quite high in Kenya). Similar results were found by Nguyen and Nguyen (2009) and Khor et al. (2009) who showed that children exclusively breast-fed for six or more months are less likely to be malnourished than those breastfed for less than six months. This supports the recommendation of WHO (2001) that children should breastfeed exclusively for at least the first six months of life, and supports the government's initiatives of six months exclusive breast-feeding.

Additionally, the study finds that children's participation in growth monitoring clinic is critical in improving the child's nutritional status. This result suggests that during these growth monitoring clinics, mothers having children with nutrition challenges can benefit from nutrition experts' advice on how to improve their children's nutrition, emphasizing the role of early corrective measures in the fight against malnutrition. It is also possible for children with poor nutrition to be put on supplementary diet just in time.

Furthermore, the study finds that marital status and the highest level of education are also important determinants of child nutrition. In terms of nutritional status, single parents (by choice or circumstances referred to in this study as single after marriage as a result of divorce, death of the spouse or separation) increase the chances of child malnutrition. The most probable reason is because of the financial strain to balance family financial responsibilities, which may not be the case for the married who are likely to share their income and, on average, have more compared to single households.

Finally, when considering the role of a mother's education on child's nutritional status, the study used the educational level as a proxy of education. Using primary, secondary, tertiary and above dummies, the findings show that in comparison to mothers with no education, children of mothers with secondary education are less likely to suffer from malnutrition as those with no formal education. Interestingly, primary education, and tertiary and above levels of education, have no impact on child nutrition. This analysis is an advanced one compared to that of Kabubo-Mariara, Ndenge and Domisiano (2008), which looked at education in terms of the number of years of schooling at primary and post-primary levels. However, the results are the same as in both cases mothers' education is found to affect child nutritional status, specifically secondary education as per this study. Other studies that have supported mother's education as an important determinant of child nutrition include that of Frost, Forste and Haas (2005) and Masiye et al. (2010).

Though many studies have argued that staying in rural areas increased immunization coverage, health expenditure and large household size increases the likelihood of a child's malnutrition (Masiye et al., 2010; Nguyen and Nguyen, 2009; Sumonkanti et al., 2008). However, this study does not support such arguments as these variables were found to be insignificant.

5. Conclusions and Recommendations

5.1 Conclusions

This study has attempted to give a better understanding of the effects of household food expenditure measured by household food budget share on child nutritional status. Using household food budget share, rather than food prices, is considered superior as it captures the household economic status (income and poverty aspects). However, past studies that have been done mainly in developed countries, with a few in Africa, have often used general food prices. Therefore, this study contributes to the understanding of this relationship using a different approach. The policy recommendations, if adopted, will greatly move the country towards the realization of Vision 2030 and achievement of MDGs. Specifically, the study underscores the value of early investment on health.

One main finding of this study is that higher household food budget share is more likely to increase child malnutrition. Using household food budget share as an indicator of poverty, the results can provide intuitive guidelines to government officials, policy makers and researchers on the extent of poverty impacts on child malnutrition. This finding is in line with past studies that have found poor households spend a greater proportion of their income on food. Therefore, it implies that malnutrition adversely affects the poor households than high income households.

The results also provide great support to WHO recommendation and government efforts for exclusive breast-feeding. From the study, it is clear that children who are exclusively breast-fed for six months are less likely to suffer from malnutrition compared to those who are breast-fed for less. This shows that breast milk provides the necessary nutrients that a child will need to grow and develop. The results also support attendance of growth monitoring clinic, as it greatly improves child nutrition. Unlike past studies that have generalized the value of education on child nutrition, this study shows that secondary level of education for women, not any other lower level, is important if improved children's nutrition is to be achieved and sustained.

Though death, separation, divorce and decision to stay single are sometimes unavoidable and personal, the study shows that single motherhood as a result of any of the mentioned reasons enhances chances of children becoming malnourished. Older children are also more likely to suffer from malnutrition than young ones. However, at some stage in life, this effect is reduced and becomes insignificant.

Past studies (Lekhraj et al., 2007 and Masiye et al., 2010) have shown that area of residence, immunization, diarrhoea, child sex and health expenditure are important determinants of child nutritional status. However, this study does not support the same. Though this study may not be the first in concluding that these factors do not determine child nutritional status in Kenya, they may not be the most important factors determining child nutrition.

With 35 per cent of children under five years of age being underweight, 11 per cent overweight and 10 per cent obese, the findings of this study indicate that children's nutritional status is an important problem in Kenya that requires to be addressed. If unaddressed, available literature shows that malnutrition could affect growth potential, cognitive, motor and socio-emotional development, reduce worker's productivity in adulthood and increase the burden of illness (UNICEF, 1998) thus undermining the country's realization of Vision 2030, MDGs as well as the national food and nutritional security policy objectives.

5.2 Policy Recommendations

In terms of policy, the study overall recommends an integrated strategy that improves child participation in growth monitoring clinic, women's education up to a minimum of secondary level, optimal exclusive breast-feeding, and government subsidy of food prices to bring down the food budget share. Specifically, the study recommends:

(a) Children growth monitoring clinics should include lessons on child nutrition knowledge and the government to support the initiative by providing supplementary foods rich in nutrients to children who are noticed to have serious malnutrition problems early in life. In general, it would also be valuable to provide food supplement to children (immediately after the first six months of birth), pregnant women and lactating mothers.

(b) Though the recommendation of WHO (2001) that children should be breast-fed exclusively for at least the first six months of child's life is being pursued by the government, a better approach is facilitation of community-based promotion efforts supported by government procedures. In the long-run, it may be appropriate for work places to have a children's corner where working mothers can breast-feed their children at some intervals for those who cannot extract breast milk and leave at home or obtain six months' leave.

In addition, household food expenditure is, on average, a larger share of the total household budget for poor households than wealthier ones. One policy implication of the results is that a food price change has greater impact on the

poor's real purchasing power. The results from the food budget share suggest that when food budget share rises, poverty levels increase. Therefore, the welfare of low income households is likely to worsen when food price increases because of their inability to substitute food towards less expensive varieties as they are likely to be already consuming the cheapest food sources. The study thus proposes government subsidy of food prices to bring down the food budget share. This will not only make food available for households, especially the poor, but will also improve household welfare in terms of schooling and healthcare.

5.3 Areas for Further Research

Areas for further research are to assess the impact of household food budget share on child nutrition over a longer period of time, given the effects could be long term in nature. Second it to analyze the effects, including information on the episodes of hunger in Kenya, using calories as a measure of child nutritional status.

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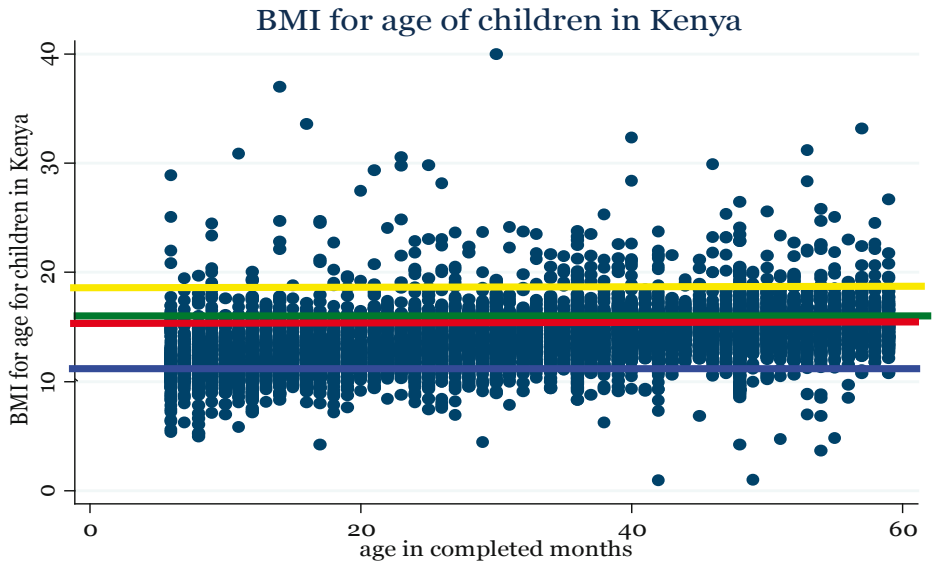
Appendix

Appendix 1: BMI for age of children in Kenya (6-60 months)



Appendix 2: Testing for endogeneity

1. Test imz_res

imz_res = 0

F(1, 2364) = 0.07

Prob > F = 0.7982

2. Test hhsize_res

hhsize_res = 0

F(1, 5342) = 0.25

Prob > F = 0.6184

3. Test hfdbs_res

hfdbs_res = 0

F(1,5350) = 0.65

Prob > F = 0.0311

4. Test pgmc_res

pgmc_res1 = 0

F(1, 5348) = 0.13

Prob > F = 0.0714

5. Test helth

helth_res1 = 0

F(1, 5348) = 0.15

Prob > F = 0.0214

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