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Maternal Autonomy as a Protective Factor in Child Nutritional Outcome in Tanzania

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By

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ABSTRACT

Child Malnutrition is a problem in all countries and centers in poorer communities. Biological and socioeconomic factors alike contribute to malnutrition with recent studies focusing on aspects of maternal autonomy as an influencing factor. In this study, maternal autonomy is defined as the independence in her actions and control over resources a mother has within her household and is made up of several factors, including decision-making power, opinion of domestic abuse, and financial independence. Child nutritional outcomes were operationalized using the anthropometric measures height-for-age (HAZ), weight-for-height (WHZ), and weight-for-age (WAZ).

For this study, the 2004-2005 Tanzanian Demographic and Health Survey (DHS) dataset was examined using weighted logistic regression in SPSS version 17. After controlling for sociodemographic covariates, the only maternal autonomy variable which was statistically associated with child nutritional outcome (associated with height-for-age) was if the mother had final say in decisions regarding her own healthcare (OR=0.857, 95% CI=0.749-0.980). Sociodemographic variables which were statistically associated with child nutritional outcome were child age (older children had higher odds ratios for stunting and lower odds ratios for wasting), child gender (being female was a protective factor against stunting and underweight), duration of breastfeeding (intervals longer than 24 months had higher odds ratios for stunting, wasting, and underweight), and family's position in the wealth index (being in the richer and richest quintiles were protective factors against stunting and underweight).

While further research is needed to examine other influencing factors such as sanitation, diet, and disease prevalence, decision-making power regarding a mother's own healthcare is an important factor that may influence her ability to meet the nutritional needs of her children. This implies that public health professionals may want to look into avenues by which maternal autonomy may be enhanced for possible interventions to improve child nutritional status in Tanzania.

APPROVAL

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Construction of mutant Streptococcus pyogenes strains using overlapping PCR

- ♦ Results presented at the Coe College 2006 Research Symposium and the 2005 Summer Undergraduate Research at Emory Symposium

Characterization of Proteins and cDNA(s) from Phragmatompoma lapidosa and Pectinaria gouldii

- ♦ Results presented at the Coe College 2005 Student Research Symposium

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ABBREVIATIONS

AARR: Average Adjusted Annual Rate of Reduction

DALY: Disability Adjusted Life-Year

DHS: Demographic and Health Survey

GDP: Gross Domestic Product

HH: Household

MDG: Millennium Development Goals

NBS: National Bureau of Statistics

SD: Standard Deviation

SES: Socioeconomic Status

SPSS: Statistical Package for the Social Sciences

UNICEF: United Nations International Children's Emergency Fund

USAID: United States Agency for International Development

WHO: World Health Organization

CHAPTER I

INTRODUCTION

Background

Malnutrition is a problem which can be found in every country in the world, centering in poorer populations. Malnutrition is a double edged sword; not only does it delay growth development, but it also puts malnourished individuals at an increased risk of acquiring an infectious disease because their bodies cannot properly fight infection (UNICEF, 1998). This infection then contributes to even greater malnutrition because the body either doesn't desire food or cannot properly absorb the nutrients it needs (Madise *et al*, 1999). This is especially true in children in developing countries, where malnutrition contributes to over 50% of childhood deaths (Djazayeny, 2004; WHO, 2002).

There are numerous biological factors which influence a child's nutrition status: nutrition status of the mother during pregnancy, how many siblings the child has, the sex of the child, how long the child was breastfed, whether that breastfeeding was exclusive or not for the first six months, what foods the child was given during complementary feeding, etc. (Victora *et al*, 2008; Wamani *et al*, 2007; Black *et al*, 2008). Influencing these biological factors are socioeconomic ones, such as the wealth of the family, the household religion, the society's view of women, the educational status of the mother and father, and what occupations the mother and father have (Sunil, 2009; Kritz & Makinwa-Adebusoye, 1999; Smith *et al*, 2003; Mazur & Sanders, 1988). Thus, both biological and socioeconomic factors may influence child nutritional status. In fact, some researchers go so far as to say that child nutritional status until the age of seven is primarily influenced by environmental factors rather than cultural ones such as nationality or ethnicity (Johnston, 1991).

Researchers are currently studying other psychosocial factors which may impact child nutrition. One of these factors is maternal autonomy, defined as the level of independence in her actions and control over resources a mother has within her household. This study is further examining maternal autonomy as an influencing factor in child nutrition status. As several factors make up the level of autonomy, the factors this study examines to determine the level of autonomy include decision-making power, opinion of domestic abuse, and financial independence measured by control of money and assets owned. Socio-demographic covariates which will also be examined include age, sex, birth order, duration of breastfeeding of the child, mother's age, age at first birth, level of education, religion, occupation, number of other wives, household's wealth, place of residence, and number of household members.

Using data from Tanzania's Demographic and Heath Survey (DHS), this study will address the following research questions: (1) are independent maternal autonomy variables associated with child nutritional outcomes as measured by height-for-age, weight-for-height, and weight-for-age?, and (2) are these maternal autonomy variables associated with child nutritional outcomes when controlling for selected biological and socioeconomic covariates?

Hypotheses

Based on a review of the literature, it was hypothesized that there would be a positive correlation between maternal autonomy and child z-scores for all three anthropometric measures (height-for-age, weight-for-height, weight-for-age). It was also hypothesized that this would hold true even when controlling for confounding covariates such as child age, sex, birth order, and duration of breastfeeding, along with mothers' age, age at first birth, education, religion, occupation, and number of other wives, and household position in the wealth index, place of residence, and number of members.

CHAPTER II

REVIEW OF THE LITERATURE

Public Health Significance of Malnutrition

Measuring child nutrition is indirectly measuring their living conditions—it reflects how much of an investment is being made in the future students and workers of a society (Simler, 2006). Especially among disadvantaged groups, child nutritional status is an indicator not only of health status but also intellectual and physical competence Because of this, it also serves as a predictor of future adult performance (Johnston, 1991).

The World Health Organization (WHO) estimates that child malnutrition contributes to over 30% of under-five deaths from acute respiratory diseases, diarrhea, and other neo- or peri-natal deaths (WHO, 2002). This is because malnutrition increases the risk of and duration of childhood illnesses such as tuberculosis, measles, diarrhea, and malaria via a decrease in cellular immunity (Huffman & Martin, 1994). It contributes to 21% of global death and disability-adjusted life-years (DALYs) in children under five—the largest percentage for any risk factor in this age group (Black *et al*, 2008). Researchers have indicated that reducing the prevalence of malnutrition in developing countries is probably the most significant preventive measure we could take to reduce child mortality from acute respiratory infections and diarrheal diseases (UNICEF, 2009).

Children who are malnourished are at greater risk for impaired brain development and body function, which decreases their ability to accrue life skills, in turn reducing their chances at survival and productivity (Rajaram *et al*, 2007; Sunita & Jain, 2005; Victora *et al*, 2008). Well-nourished children are more likely to start school at an earlier age, repeat fewer grades in school, and will either enter the labor force earlier or will complete more years of school, or both, and can achieve as much as 46% higher earnings than their undernourished counterparts during work (Alderman *et al*, 2009; Hoddinott *et al*, 2008).

Nutrition is so important that the consequences of malnutrition can span three generations (Victora *et al*, 2008). Addressing it will help achieve at least three of the eight Millennium Development Goals (MDG) by reducing the proportion of people suffering from hunger (Goal 1), improving the number of children who are able to complete primary school (Goal 2), and reducing the under-five mortality rate (Goal 4) (United Nations, 2009).

Measurements of Malnutrition

The most widely accepted form of quantifying malnutrition is anthropometric measures; this is because changing body dimensions indicate the health of an individual or population. Anthropometric measures, when compared with an established standard, can be used to predict performance and survival. In addition, the methods used to collect anthropometric data are easy, inexpensive, and non-invasive. For children, the method most often used is to measure weight in kilograms, height in centimeters, and age in months. Combining two of these variables together creates an index. The indices used for quantifying malnutrition are height-for-age, weight-for-height, and weight-for-age; each index identifies a separate nutrition phenomenon. Low height-for-age (<-2 SD) when compared to a well-nourished child of the same age is an indicator for stunting, or reduced growth rate, which measures past or chronic malnutrition. Low weight-for-height (<-2 SD) compared to a healthy child of the same height indicates wasting, or too little body mass for height, which is a measurement of current or acute malnutrition. Low weight-for-age (<-2 SD) when compared to a child in good health of the same age is a combined measurement of stunting and wasting called underweight (too little body mass for age). It is used to evaluate variation in the degree of malnutrition over time (Cogill, 2003).

In order to determine the severity of malnutrition indices are stated in terms of standard deviation units (SD), called Z-scores, from the median value of the international reference population (NBS, 2005). It should be remembered that ±1 SD from the median value captures 68% of a population, ±2 SD represents 95%, and ±3 SD represents 99.7% (Gerstman, 2008). Therefore, the World Health Organization (WHO) has a cut-off for malnutrition indices of -2 SD. Indices that fall below -2 SD mean that a child shows moderate malnutrition and is considered stunted, wasted or underweight (NBS, 2005).

It should be noted that anthropometric measures are only able to identify the condition of malnutrition; they are not able to determine the source (Simon *et al*, 2002). Thus, the goal of researchers is to identify and determine the association of independent factors as they relate to malnutrition as quantified by these anthropometric measures.

Causes of Child Malnutrition

There have been numerous studies over the years researching what factors impact child malnutrition (see Figure 1). These factors can be classified into two categories: biological determinants and social ones. Biological determinants include such factors as duration of breastfeeding, child sex, and birth order, while social determinants include factors such as family socio-economic status (SES), place of residence, parental education, parental employment, and the status of women.

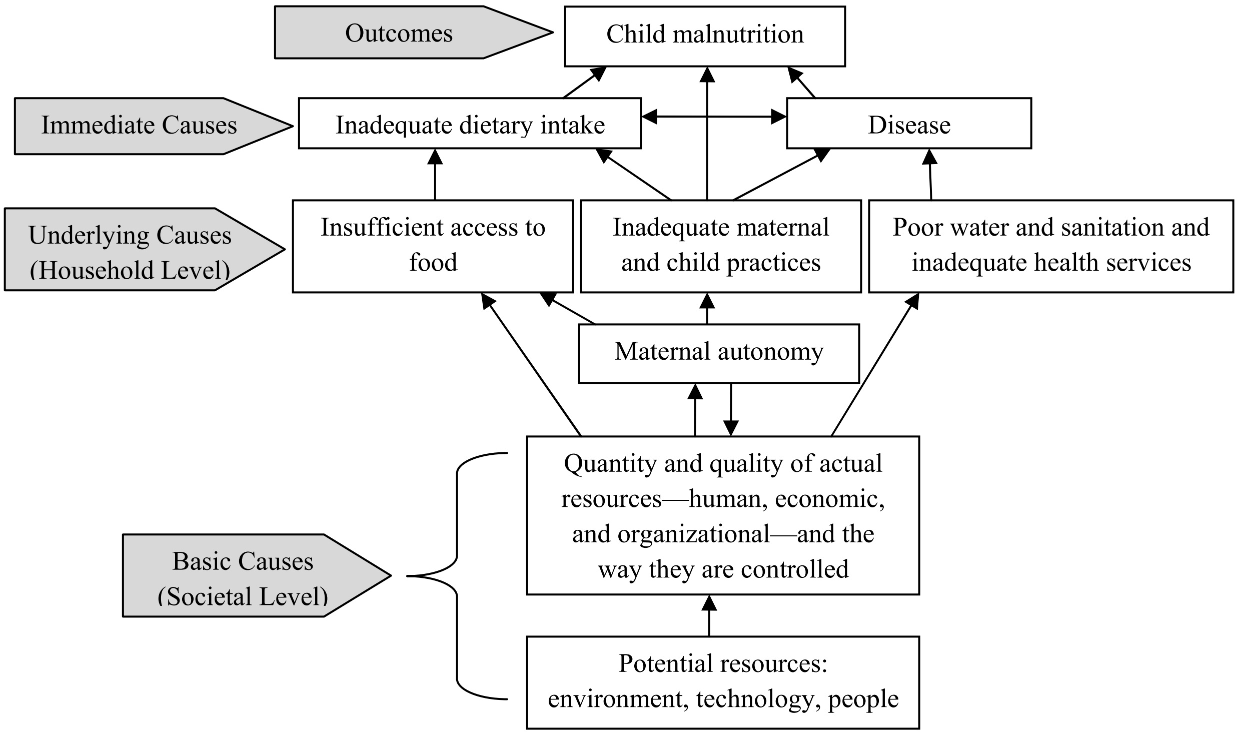

Figure 1. Causes of child malnutrition (Adapted from: Smith *et al.*, 2003)

Biological Determinants of Nutrition

Duration of Breastfeeding

According to UNICEF, proper infant and young child feeding has the greatest impact on child survival, with the prospect of preventing 19 percent of under-five deaths (2009). However, Ukwuani & Suchindran's study in Nigeria showed that exclusive breastfeeding decreased wasting but could actually increase stunting prevalence if continued past 4-6 months (2003). Therefore, proper breastfeeding and introduction of nutrient-rich complementary foods at the correct time insures children receive the most nutrients possible for good growth; in fact, breastfed children are at least six times more likely to survive their early months of life than non-breastfed ones (UNICEF, 2009).

Child Sex

There is an interesting trend in the association between child sex and nutritional status. In Asia, female children tend to be more malnourished than male (Saito *et al*, 1997; Ramli *et al*, 2009). Several studies have indicated a sub-Saharan African trend that female children are better nourished than male ones, though at least one showed the opposite (Madise *et al*, 1999; Wamani *et al*., 2007; Hall *et al*, 2008; Lapidus *et al*, 2009). One study indicated that male children are biologically at greater risk of stunting, though the reason for this is unknown (Wamani *et al*., 2007).

Birth Order

Regarding birth order, studies show that children with more siblings were more likely to be stunted than their siblings because of the increased competition for food (Mishra & Retherford, 2000; Ukwuani & Suchindran, 2003; Mazur & Sanders, 1988). There tends to be an inverse relationship between higher birth order and time spent in feeding care (Gupta, 1986). Behrman discovered an apparent parental bias towards their earlier-born children in India in regards to feeding practices, and Madharavan noted that children in South Africa who had more siblings and more older siblings were more likely to be undernourished than children with fewer siblings and fewer older siblings, even when controlling for age (Behrman, 1986; Madharavan & Townsend, 2007). In addition, more children means a larger family size in general, and large household size is an independent risk factor for child nutrition (Stinson, 1983).

Social Determinants of Nutrition

Family SES

It is well-known that family socioeconomic status (SES) contributes to child nutrition because families that have more money are better able to secure more food for their children to eat (Bairagi, 1983; Delpeuch *et al*, 1999; Levine, 1988; Skoufias, 1999). In one study, low SES was a significant risk factor for all three malnutrition indicators (Sunil, 2009), and several studies have shown that higher SES is a protective factor against stunting (Ukwuani & Suchindran, 2003; Uthman, 2009).

Place of Residence

Rural children tend to be at greater risk of malnutrition when compared to urban children (Kritz & Makinwa-Adebage, 1999; Mazur & Sanders, 1988; Rajaram *et al*, 2007). Where a family lives can contribute to child nutrition due to the fact that rural areas, while agricultural, may not have as much access to food as those in urban areas (Skoufias, 1999). There may also be a lack of access to nutritional and educational resources, and possibly even differences in child raising (Rajaram *et al*, 2007).

Maternal Education

Numerous studies have examined the effects of parental, particularly mother's, education on the nutritional status of children, in that greater parental education improves child nutrition (Skoufias, 1999). A study in India showed that, even when controlling for 12 possible confounding variables, greater maternal education is strongly correlated with decreased child stunting, wasting, and underweight (Mishra & Retherford, 2000). The reasons behind this effect include chances of better employment (thus improving the family SES), greater knowledge of the importance of a balanced diet and which foods are high in nutrients, and increased maternal status (Mishra & Retherford, 2000). In addition, educated mothers are reported to be more likely to take advantage of health services (Simon *et al*, 2002). As the level of mother's education increases, the prevalence of stunting, wasting, and underweight decreases (Delpeuch *et al*, 1999; Mazur & Sanders, 1988; Wenlock, 1979). And, while maternal knowledge of the causes of nutrition does not necessarily translate into improved feeding practices, it can increase maternal confidence and information sharing, which can have a ripple effect in the community and may later translate into changes in practices (Saito, *et al*, 1997, Hendrickson *et al*, 2002).

Maternal Employment

Maternal employment can affect child nutritional status in two basic ways. It can decrease the risk of malnutrition if it results in greater decision-making authority in the home and more money which can be spent on food and resources for child care (Kritz & Makinwa-Adebage, 1999; Ukwuani & Suchindran, 2003). Conversely, it can increase the risk of malnutrition if the mother has to work away from home, thus taking away from time she would spend taking care of her children and looking after their feeding (Ukwuani & Suchindran, 2003). Women who work are more likely to stop breastfeeding and use milk substitutes, and may have to leave their children to substitute caretakers (Ukwuani & Suchindran, 2003; Levine, 1988; Panter-Brick, 1992). Some studies have shown no difference between working and non-working mothers (Christian *et al*, 1989; Banji & Thimayamma, 2000). However, several studies have shown maternal employment as a protective factor in child nutrition (Mazur & Sanders, 1988; Kritz & Makinwa-Adebage, 1999; Ulijaszek & Leighton, 1998).

Religion

Religion can affect child nutritional outcome by influencing feeding practices. For example, families of the Muslim and Jewish faiths do not consume pork. In Nigeria, pregnant women refused to eat rabbit because it was local belief that doing so would result in a child with "kleptomaniacal tendencies" (Ebomoyi, 1988). Another study in Nigeria noted that being of the Christian faith was a protective factor against wasting (Ukwuani & Suchindran, 2003). Religion can also affect maternal authority—one Nigerian study showed that being Muslin decreased the amount of decision-making authority a woman had in her household (Kritz & Makinwa-Adebage, 1999).

Domestic Violence

Maternal experience of domestic violence can reduce nutritional status of women and their children in addition to decreasing their empowerment (Sethuraman *et al*, 2006). According to a study in India the chronic experience of domestic violence has a "dose-response" relationship, where frequent or recent abuse was associated with the highest probability of poor nutritional status. It was hypothesized that this was due to reducing a woman's ability to make decisions for herself and her family, including food decisions, and also psychological stress (Ackerson & Subramanian, 2008).

Polygamy

In an examination of polygamous households in Sub-Saharan African, Madhaven noted that the co-wives can live in one of two fashions: collaboration or competition. If the wives live in collaboration, their children may benefit from additional childcare. If the wives are in competition, there is a decrease in intervals between births—thus more children—and the children have decreased survival chances because there isn't that "reciprocity in childcare" (Madhaven, 2001). An ethnographic study of households in the Mount Kilimanjaro region observed that the favorite wife's children were often given better food, shelter, clothing, and education that the children of less favored wives (Howard & Millard, 1997). Quantitative studies have shown that polygamy decreases maternal authority, and at least one has noted that households with at least two wives are associated with increased wasting prevalence (Kritz & Makinwa-Adebage, 1999; Ukwuani & Suchindran, 2003).

Maternal Status

According to the 2002 International Food Policy Research Institute's report, "The Importance of Women's Status for Child Nutrition in Developing Countries," women's status affects child nutrition in three main ways: food security, caring practices for women and children, and quality of the health environment. The report measured maternal status by looking at two variables: societal gender equity, and women's decision–making power. Researchers determined that women's decision-making power had a significant, positive effect on height-for-age, weight-for-height, and weight-for-age in Sub-Saharan Africa, while societal gender equality did not (Smith *et al*, 2003).

In addition, women's decision-making power has a stronger effect on child nutritional status in poorer household than in richer ones, because influencing decisions over the allocation of resources is more important when those resources are scarce in number (Smith *et al*, 2003). In addition, an ethnology study of Balinese culture highlighted the fact that "the ability to make decisions endows the decision-maker, man or woman, with a sense of independence and command of his or her own destiny" (Jha, 2004). This independence in mothers may translate into improved child nutritional status.

Importance of Maternal Autonomy

More of the current studies are looking at the impact of maternal autonomy on child nutrition. This is because maternal autonomy, described in this study as how much control a mother has within her household to access resources and behave independently, determines how well a mother is able to act in a manner which best promotes the survival and growth of her children. According to Brunson *et al*, studying maternal autonomy is important for two main reasons—the first being that autonomy gives empowerment, which is a basic human right, and the second being that autonomy gives a perspective into theories of "parental investment." The premise for this is that it is in the best interest of males to produce as many children as they can ("offspring quantity") while it is in the best interest of females to invest in the children they currently have by taking care of them to the best of their ability ("offspring quality") (Brunson *et al*, 2009).

One study in India looked at the effect of maternal autonomy on stunting. Researchers in this study broke maternal autonomy into multiple independent parts—namely decision-making power, whether a mother needs to ask permission to leave the compound, who makes financial decisions in the family, and mother's attitude towards domestic violence (Shroff *et al*, 2009). As the study most closely resembles the questions of the current investigation, its study design was used as a template. While Shroff *et al* examined only stunting as a measure of long-term impact on child nutrition, this study investigates wasting and underweight as well, in order to examine both short- and long-term effects. In addition, Shroff *et al* considered some possible confounding covariates, namely child age, sex, and birth order, mother's age, education, SES, place of residence, and religion. This study will control for the additional confounding covariates child's duration of breastfeeding (UNICEF, 2009), mother's age at first birth (Uthman, 2009), mother's occupation (Stinson, 1983), the number of other wives (Ukwuani & Suchindran, 2003), and number of household members (Pelto *et al*, 1991), since these were indicated as contributing variables as well.

Child Malnutrition in Tanzania

Tanzania is an East-African country bordered on one side by the Indian Ocean and surrounded by eight other countries. It is slightly larger than twice the size of California, and is home to more than 41 million people. Its infant mortality rate is 69.28 deaths per 1,000 live births, and its under-five mortality rate is 116 deaths per 1,000 children (World Factbook, 2010; UNICEF, 2007). The average number of children per mother is 4.46, and the growth rate is currently estimated at 2.04% (World Factbook, 2010). A primarily agricultural economy, it ranks 85 out of 226 countries in terms of gross domestic product (GDP).

Tanzania ranks 10th on the list of the top 24 countries for stunting prevalence with 44% of children (or approximately 3,359,000) suffering from moderate or severe stunting. Besides this, 3% of children are wasted and 17% of children are underweight. In addition, Tanzania has made insufficient progress in achieving MDG #1 (to halve the percent of the population that is suffering from hunger) with an average annual rate of reduction (AARR) less than 2.5 percent (UNICEF, 2009).

While child nutrition studies in Tanzania have focused on intervention strategies and constraints to good child-care practices, they have yet to look at maternal autonomy as an influencing factor of child nutrition. Therefore, this study will add not only to the research of maternal autonomy but will also further the investigation of issues affecting child nutritional status in Tanzania. This in turn could lead to the discovery of new avenues of investigation for future nutrition interventions.

CHAPTER III

METHODS AND PROCEDURES

Study Description

This study is a secondary analysis of the Demographic and Health Survey (DHS) dataset for Tanzania from 2004-2005, this being the most recent DHS for that country. The DHS dataset is put out in a five-year cycle by the Measure DHS project, which has been conducting surveys in 84 countries since 1984 and which compiles representative data on topics such as maternal and child health, nutrition, family planning, malaria, HIV/AIDS, and more. The project is funded by the United States Agency for International Development (USAID), along with donations from private people/industries and host countries, and is provided free of charge but by request.

The Demographic and Health Survey differs from other Measure DHS surveys in that the information it collects may be more broad than other surveys (i.e. Malaria Indicators Survey or Survey Provision Assessment Survey), but has a larger sample size (5,000-30,000 households) and thus may better represent a country statistically speaking. The DHS is composed of three core questionnaires: Household, which collects household information along with anthropometric measures and anemia status; Women's (for women 15-49), which collects individual information such as background characteristics, reproductive behavior, nutrition; and Men's (for men 15-59), which is similar to the women's questionnaire but is shorter.

For the anthropometric measures, children 60 months or younger and women interviewed were eligible for measurement. Weight was taken with UNICEF-approved scales and height was measured with measuring boards specifically designed for survey settings by Shorr Productions. Recumbent length was taken for children 24 months old or younger and standing height was taken for children 25 months to 60 months. From this information, Z-scores were tabulated for weight-for-height, height-for-age, and weight-for-age in order to show units of deviation from the mean as an indicator of malnutrition. A Z-score less than -2 standard deviations (SD) for height-for-age indicated stunting, for weight-for-height indicated wasting, and for weight-for-age indicated underweight. Having a Z-score of less than -3SD for any of these indicated severe wasting, stunting, or underweight (NBS, 2005).

Method of Analysis

Statistical analysis was carried out using SPSS v. 17.0 (SPSS, Inc., Chicago, IL). DHS child, woman, and anthropometric datasets were merged and organized according to strata and primary sampling unit. Using the “sample weight” variable, cases were weighted to correct oversampling of subgroups and non-response bias. Matching variables between woman and child datasets reduced the sample from 10,329 to 8,564, and removing missing values for children who weren’t measured for height, weight, or age reduced the number to 7,299. A final removal of missing variables for each of the independent variables gave a final sample size of 6,101 cases.

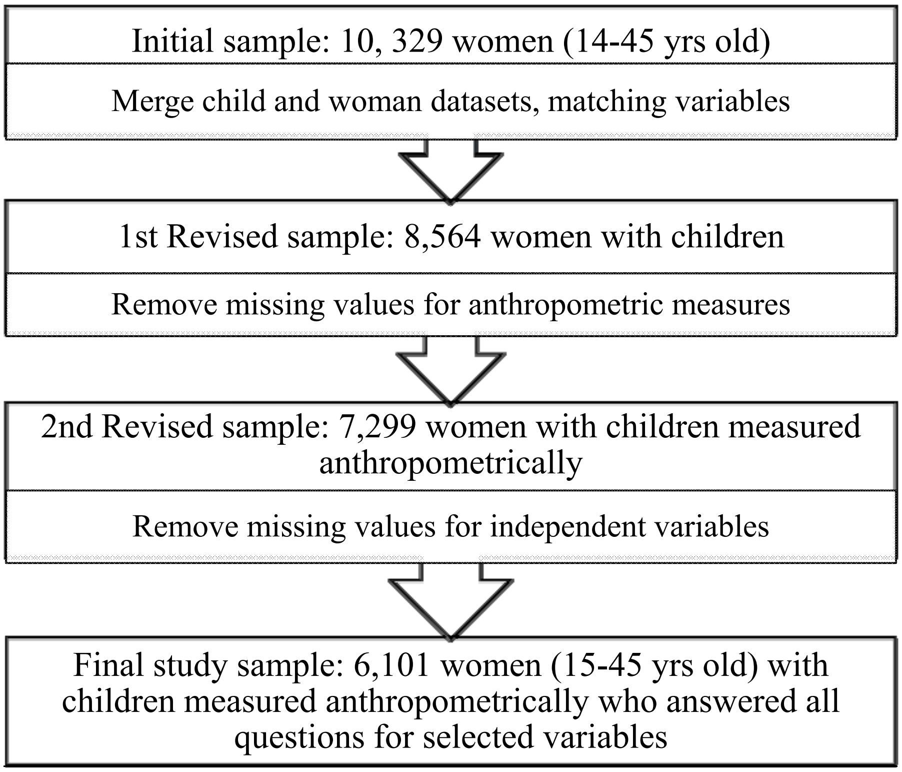

Figure 2. Flow chart of sample selection

The dependent variables for child nutritional status were height-for-age, weight-for-height, and weight-for-age. These variables were dichotomized into “not stunted” (Z-score greater than -2SD) and “stunted” (Z-score less than -2SD), “not wasted” (Z-score greater than -2SD) and “wasted” (Z-score less than -2SD), and “not underweight” (Z-score greater than -2SD) and “underweight” (Z-score less than -2SD), respectively.

The independent variables for maternal decision-making power include final say on (1) own healthcare, (2) making large household purchases, (3) making household purchases for daily needs, (4) visits to family or relatives, and (5) foods to be cooked each day. These variables were dichotomized into “respondent has no say” if one or more persons other than the interviewed mother made the decision and “respondent has say” if the respondent had part (with spouse or household head) or sole decision-making power, and used separately in analysis.

The independent variable for attitude toward domestic violence was measured with responses to five questions. Respondents were asked to indicate whether wife beating was justified under the following circumstances: (1) she goes out without her husband, (2) she neglects the children, (3) she argues with her husband, (4) she refuses to have sex with her husband, or (5) she burns the food. Response options included “not justified” (0), “justified” (1), and “don’t know.” The “don’t know” response was recoded to missing. Responses to the five items were scored ranging from zero to five. This resulting score was dichotomized again into “not justified under any circumstance” and “justified under at least one circumstance” in accordance with Shroff *et al.*’s methods. The reasoning behind this is that a woman who believes domestic violence is not justified under any circumstance has high autonomy while a woman who believes domestic violence is justified under at least one circumstance has low autonomy.

The independent variables for financial independence included two types: control of money, and ownership of assets. The control of money variables included monetary control for (1) perishable foods, (2) clothes, (3) medicine, and (4) toiletries. These variables were dichotomized into “no control” and “has control.” The ownership of assets variables included if the mother owns (1) land, (2) the dwelling, (3) another dwelling elsewhere, (4) jewelry, and (5) livestock. These variables were dichotomized into “does not own” and “owns alone or jointly.”

The covariates which could possibly confound the data included those related to the child, the mother, and the household (HH). Child variables included age, sex, duration of breastfeeding, and birth order (1, 2, 3, 4, 5+), while maternal variables included age, age at birth of first child, highest educational level (No education, Primary, Secondary, Tertiary or higher), religion (Muslim, Catholic, Protestant, None), occupation (Not working, Professional, Agricultural, Service, and Manual Labor) and number of other wives. Household independent variables included family's position in the wealth index (Poorest, Poorer, Middle, Richer, Richest quintiles based on scores of weight household assets), type of place of residence (urban, rural), and number of HH members (DHS, 2002).

In SPSS, the complex samples package was used to account for weighting. Bivariate analysis with Chi-square statistics was performed to test the independence of distribution between independent variables. Bivariate analysis with Chi-square statistics was also performed for covariates to determine possible confounding. For covariates, if Chi-square statistics were significant for at least two of the three dependent anthropometric measures, they were selected for inclusion in the logistic regression model.

CHAPTER IV

RESULTS

After excluding respondents with missing values for any of the examined variables, the final sample population was 6,101 mothers who completed the DHS survey with most-recently born children under five years old who were measured anthropometrically. Table 1 presents the descriptive statistics for child, mother and household variables. Children's age ranged from 0-59 months with both sexes represented equally (male=50.2%), approximately half of children were 1st, 2nd, or 3rd births (54.8%), and almost 60% of children were breastfed between 13 and 24 months. The anthropometric measures show that stunting was most prevalent for children with 41.9% of all children in the sample having a height-for-age Z-score under -2 SD; wasting showed 4.2% of children had a weight-for-height Z-score less than -2 SD, and 16.4% of children were underweight, with a weight-for-age less than -2 SD. Looking at the mean Z-score for those children who are stunted, -2.953 SD falls close to the "severely" stunted classification of -3 SD. This indicates that not only does prolonged malnutrition have greater prevalence than acute malnutrition, but also that children who are stunted have a good chance of being severely stunted.

The majority of mothers were between 15-19 years of age at their first childbirth (61.7%), had achieved the primary education level (69%) and worked in the agricultural sector (79.8%). In addition, the majority of mothers were the only wife in their marriage (77.6%), and the distribution of religious beliefs was balanced. Looking at household characteristics, most fell within the poorest-middle classification range of the wealth index (65.9%), were located in rural areas (82.5%), and had between one and nine household members (83.5%).

Table 1. Sample characteristics

Characteristics	*n*	Mean (SE)
Anthropometric		
Height-for-age Z-score	6101	-1.770 (0.033)
Weight-for-height Z-score	6101	-0.955 (0.028)
Weight-for-age Z-score	6101	0.090 (0.021)
Stunting		
<-2 SD height-for-age Z-score	2555 (41.9%)	-2.953 (0.05)
≥-2 SD height-for-age Z-score	3546	-0.837 (0.016)
Wasting		
<-2 SD weight-for-height Z-score	258 (4.2%)	-2.733 (0.042)
≥-2 SD weight-for-height Z-score	5843	0.112 (0.014)
Underweight		
<-2 SD weight-for-age Z-score	1001 (16.4%)	-2.658 (0.018)
≥-2 SD weight-for-age Z-score	5100	-0.665 (0.012)
Children's		**Percentage**
Age (months)		
0-11	1422	23.4
12-23	1306	21.4
24-35	1254	20.2
36-47	1058	18.0
48-59	1061	17.0
Sex		
Male	3070	50.2
Female	3031	49.8
Birth Order		
1	1078	18.4
2	1179	20.0
3	963	16.4
4	760	12.8
5	593	9.3
6	507	8.1
7	367	5.6
8	263	3.8
9+	391	5.6
Duration of Breastfeeding		
Never breastfed	105	2.1
0-6 months	853	13.6
7-12 months	1088	18.1
13-18 months	1565	27.5
19-24 months	1990	29.8
25+ months	500	8.8
Mothers'		
Age (years)		
15-19	258	4.6
20-24	1436	25.1
25-29	1676	27.8

Table 1 continued

Characteristics	*n*	Percentage
Mothers'		
Age (years)		
30-34	1358	22.7
35-39	825	12.1
40-44	422	5.9
45-49	126	1.9
Age at first birth (years)		
8-14	200	3.2
15-19	3667	61.7
20-24	1888	29.7
25-29	302	4.7
30-35	44	0.8
Highest educational level		
No education	1736	26.9
Primary	3860	69.0
Secondary	431	3.1
Tertiary or more	74	1.0
Religion		
Muslim	2341	23.8
Catholic	1443	27.3
Protestant	1538	31.4
None	779	17.5
Occupation		
Not working	871	9.6
Professional	162	2.1
Agriculture	4483	79.8
Services	34	0.7
Manual Labor	551	7.8
Number of other wives		
0	4752	77.6
1	1079	17.3
2+	270	5.2
Household variables		
Family wealth index		
Poorest	1331	22.9
Poorer	1237	21.2
Middle	1244	21.8
Richer	1358	19.7
Richest	931	14.4
Place of residence		
Urban	974	17.5
Rural	5127	82.5
Number of household members		
1-9	5167	83.5
10-19	817	13.8
20-29	84	2.0
30+	33	0.7

Table 2 shows the unadjusted percentages of stunting, wasting, and underweight among the selected autonomy variables. Various independent variables showed significant difference between high and low autonomy groups, and those were selected for adjusted logistic regression. Among the decision-making variables, having a say in one's own healthcare was significantly protective against stunting and underweight, while having a say in making purchases for daily needs and what foods are to be cooked each day were significantly protective against wasting. Among the financial independence variables, having control of money for perishable foods was associated with both stunting and underweight, having control of money for clothes, medicine, and toiletries were associated with underweight, and single- or joint- ownership of land was associated with stunting and single- or joint- ownership of the family dwelling was associated with both stunting and underweight. Interestingly, the percentage of children being underweight was greater for mothers with single- or joint- ownership of the family dwelling (16.9%) than for mothers who did not have ownership (13.5%).

Bivariate association among socio-demographic factors and anthropometric measures are found in Table 3. While different socio-demographic variables were associated with various anthropometric measures, those variables which were significantly associated ($p<0.05$) with at least two of the three anthropometric measures were selected as covariates for the logistic regression model. These variables were child age, with lower rates of stunting and underweight among younger children and lower rates of wasting among older children; child sex, with lower rates of stunting and underweight among females; and duration of being breastfed, with lower rates of stunting, wasting and underweight for children breastfed for shorter periods of time. Mother's level of education and occupation were statistically significant, with rates of stunting and underweight decreasing with higher educational levels and the highest proportion of stunting and underweight among mothers who work in agriculture. Household's position in the wealth index and place of residence were significantly associated with stunting and underweight with rates decreasing from poorest to richest and urban households having lower percentages than rural ones.

Table 2. Bivariate analysis of autonomy variables by anthropometric measures

Autonomy Variables	Dichotomized Categories	*n*	Height for Age		Weight for Height		Weight for Age	
			% Stunted	p-value	% Wasted	p-value	% Underweight	p-value
Decision-making power								
Has final say on:								
Own healthcare	Respondent has say	3396	41.5	.008*	3.5	.983	14.6	.006*
	Respondent has no say	2705	45.7		3.4		17.6	
Making large household purchases	Respondent has say	1770	41.9	.283	2.7	.072	14.2	.062
	Respondent has no say	4331	43.9		3.8		16.6	
Making household purchases for daily needs	Respondent has say	2544	42.4	.339	2.7	.012*	14.7	.094
	Respondent has no say	3557	44.0		4.1		16.9	
Visits to family or relatives	Respondent has say	2962	43.8	.571	3.2	.373	15.7	.732
	Respondent has no say	3139	42.8		3.7		16.0	
What foods are to be cooked each day	Respondent has say	4734	43.2	.807	3.2	.043*	16.0	.754
	Respondent has no say	1367	43.7		4.6		15.5	
Attitude towards domestic violence								
Respondent was asked if domestic violence is justified under five circumstances	Not justified under any circumstance	2516	41.6	.145	3.2	.319	15.0	.247
	Justified under at least one circumstance	3585	44.3		3.8		16.4	
Financial independence								
Has control of money for:								
Perishable foods	Has control	3666	41.7	.011*	3.2	.291	14.5	.004*
	No control	2435	45.9		3.8		18.0	
Clothes	Has control	3185	42.3	.249	3.6	.596	14.2	.002*
	No control	2916	44.2		3.3		17.4	
Medicine	Has control	3177	42.5	.314	3.1	.289	14.2	.004*
	No control	2924	44.1		3.8		17.6	
Toiletries	Has control	3667	42.6	.366	3.4	.683	14.7	.009*
	No control	2434	44.2		3.6		17.6	
Has ownership of assets:								
Land	Owns alone or jointly	3710	45.3	<.001*	3.3	.520	16.4	.245
	Does not own	2391	39.1		3.7		14.8	
Dwelling	Owns alone or jointly	3788	45.8	<.001*	3.5	.868	16.9	.005*
	Does not own	2313	37.7		3.4		13.5	
Other dwelling	Owns alone or jointly	1650	43.0	.833	3.4	.808	15.7	.867
	Does not own	4451	43.4		3.5		15.9	
Jewelry	Owns alone or jointly	1906	41.6	.127	3.5	.898	15.0	.332
	Does not own	4195	44.0		3.4		16.2	
Livestock	Owns alone or jointly	2089	42.4	.452	3.5	.857	15.7	.842
	Does not own	4012	43.8		3.4		16.0	

*Significant difference indicated by $p<0.05$, based on weighted chi-square statistics

Table 3. Bivariate analysis of sociodemographic variables by anthropometric measures

Characteristics	***n***	**Height for Age**		**Weight for Height**		**Weight for Age**	
		%Stunted	p-value	%Wasted	p-value	%Underweight	p-value
Children's							
Age (months)							
0-11	1422	23.4	<.001*	5.2	<.001*	12.5	.018*
12-23	1306	45.5		4.9		16.0	
24-35	1254	54.0		2.5		17.2	
36-47	1058	51.8		1.7		16.5	
48-59	1061	46.0		2.2		18.0	
Sex							
Male	3070	46.3	<.001*	3.8	.195	17.5	.003*
Female	3031	40.2		3.1		14.2	
Birth Order							
1	1078	45.9	.080	4.0	.300	17.0	.180
2	1179	42.1		2.8		14.2	
3	963	42.0		2.6		14.9	
4	760	39.2		3.4		14.7	
5	593	44.4		4.9		18.8	
6	507	41.1		3.6		13.5	
7	367	49.3		2.7		17.6	
8	263	40.6		1.1		18.5	
9+	391	48.4		5.0		18.7	
Duration of Breastfeeding							
Never breastfed	105	41.8	<.001*	2.5	.001*	16.4	<.0001*
0-6 months	853	21.8		4.3		9.5	
7-12 months	1088	33.1		5.3		15.6	
13-18 months	1565	46.5		3.4		14.4	
19-24 months	1990	50.8		2.0		17.6	
25+ months	500	62.2		3.8		24.4	
Mothers'							
Age (years)							
15-19	258	36.4	.008*	7.0	.104	17.4	.586
20-24	1436	45.9		3.3		15.5	
25-29	1676	40.8		3.0		14.7	
30-34	1358	42.7		3.0		16.0	
35-39	825	42.0		3.9		16.3	
40-44	422	51.6		4.5		18.4	
45-49	126	51.3		3.6		21.1	
Age at first birth (years)							
8-14	200	38.2	.681	3.3	.440	13.7	.650
15-19	3667	43.9		3.3		15.4	
20-24	1888	43.1		3.5		16.3	
25-29	302	39.4		5.7		18.9	
30-35	44	44.8		2.2		20.4	
Highest educational level							
No education	1736	46.6	<.001*	4.3	.108	19.7	.001*
Primary	3860	43.2		3.2		14.7	
Secondary	431	27.2		2.6		11.6	
Tertiary or more	74	9.0		3.4		6.0	
Religion							
Muslim	2341	41.4	.335	4.9	.014	18.1	.114
Catholic	1443	43.5		3.2		16.0	
Protestant	1538	45.4		2.6		15.1	
None	779	41.7		3.4		13.9	

Table 3 continued

Characteristics	***n***	**Height for Age**		**Weight for Height**		**Weight for Age**	
		%Stunted	p-value	%Wasted	p-value	%Underweight	p-value
Mothers'							
Occupation							
Not working	871	29.6	<.001*	4.8	.175	12.6	.001*
Professional	162	25.5		0.7		6.0	
Agriculture	4483	46.7		3.4		17.0	
Services	34	20.5		3.2		12.3	
Manual Labor	551	32.2		2.8		11.6	
Number of other wives							
0	4752	42.9	.514	3.5	.963	15.6	.592
1	1079	43.6		3.3		16.2	
2+	270	47.2		3.4		18.8	
Household variables							
Family wealth index							
Poorest	1331	48.6	<.001*	4.1	.204	19.3	<.001*
Poorer	1237	48.0		4.2		20.2	
Middle	1244	47.3		2.7		15.2	
Richer	1358	43.4		3.0		13.6	
Richest	931	21.6		3.0		8.0	
Place of residence							
Urban	974	32.5	<.001*	3.3	.744	11.3	.002*
Rural	5127	45.6		3.5		16.8	
Number of household members							
1-9	5167	44.8	<.001*	3.4	.692	16.5	.068
10-19	817	38.0		3.9		13.4	
20-29	84	24.4		2.2		10.2	
30+	33	15.6		4.2		4.2	

*Significant difference indicated by p<0.05, based on weighted chi-square statistics

Tables 4 through 6 present the results of logistic regression analysis for the dependent variables height-for-age, weight-for-height, and weight-for-age, respectively. Interestingly, after controlling for sociodemographic covariates, the only autonomy variable that remained significantly associated with any anthropometric dependent variable was "final say in own healthcare." According to the results, a mother having the final say in her own healthcare had a protective association with stunting in her child (OR=0.857, CI=0.749-0.980).

Table 4. Weighted logistic regression results for height-for-age variable

	Crude odds ratio	(95% CI)	Adjusted odds ratio‡	(95% CI)
Has final say in own healthcare				
No say	1.0	-	1.0	-
Has a say	0.876†	(0.771-0.996)	0.857†	(0.749-0.980)
Has control of money for perishable foods				
No control	1.0	-	1.0	-
Has control	0.847†	(0.742-0.966)	0.946	(0.824-1.086)
Has ownership of asset: land				
Doesn't own	1.0	-	1.0	-
Owns alone or jointly	1.060	(0.874-1.286)	0.956	(0.770-1.186)
Has ownership of asset: dwelling				
Doesn't own	1.0	-	1.0	-
Owns alone or jointly	1.340†	(1.092-1.645)	1.074	(0.861-1.339)
Child age in months				
0-11			1.0	-
12-23			1.979†	(1.413-2.770)
24-35			2.603†	(1.893-3.581)
36-47			2.292†	(1.665-3.156)
48-59			1.730†	(1.305-2.292)
Child sex				
Male			1.0	-
Female			0.768†	(0.684-0.862)
Duration of breastfeeding in months				
Never breastfed			1.0	-
0-6			0.698	(0.383-1.275)
7-12			0.920	(0.509-1.666)
13-18			1.118	(0.643-1.944)
19-24			1.306	(0.745-2.291)
25+			2.215†	(1.257-3.904)
Highest educational level				
No education			1.0	-
Primary			1.048	(0.875-1.255)
Secondary			0.886	(0.601-1.307)
Tertiary or higher			0.313	(0.066-1.483)
Respondent's occupation				
Not working			1.0	-
Professional			1.502	(0.782-2.886)
Agricultural			1.343†	(1.053-1.713)
Services			0.567	(0.178-1.804)
Manual labor			1.084	(0.758-1.550)
Family wealth index				
Poorest			1.0	-
Poorer			0.973	(0.794-1.193)
Middle			0.939	(0.772-1.142)
Richer			0.784†	(0.636-0.965)
Richest			0.275†	(0.201-0.377)
Place of residence				
Rural			1.0	-
Urban			1.315	(0.988-1.752)

† Statistical significance based on 95% confidence interval not crossing 1.0, ‡ Adjusted for child's age, sex, duration of breastfeeding, mother's education, occupation, and household's wealth and place of residence.

Table 5. Weighted logistic regression results for weight-for-height variable

	Crude odds ratio	(95% CI)	Adjusted odds ratio‡	(95% CI)
Has final say in daily purchases				
No say	1.0	-	1.0	-
Has a say	0.714	(0.509-1.002)	0.739	(0.527-1.037)
Has final say in food to be cooked each day				
No say	1.0	-	1.0	-
Has a say	0.795	(0.523-1.188)	0.811	(0.543-1.212)
Child age in months				
0-11			1.0	-
12-23			1.017	(0.529-1.953)
24-35			0.470†	(0.237-0.929)
36-47			0.295†	(0.143-0.610)
48-59			0.392†	(0.178-0.863)
Child sex				
Male			1.0	-
Female			0.787	(0.573-1.081)
Duration of breastfeeding in months				
Never breastfed			1.0	-
0-6			1.562	(0.420-5.810)
7-12			2.203	(0.644-7.538)
13-18			1.763	(0.015-6.032)
19-24			1.370	(0.414-4.527)
25+			3.731†	(1.057-13.172)
Highest educational level				
No education			1.0	-
Primary			0.832	(0.589-1.174)
Secondary			1.052	(0.447-2.478)
Tertiary or higher			1.028	(0.153-6.922)
Respondent's occupation				
Not working			1.0	-
Professional			0.155†	(0.050-0.485)
Agricultural			0.683	(0.398-1.170)
Services			0.969	(0.132-7.108)
Manual labor			0.665	(0.289-1.533)
Family wealth index				
Poorest			1.0	-
Poorer			1.034	(0.696-1.536)
Middle			0.668	(0.410-1.090)
Richer			0.759	(0.446-1.292)
Richest			0.713	(0.329-1.544)
Place of residence				
Rural			1.0	-
Urban			0.739	(0.527-1.037)

† Statistical significance based on 95% confidence interval not crossing 1.0, ‡ Adjusted for child's age, sex, duration of breastfeeding, mother's education, occupation, and household's wealth and place of residence.

Table 6. Weighted logistic regression results for weight-for-age variable

	Crude odds ratio (95% CI)		Adjusted odds ratio‡ (95% CI)	
Has final say in own healthcare				
No say	1.0	-	1.0	-
Has a say	0.845†	(0.724-0.989)	0.863	(0.732-1.531)
Has control of money for perishable food				
No control	1.0	-	1.0	-
Has control	0.850	(0.643-1.123)	0.957	(0.706-1.298)
Has control of money for clothes				
No control	1.0	-	1.0	-
Has control	0.891	(0.678-1.172)	0.845	(0.636-1.124)
Has control of money for medicine				
No control	1.0	-	1.0	-
Has control	0.915	(0.643-1.303)	0.913	(0.619-1.346)
Has control of money for toiletries				
No control	1.0	-	1.0	-
Has control	1.081	(0.805-1.453)	1.113	(0.809-1.533)
Has ownership of asset: dwelling				
Doesn't own	1.0	-	1.0	-
Owns alone or jointly	1.301†	(1.083-1.564)	1.049	(0.864-1.272)
Child age in months				
0-11			1.0	-
12-23			1.006	(0.689-1.468)
24-35			0.968	(0.673-1.392)
36-47			0.910	(0.614-1.347)
48-59			0.981	(0.674-1.428)
Child sex				
Male			1.0	-
Female			0.783†	(0.666-0.920)
Duration of breastfeeding in months				
Never breastfed			1.0	-
0-6			0.618	(0.293-1.300)
7-12			1.078	(0.558-2.085)
13-18			1.000	(0.517-1.932)
19-24			1.303	(0.710-2.389)
25+			2.063†	(1.064-3.998)
Highest educational level				
No education			1.0	-
Primary			0.848	(0.700-1.029)
Secondary			1.041	(0.553-1.959)
Tertiary or higher			0.947	(0.234-3.843)
Respondent's occupation				
Not working			1.0	-
Professional			0.601	(0.266-1.357)
Agricultural			1.032	(0.772-1.378)
Services			1.179	(0.319-4.361)
Manual labor			1.013	(0.647-1.587)
Family wealth index				
Poorest			1.0	-
Poorer			1.074	(0.836-1.380)
Middle			0.784	(0.581-1.058)
Richer			0.699†	(0.518-0.944)
Richest			0.382†	(0.244-0.598)
Place of residence				
Rural			1.0	-
Urban			1.132	(0.837-1.531)

† Statistical significance based on 95% confidence interval not crossing 1.0, ‡ Adjusted for child's age, sex, duration of breastfeeding, mother's education, occupation, and household's wealth and place of residence.

The socio-demographic covariates which maintained significant association with child stunting were child age (with older children having increased odds of stunting), child sex (being female had a protective effect), duration of breastfeeding (children breastfed for longer than two years show increased odds), mother's occupation (mothers in agriculture show increased odds), and family's position in the wealth index (richer and richest families have significantly decreased odds of stunting).

While no autonomy variable was significantly associated with weight-for-height or weight-for age variables, several sociodemographic variables were. Looking at weight-for-height, children between two and five years of age and children of mothers in professional occupations had decreased odds of wasting, while children breastfed for longer than two years had increased odds. Children who were female or who were in families in the richer or richest categories of the wealth index had decreased odds of being underweight, while children breastfed for longer than two years had increased odds.

CHAPTER V

DISCUSSION AND CONCLUSION

Discussion

The only autonomy variable showing significant association with child anthropometry was "final say in own healthcare." This autonomy variable was associated with child height-for-age after adjusting for other variables and was also associated with weight-for-age when unadjusted. This indicates that decision-making power regarding personal healthcare is important for a Tanzanian mother and may be associated with improved nutritional outcome for her children. By being able to make the decision to seek healthcare for herself, she may be better able to keep herself healthy, and in doing so, may be better able to take care of her children. This is consistent with other studies which have looked at access to healthcare as a predictor for child anthropometry. Alderman *et al*'s investigation of income growth and nutrition program interventions showed that access to healthcare is protective against stunting prevalence (Alderman *et al*, 2006). Additionally, Mazur and Sanders' study of Zimbabwean children showed that children born in modern medical facilities (clinics or hospitals) rather than at home were less likely to experience stunting, wasting, or underweight (1988).

Turning to the socio-demographic variables, odds of stunting increased with child age. This is because stunting is the result of prolonged malnutrition—therefore, the longer a child lives, the greater the odds that he or she is stunted (Simler, 2006). The odds for wasting decreased with child age if the child was older than 24 months; this is because wasting is a measure of acute malnutrition, and the older a child is, the greater the chance that the child can secure food for himself/herself within the household or elsewhere (i.e. school, or a neighboring compound). Studies have shown that there is a pattern to wasting in developing countries, where it decreases during the first 18 months, then increases to expected levels by 36 months, then remains relatively unchanged through 60 months of age (Pelletier *et al*, 1991). In this study, odds ratios for wasting were increased—though not significantly so—between 12-23 months of age, then decreased after 24 months. The reasons for this trend are unclear.

Similar to other African studies, being a female child was associated with decreased odds of stunting and underweight. Several studies have indicated that in sub-Saharan Africa, female children are better nourished than male ones, while the opposite trend is observed in other parts of the globe (Ramli *et al*, 2009; Madise *et al*, 1999; Wamani *et al*, 2007). One study indicated that male children are biologically at greater risk of stunting, though the reason for this is unknown (Wamani *et al*, 2007).

Duration of breastfeeding longer than two years was associated with increased odds of stunting, wasting, and underweight. This is most likely because after two years, the nutritional stores in breast milk have been mostly depleted (Hopkins *et al*, 2007). Also, mothers who breastfeed their children for such a long period of time may do so because there is a lack of solid food for the children to eat and they are trying to compensate for the family's food insecurity.

Mother's occupation was associated with child anthropometry in two ways—mothers working in agriculture had children with increased odds of stunting, and mothers working in professional occupations had children with decreased odds of wasting. These results are most likely because agricultural work is extremely labor-intensive and time-consuming, thus reducing time spent addressing children's critical needs. In contrast, professional work requires more education and pays better than many other occupations. A study in Kenya also found that agricultural households had a higher prevalence of stunting than non-agricultural households in rural areas, while an investigation in Bolivia noted that children from merchant-professional families were "significantly taller, heavier, and fatter" than children from agricultural families (Haaga *et al*, 1986; Stinson, 1983).

Living in a household in the richer and richest categories of the family wealth index was associated with decreased odds of stunting and underweight. Families in these categories have greater resources at their disposal; potentially mothers with more resources could use those resources to address child nutritional needs. One study noted a significant protective relationship between greater family landholding and nutritional status (Bairagi, 1983). Other studies have shown that higher SES is associated with decreases stunting prevalence (Ukwuani & Suchindran, 2003; Uthman, 2009).

Limitations

This study used a secondary dataset which, while vastly increasing the sample size, limited the availability of variables specifically associated with the research questions. The DHS is based on a questionnaire and uses self-reported information, which is subject to recall bias. In addition, the survey is cross-sectional, which allows for a snapshot of information at a moment in time but which can only establish association, not causality.

Other studies have looked at permission as an autonomy variable (Shroff *et al*, 2009). This study did not do so because looking at the DHS "can sell ______ without permission" questions would have constrained the sample to a much smaller size (only those mothers who owned assets), which would not have accurately represented the population. However, the adjusted financial independence variables were not significantly associated with child anthropometry.

This study did not look at sanitation or inadequate diet as covariates, though they are associated with malnutrition (Alderman *et al*, 2006; Madise *et al*, 1999; Mazur & Sanders, 1979; Sunil, 2009). It also did not look at infectious diseases such as malaria and HIV/AIDS, which are prevalent health issues in Tanzania as well as in many other developing countries. This study is only an initial glimpse at maternal autonomy as a protective factor in child nutrition in Tanzania. Further studies should investigate the association of sanitation, diet, infectious diseases and maternal autonomy.

While this study found that "final say in own healthcare" is a significant factor in determining prolonged child nutritional outcome, it did not look at access to healthcare as a covariate. Further research should look at healthcare access in Tanzania.

Conclusion

"Final say in own healthcare" was the only maternal autonomy variable which was significantly associated with child anthropometry, indicating that decision-making power regarding own healthcare is an important factor that influences a mother's ability to meet the nutritional needs of her children. While other factors (sanitation, diet, disease prevalence) do play a role and need to be studied further, these results indicate that policy-makers and public health professionals may want to look into avenues by which maternal autonomy can be enhanced. Further research should be done to look at culturally-acceptable means of increasing awareness regarding the importance of maternal decision-making power for her healthcare.

While the current study indicates that maternal autonomy plays a role in child nutritional status, other literature suggests that maternal empowerment—similar to maternal autonomy—may not be enough to protect against child malnutrition. Education regarding proper feeding practices and societal access to resources all play a key role (Sethuraman *et al*, 2006). Investigations of interventions in Tanzania have shown that a combination of income growth and nutrition interventions have a positive impact on reducing child nutrition (Alderman *et al*, 2006). However, other studies have noted that improving the "underlying determinants" of malnutrition, including lack of women's empowerment, are required to improve child nutrition in the long-term (Bhutta *et al*, 2008).

Suggestions for interventions include mother-to-mother support groups, community initiatives, and teaching nutrition and hygiene education not only to mothers, but also to substitute caregivers and those who influence their decisions (Cattaneo *et al*, 2008; Kulwa *et al*, 2006). Most importantly though, is to teach and reinforce mothers' awareness of themselves as "autonomous agents" who impact their children's health (Whyte & Kariuki, 1991). Public health professionals should look into increasing maternal autonomy in combination with community initiatives such as increasing access to healthcare, household nutrition education, and gender equality education as possible interventions to improve child nutritional status.

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