Mothers Education and Children's Nutrition Outcomes in Tanzania

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Abstract.
Childhood malnutrition continues to be a pressing concern in sub-Saharan African countries, as it affects millions of children. Despite numerous efforts to mitigate malnutrition, this problem persists. We investigated the effects of mothers' education on the nutritional status of children aged 0-59 months in Tanzania using data from the 2020/21 National Panel Survey. Three indicators of childhood malnutrition were assessed: stunting, underweight, and wasting. Chi-square Test statistics were used to estimate the association between childhood nutritional status and the categorical variables of mothers' education. For the analysis, the study employed binary logistic regression to examine the relationship between mothers' education and childhood nutrition status. The findings revealed that higher levels of maternal and paternal education reduce the probability of child stunting, underweight, and wasting. Furthermore, occupation of the head of the household and living in urban areas is associated with a decreased probability of child stunting, wasting, and underweight. Based on these findings, the study advocates for policy interventions that enhance educational opportunities for women and girls and improve healthcare services, particularly in rural areas. The research also recommends government and stakeholder involvement in creating employment opportunities and ensuring the economic stability of families.

Keywords: Childhood malnutrition; Maternal education; National Panel Survey; Tanzania
JEL Classification Codes: I12, 121, I32.

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1 Introduction

Attaining Sustainable Development Goals (SDGs) is a crucial aspiration for every nation, and encompasses various aspects of social, economic, and environmental progress. Among these objectives, reducing childhood malnutrition and enhancing maternal education is vital for sustainable development (Baker *et al.*,2018). Addressing childhood malnutrition improves health outcomes and fosters human capital development, which drives economic growth (WHO 2018). Likewise, empowering women through education leads to better decision-making and resource allocation, positively impacting their families and communities (Ashraf *et al.*,2010). The interconnected nature of these goals underlines the importance of adopting a comprehensive approach to achieving meaningful progress by 2030.

The pivotal role of maternal education in mitigating childhood malnutrition has gained significant attention in global research and policy discussion (Abuya *et al.,* 2012; Makoka and Masibo, 2015; Wachs *et al.,* 2005). Various studies have established a multifaceted relationship between maternal education and childhood malnutrition, highlighting the crucial role of educated mothers in ensuring their children's proper nutrition and care (Fadare *et al.*,2019).

With growing awareness of the importance of empowering women through education, policymakers and development organizations prioritize initiatives that enhance mothers' abilities to provide optimal care for their children (Barros *et al.,* 2010). Nevertheless, the availability and accessibility of resources such as food and healthcare facilities remain insufficient to guarantee child health (Singh *et al.,* 2009). As a result, there is an increasing emphasis on human resource determinants, specifically maternal education, and their impact on dietary preferences, feeding practices, and health-seeking behaviors (Douthit *et al.,* 2015).

More importantly, educated mothers significantly reduced childhood malnutrition by leveraging their knowledge and access to resources, leading to better health outcomes for their children. Studies in SSA have demonstrated that maternal education positively influences children’s nutritional status (Abuya *et al.,* 2015; Wachs *et al.,* 2005). These studies posit that educated mothers reduce malnutrition by making informed decisions about their children's dietary preferences, feeding practices, and health-seeking behaviors (Girma & Alenko,2015). In addition, educated mothers have better access to health and nutritional information, enabling them to provide appropriate and balanced meals for their children (Blum *et al.*,2023).

Malnutrition remains a persistent problem in Sub-Saharan Africa (SSA), particularly in Tanzania. Despite the benefits of maternal education, recent statistics have revealed that the prevalence of malnutrition among children aged 0-59 months remains high in these regions (Monteiro et al.2010). According to the United Nations Children's Fund (UNICEF,2020), the prevalence of stunting, which is the low height for age among children under five years of age in SSA, was 31.5%, while the prevalence of wasting (low weight-for-height) was 6.7%. However, in Tanzania, the situation is similar. The 2019 Tanzanian Demographic and Health Survey (TDHS) reported that 31.8% of children under five years of age were stunted, 3.6% were wasted, and 6.1% of children in the same age group were underweight (MHCDGEC,2020).

Malnutrition among children under five years of age has short- and long-term effects. In the short term, malnutrition can result in impaired immune function and increased susceptibility to infection (Victora *et al.*,2008). In addition, malnourished children are more prone to growth failure, resulting in delayed physical growth and impaired brain development. The literature indicates that malnourished children tend to be shorter as they become adults, have poorer

educational attainment, lower incomes, and lower birth weights for their offspring (Victora *et al.,* 2008). Given childhood malnutrition's effects it is imperative to understand the immediate solutions to this problem for policy purposes.

In this study, we investigated the effects of maternal education on childhood nutrition outcomes in Tanzania using data from the to 2020/2021 National Panel Survey (NPS). Although prior studies in Sub-Saharan Africa have identified a link between maternal education and childhood malnutrition (Abuya *et al.,* 2012; Fikadu *et al.,* 2014; Wamani *et al.,* 2007; Makoka, 2013), there is limited empirical research on this relationship, specifically in Tanzania. Makoka (2013) studied the relationship between Tanzania, Zimbabwe, and Malawi. While his study included Tanzania, it primarily relied on outdated 2009-10 data from the Demographic Health Survey (DHS). The use of these DHS data might not offer a comprehensive understanding of the issue, as it only encompasses Tanzania's mainland. In contrast, the NPS provides a more representative dataset covering both the Tanzanian mainland and Zanzibar, thus offering a broader perspective than the DHS. Our study addresses the existing gaps in the literature by providing empirical evidence from Tanzania, a region with limited available research, and by leveraging a recent, nationally representative dataset. We hypothesized that maternal education in Tanzania spans the primary, secondary, and tertiary levels. Employing the current data in this study is essential for capturing the most accurate and up-to-date understanding of the relationship between maternal education and childhood nutritional outcomes. This, in turn, contributes to more informed policymaking and the design of effective interventions to improve child health outcomes.

The remainder of this paper is organized as follows. Section 2 describes the data and methods, section 3 explains the empirical strategy, section 4 presents the findings of the study, section 5 explains the discussion of the results, and section 6 presents the conclusion and policy recommendations.

2. Data and Methods.

This study used the fifth wave of the National Panel Survey Data of Tanzania (2019/20). The target population for this study included all children under five years of age. This study used the 2019/20 dataset from the National Panel Survey (NPS). This was the fifth round of data collected by the National Bureau of Statistics of Tanzania in collaboration with the World Bank. The survey collected various types of information, including child characteristics, such as age, sex, length, and body circumference. It also collected household characteristics, including age, education level, sex, and marital status. This information was used in this study. This study used a sample size of 3,129 children aged 0-59.

The main outcome variable in this study was childhood nutritional status. We measured childhood nutrition outcomes using anthropometric information, including the height-for-age, weight-for-height, and weight-for-age Z-scores. The nutritional status of a child is normally measured in terms of stunting, underweight, and wasting. Stunting measures chronic malnutrition. It is defined as the height/length to age ratio, denoted as HAZ. Underweight denotes a child's WAZ and is known as undernutrition. It is measured as the ratio of weight to the child's age. Wasting refers to acute malnutrition, denoted as WHZ. Z-scores were calculated using the WHO Growth Chart Reference 2007 for children below five years of age. The z-scores indicate the number of standard deviations (SD) of a child in relation to the median of the referenced population from the WHO charts. Children with a HAZ value $\leq$ -2SD were regarded as stunted, while those with WAZ and WHZ less than or below -2SD were regarded as underweight and wasted children, respectively (WHO, 2007). For instance, stunting

measures cumulative linear growth to capture chronic malnutrition, whereas wasting indicates inadequate nutrition immediately before the survey. The ranges of the three continuous, normally distributed anthropometric indicators, HAZ, WHZ, and WAZ, were between 6 and 6 standard deviations (SD). The three continuously distributed and normally distributed anthropometric indices (HAZ, WHZ, and WAZ) have a range of six-to-six standard deviations (SD). Similarly, children with WAZ less than -2 SD from the reference population's median weight are underweight for their age, those with WHZ less than -2 SD from the median are wasted, and those with WHZ greater than +2 SD are overweight. All dependent variables were binary variables, with a value of either 0 or 1. On the other hand, the main explanatory variable in this study is maternal education. We also measured maternal education as a categorical variable, which is the main explanatory variable, with four categories indicating zero for no formal education, one for primary education, two for secondary education, and three for tertiary education. Table 1 presents the definitions of the variables used in this study.

Table 1: Definitions and Measurements of Variables

Stunting	**Dummy=1 if a child is stunted and 0 if otherwise**
Wasting	Dummy=1 if a child is wasted and 0 if otherwise
Underweight	Dummy=1 if a child is underweighting and 0 if otherwise
Overweight	Dummy=1 if a child is overweight
Maternal education	Categorical variable that captures education level for mothers (0=No formal education; 1=Primary education; 2=Secondary education; 3=Tertiary education)
Mother's age	Categorical variable that captures age groups for mothers (1=15-30 years; 2=31-45 years; 3=46-60 years; 4=61 years and above)
Child Sex	Dummy=1 if the child's sex is male and 0 if otherwise
Child Age	Child age in months
Household head occupation	Categorical variable with three categories of occupation (0=Other occupation, 1=Farming, 2=Employed). Other occupation includes mining, tourism, family work, and no work.
Household head age	Capture the age of the head of the household in years.
Household size	Measures the individual's number in the household.
Residence	Dummy = 1 if the location is rural and 0 if otherwise
Improved toilet facility	Dummy =1 if the household uses an improved toilet facility and 0 if otherwise
Wealth index	Measured using Principal component analysis whereby 16 assets were included in the construction of this variable. It ranges from 0 to 100, indicating the household is wealthier as the value is higher. Assets include radio, television, sewing machine, mobile phone, chairs, sofas, tables, watches, beds, cupboards, mosquito nets, electric/gas stove, motor vehicle, motorcycle, bicycle, and poultry.
Mother BMI	Categorical variable with three categories representing mother health status (1=underweight, 2=normal weight, 3=overweight). The healthy range is 18.5 to 24.9; underweight is less than 18.5, while overweight is above 25.
Health seeking behavior	Dummy=1 if the household sought health services within the last 30 days, and 0 if otherwise
Overweight	Dummy=1 if the child is overweight and 0 if otherwise
Diarrhea	Dummy=1 if the child has suffered from diarrhea in the last two weeks, and 0 if otherwise
Married	Dummy =1 if the head of the household is married

Source**:** Own Computation: NPS 2020/21

3. Empirical Strategy

We employed both bivariate and multivariate models to investigate the association between a mother's education and child nutrition outcomes. Pearson(x^2) test was used to show the relationships between indicators of childhood malnutrition with mothers' age and education. For the validity of the results, we compared the chi-square ($\chi 2$) test while accounting for the survey design used in the National Panel Survey (NPS). This approach ensures that statistical analysis correctly considers the complex sampling design, which typically involves stratification, clustering, and unequal selection probabilities (Takele *et al.*2019). It also helps to obtain more accurate estimates of the relationships between the variables. Like many other nationally representative surveys, the National Panel Survey employs a multistage stratified sampling design (Rao, 2005). This involves dividing the population into different strata (For example urban and rural areas or administrative regions) and selecting primary sampling units within each stratum.

The dependent variable in this study was malnutrition among children aged 0-59 months, as indicated by stunting, underweight, wasting, and overweight status. Logistic regression analysis was used to estimate the association between maternal education and the probability of a child experiencing malnutrition. The logistic regression model assumes a logarithmic relationship between predictor(s) and outcome variables and is designed to estimate the probability of belonging to a specific group, given a set of predictors. We first assume the binary responses for stunting, underweight, wasting, and overweight represented by Y_{1i}, Y_{2i}, Y_{3i} Y_{4i} respectively, in the i^{th} child under the age of five. For a binary response Y_{ji}, (stunting, underweight, and wasting), and a set of explanatory variables denoted by the vector X including mothers' socioeconomic characteristics, demographic factors, and environmental factors, the logistic regression model is formulated as shown in equation 1(Agresti, 2018).

$$\pi_j(X) = \frac{e^{\beta_{j0}+\beta j_1 X_1+\beta j_2 X_2+\cdots+\beta j_p X_p}}{1+e^{\beta_{j0}+\beta j_1 X_1+\beta j_2 X_2+\cdots+\beta j_p X_p}} = \frac{e^{X\beta_j}}{1+e^{X\beta_j}} \quad (1)$$

In this context, πj(X) represents the probability of the i^{th} a child experiencing malnutrition, including stunting, indicated by Y_{1i} underweight Y_{2i} or wasted Y_{3i} given maternal education and another set of other explanatory variables.[1] Given a set of explanatory variables, this indicates the likelihood of childhood malnutrition. We transformed these probabilities into logit or log odds to further analyze the relationship between these malnutrition outcomes and the explanatory variables.

We transformed the probabilities into logits to further analyze the relationship between maternal education and childhood nutrition status. The logit function allowed for a linear relationship between the outcome variables and the explanatory variables. The logistic regression model allows for a comprehensive examination of how these explanatory variables influence the probability of a child being stunted, underweight, or wasted. The logit model is presented in equation (2) below.

$$logit[P(Yj_i = 1|X)]=\beta j_0 + \beta j_1 X_1 + \beta j_1 X_1 + \cdots + \beta j_1 X_1 = X\beta_j \quad (2)$$

[1] In this study, the set of explanatory variables comprises various demographic characteristics of both the mother and the child, as well as socioeconomic factor

Odds ratio (OR) is one of the most prevalent methods for assessing the association between categorical variables. The odds ratio represents the proportion of odds, defined as the likelihood of an event occurring relative to its probability of not occurring. The odds ratio is particularly useful for comparing the odds of an outcome occurring in two different groups, providing insight into the strength and direction of the association between the explanatory variable and the outcome of interest. An odds ratio greater than 1 indicated a positive association between the covariate values and the outcome, while an odd ratio less than 1 indicated a negative association[2]. The odds ratio is represented as;

$$\frac{Oddsj_1}{Oddsj_2} = \frac{\pi_j(X_1)/(1-\pi_j(X_1))}{\pi_j(X_2)/(1-\pi_j(X_2))} \quad (3)$$

To measure the effects of maternal education on the four measures of malnutrition (stunting, underweight, wasting, and overweight), the following equation 4.

$$log\left(\frac{P_i}{1-P_i}\right) = \beta_0 + \beta_1 MothersED_i + \beta_1 X + \varepsilon_i \quad (4)$$

Where, $log\left(\frac{P_i}{1-P_i}\right)$ is the probability of child i stunted, underweight, or wasted. *Mothers ED* indicates the mother's education level for the child i, β_0 is the intercept term, signifying the log odds of childhood malnutrition when the mother's education level is zero; β1 is the coefficient for mother education which measures the average probability change in malnutrition for a one-unit increase in the mother's education level and ε_i shows the error term.

4. Findings

4.1 Descriptive Statistics

Descriptive statistics for this paper were derived from a sample of 3,129 children aged 0-59 months in Tanzania. As shown in Table 2, the sample exhibited a nearly even distribution of male and female children (49% male and 51% female). The average age of the children was 29 months old. A significant number of children faced nutritional challenges, as evidenced by the fact that, on average, 32% of the children experienced stunting, 11% were underweight, and 4% experienced wasting.

The statistics revealed that the average maternal education level was low, with maternal education being the main explanatory variable. On average, 51% of the mothers completed primary education, 20% attained secondary education, 2% had completed tertiary education, and 27% had no formal education. The age distribution of mothers in the sample was as follows: on average, 38% were between 15 and 30 years, 40% were between 31 and 45 years, 15% were between 46 and 60 years, and 7% were 61 years or older. Most mothers in this sample were of reproductive age. Environmental factors have also been suggested to be determinants of nutritional outcomes in children. In this sample, 44% of the Tanzanian households had access to improved toilets. The average household size of the sample was 7.

[2] Frost *et al*. 2005; Emmanuel *et al*. 2011

Table 2: Descriptive Statistics

Variable	N	Mean	Std. Dev.	Min	Max
Stunting	3129	0.32	0.47	0	1
Wasting	3129	0.04	0.21	0	1
Underweight	3129	0.11	0.31	0	1
Child sex (Male=1)	3129	0.49	0.50	0	1
Child age (months)	3129	29.12	16.74	0	59
Mother education level					
No formal education	3129	0.27	0.44	0	1
Primary education	3129	0.52	0.50	0	1
Secondary education	3129	0.20	0.40	0	1
Tertiary education	3129	0.02	0.12	0	1
Mother age					
15-30 years	3129	0.38	0.48	0	1
31-45 years	3129	0.40	0.49	0	1
46-60 years	3129	0.15	0.36	0	1
61 years and above	3129	0.07	0.24	0	1
Paternal education level					
No formal education	3129	0.33	0.47	0	1
Primary	3129	0.48	0.50	0	1
Secondary	3129	0.16	0.37	0	1
Tertiary	3129	0.03	0.17	0	1
Household head occupation					
Other occupation	3129	0.25	0.43	0	1
Farming	3129	0.59	0.49	0	1
Employed	3129	0.16	0.37	0	1
Household size	3129	7.18	4.03	2	29
Improved toilet (Yes=1)	3129	0.44	0.50	0	1
Household head age (years)	3,129	42.42	13.31	17	95
Marital status (Married=1)	3,129	0.83	0.37	0	1
Place of Residence (Urban=1)	3,129	0.33	0.47	0	1
Household wealth status					
Poorest	3,129	0.20	0.40	0	1
Poor	3,129	0.20	0.40	0	1
Middle	3,129	0.20	0.40	0	1
Richer	3,129	0.20	0.40	0	1
Richest	3,129	0.20	0.40	0	1
Mother BMI	3,129	19.51	3.59	11.35	39.65

Source: *Authors' computation from NPS 2020/21.*

On average, the proportion of fathers with no education was higher than that of mothers with no formal education. 33% of the fathers had no formal education, 48% had completed primary education, 16% had attained secondary education, and 3% had achieved tertiary education. The average age of the households is 42 years. Statistics also reveal that approximately 83% of household heads are married and 33% reside in urban areas. The findings in Table 2 show that on average, 25% of individuals were engaged in occupations unrelated to farming or employment, 59% participated in farming activities, and 16% of household heads held employment. These results highlight the significance of agriculture as a primary source of livelihood for Tanzanian households. The descriptive statistics further provided insight into the sample's socioeconomic distribution and the mother's Body Mass Index (BMI). The average BMI of mothers in the sample was 19.51.

4.2 Results

4.2.1 Childhood Nutrition Outcomes by Mother's Educational Level in Tanzania

Table 3 shows the bivariate analysis of the association between childhood nutrition status and by mother’s level of education.

Table 3. Childhood nutrition outcomes by mother's Educational Level in (in %)

Mother education level	Stunted [1]	Wasted [2]	Underweight [3]
No formal education	37.64	4.95	12.67
Primary education	31.01	3.98	10.15
Secondary education	27.64	5.37	11.87
Tertiary education	16.00	2.00	2.00
Total	31.86	4.47	11.03
Pearson Chi2	24.12	3.24	8.14
P-value	0.00	0.36	0.04

Source: *Authors Computation from NPS 2020/21.*

The results indicated a significant association between the mother's education level and child stunting. The Pearson correlation value (24.12) suggests a moderate positive correlation between a mother's education level and child stunting. Further from Table 3, stunting and being underweight was more prevalent for the children whose mother had no formal education than their counterparts with formal education. Further analyses indicated no significant relationship between maternal education and child wasting among children aged 0-59 months in Tanzania. Table 4 shows the correlation between children's nutrition outcomes and the areas of residence (rural and urban). As shown in Table 4, child stunting, underweight, and wasting among children between 0-59 months in Tanzania was higher in rural areas than in urban areas (p = 0.00 and 0.01, respectively). The Chi-Square test revealed a significant relationship between childhood nutrition status and the area of residence at the 5% level. Similar findings have been observed in developing countries (Smith *et al*.,2005).

Table 4: Childhood Malnutrition by Area of Residence and Age of Children in Tanzania.

Variables	Stunted [1]	Wasted [2]	Underweight [3]
Residence			
Rural	34.93	4.50	12.01
Urban	25.70	4.43	9.05
Pearson Chi2	27.24	0.01	6.21
P-value	0.00	0.93	0.01

Source: ***Authors Computation from NPS (2020/21)***

4.2.2 Maternal education on childhood malnutrition (Logistic Regression Results).

To examine the effects of mother's education on childhood nutrition outcomes we employed the binary logistic regression because of the dependent nature of the dependent variable. Table 5 presents the results. Column (1) of Table 5 displays the marginal effects of the logistic regression of maternal education on stunting, Column (2) shows the logistic regression of maternal education on child wasting, and Column (3) shows the marginal effects of maternal education and underweight.

Table 5: Maternal Education and Childhood Malnutrition (Marginal Effects Estimates)

VARIABLES	*(1)* *Stunting*	*(2)* *Wasting*	*(3)* *Underweight*
Reference maternal education level = No formal education.			
Primary education	-0.0570**	-0.0115	-0.00761
	(0.0232)	(0.0108)	(0.0149)
Secondary education	-0.0385	0.00327	0.0249
	(0.0330)	(0.0158)	(0.0234)
Tertiary education	-0.0711	-0.0266	-0.0623
	(0.0852)	(0.0273)	(0.0479)
Child sex (Male=1)	0.0611***	-0.0062	0.0235**
	(0.0175)	(0.0080)	(0.0120)
Child age (months)	0.0008	-0.0010**	0.0010**
	(0.0005)	(0.0003)	(0.0004)
Reference Mother age group = 15-30 years of age			
31-45 years of age	0.00174	-0.0118	-0.00877
	(0.0248)	(0.0116)	(0.0175)
46-60 years of age	0.0544	0.0058	0.00137
	(0.0440)	(0.0219)	(0.0292)
61 years of age and above	0.141*	0.0224	0.00941
	(0.0725)	(0.0401)	(0.0466)
Reference paternal education level – No formal education			
Primary education	0.00896	-0.0022	-0.0216
	(0.0256)	(0.0124)	(0.0172)
Secondary education	0.0037	-0.0089	0.0101
	(0.0343)	(0.0150)	(0.0250)
Tertiary education	-0.173***	-0.0204	-0.0934***
	(0.0500)	(0.0209)	(0.0244)
Reference household head occupation – Other occupation			
Farming occupation	0.0045	-0.0074	0.0214
	(0.0253)	(0.0111)	(0.0159)
Employed occupation	-0.0541*	0.0021	0.0403**
	(0.0279)	(0.0136)	(0.0202)
Improved toilet (Yes=1)	-0.0326	0.0185*	0.00675
	(0.0220)	(0.0102)	(0.0149)
Toilet sharing (Yes=1)	0.0207	-0.0175*	0.00344
	(0.0221)	(0.0106)	(0.0150)
Reference wealth quintile = Poorest			
Poor	-0.0144	0.0039	0.0184
	(0.0296)	(0.0130)	(0.0202)
Middle	-0.0549*	0.0051	-0.00860
	(0.0301)	(0.0136)	(0.0199)
Richer	-0.0462	0.0075	0.00627
	(0.0315)	(0.0142)	(0.0215)
Richest	-0.0747**	-0.0002	-0.0266
	(0.0337)	(0.0148)	(0.0216)
Household size	0.0015	0.0012	0.00255
	(0.0029)	(0.0013)	(0.00187)
Household head age	-0.0029**	-0.0001	0.000565
	(0.0013)	(0.0006)	(0.000865)
Mother's BMI index	-0.0007	-0.0037***	-0.00580***
	(0.0007)	(0.0014)	(0.00195)
Marital status (Married=1)	-0.00327	-0.0028	-0.00340
	(0.0312)	(0.0140)	(0.0205)
Observations	3,129	3,129	3,129

Standard errors in parentheses
****** p<0.01, ** p<0.05, * p<0.1***

These results from Table 5 indicate a statistically significant relationship between primary mother's education and reduction in childhood malnutrition by a 5% significance level. This suggests that when a mother has a primary education, there is a 5.7% decrease in the probability of child stunting compared to mothers with no formal education. Further, the results indicate that tertiary education is associated with a 6.23% decrease in the probability of being underweight, although this is not significant at conventional levels. The binary logistic regression further indicated that male children were significantly more likely to be stunted and underweight than female children in columns (1) and (3) of Table 5. This indicates that male children have a 2.35% higher probability of being underweight than female children. These findings suggest that sex-based disparities in nutritional outcomes exist, with male children being more vulnerable to stunting and being underweight.

Child age plays a significant role in determining the nutritional status of children, specifically wasting and underweight statuses. A one-month increase in child age is associated with a decrease in wasting in Model (2) and an increase in underweight in Model (3) by 0.10%. The indication is that as children grow older, they may become less susceptible to wasting, but are more prone to being underweight. Furthermore, the results show that tertiary education for fathers is significantly associated with a decrease in stunting (17.3%) in Model (1) and underweight (9.34%) in Model (3) by 17.3% and 9.34% respectively. Thus the children whose fathers have tertiary education have a 17.3% lower probability of being stunted than their counterparts. This relationship is statistically significant at a 1% level. In addition, children who's with fathers who had tertiary education had a 9.34% lower probability of being underweight than their counterparts. Further results indicated that the children in households with an employed head are significantly less likely to be stunted (5.41%) and more likely to be underweight (4.03%) than those in households with other occupations (such as agriculture and no jobs at all). Access to improved toilet facilities was significantly associated with increased waste (1.85%). This may seem counterintuitive, but it could be due to other factors such as differences in hygiene practices or living conditions. Toilet sharing was significantly associated with decreased wasting (1.75%), suggesting that sharing facilities had a protective effect, possibly due to increased social support. In addition, the results indicate that children in the middle and richest wealth quintiles have significantly lower stunting rates (5.49% and 7.47%, respectively) than those in the poorest quintiles. A one-year increase in the age of the household head was significantly associated with a decrease in stunting by (0.29%). In contrast, a one-unit increase in the mother's BMI was significantly associated with decreased wasting (0.37%) and underweight by (0.37%) and (0.58%).

5. Discussion.

This study examined the effects of maternal education on childhood nutrition outcomes for children between(0-59months) in Tanzania. Stunting, underweight, and wasting–were used to measure childhood nutrition status. The findings of this study highlight that the effects of mother's education on children's nutrition outcomes in Tanzania vary depending on specific indicators of stunting, underweight, and wasting. Stunting was found to be more prevalent among children whose mothers have no formal or only primary education than those whose mothers have secondary or tertiary education. In line with this finding, the earlier researchers found similar results (Emina *et al.*, Solon *et al.*, 1985; Desai & Alva, 1998; Frost *et al.*, 2005). When mothers have higher levels of education, they possess better knowledge, decision-making skills, and awareness, which are positively correlated with the improved nutritional status of their children (Jones *et al.*,2019).

The results also demonstrated that paternal education, particularly at the primary level, reduced the likelihood of children being underweight. Previous research has highlighted the significance of paternal education in determining children's nutritional status. This may be attributed to the fact that educated fathers are more inclined to prioritize their children's health and well-being and ensure proper care and nourishment. In addition, higher paternal education is commonly linked to an elevated socioeconomic status, providing better access to essential resources such as healthcare, quality food, and safe living conditions (Aizer *et al.*,2016). Consequently, improved access to these resources leads to better nutritional outcomes for children. Finally, educated fathers may possess greater decision-making power within the household, resulting in a heightened emphasis on child health and nutrition Lawson & Mace, 2011).

Place of residence plays a significant role in the association between maternal education and childhood malnutrition and is more pronounced in rural areas than in urban areas. Stunting may be higher in rural areas than in urban areas because of factors such as limited access to healthcare services, educational resources, and quality nutrition, which can contribute to higher levels of stunting among children from these regions (Smith *et al.*,2005). By contrast, urban areas tend to have better access to healthcare facilities, educational institutions, and a more diverse range of food choices, which can help reduce the prevalence of malnutrition (Kandala *et al*.,2011). Moreover, cultural differences between rural and urban areas may influence child-rearing and nutritional practices. Rural areas may have more traditional practices that might not prioritize proper child nutrition or health care.

The results suggest that boys are more likely to experience stunting and being underweight than girls are. The observed sex differences in stunting and underweight among children may be attributed to biological, cultural, and health-seeking factors. Boys may have different nutritional requirements and vulnerabilities, which makes them more susceptible to environmental stressors and malnutrition (Ozaltin *et al.* 2007). Cultural preferences and gender biases in resource allocation could lead to boys receiving inadequate nutrition or healthcare (Barcellos et al. 2014). Furthermore, parental health-seeking behaviors may differ between boys and girls, with parents potentially seeking medical care more often for boys than for girls, affecting their nutritional outcomes (Chadoka-Mutanda & Odimegwu,2017). Some studies have found that girls are more likely to be stunted and underweight than boys. For example, Harding *et al*. (2018) found that girls in these countries were more likely to experience stunting and be underweight than boys. Although this study does not focus specifically on Tanzania, it provides evidence of gender disparities in stunting and underweight in other low-income and middle-income countries.

The findings revealed a negative relationship between being in a richer household and child stunting. This suggests that children from wealthier households are less likely to experience stunting than those from poorer households. The richer households are likely to have better access to resources such as nutritious food, clean water, and healthcare services in wealthier households, leading to improved child growth and development (Victora *et al.*, 2003). In addition, higher-income families can afford better living conditions, including housing and sanitation facilities, which reduces children's exposure to environmental factors that could negatively impact their growth. Furthermore, wealthier households may have greater access to education and information about proper child nutrition and care, contributing to better overall child health and reduced stunting (Smith and Haddad, 2015).

The findings reveal decreased stunting among children living in households with employed heads compared with their counterparts. Several factors contribute to this outcome, all of which are linked to economic stability provided by the household head's employment. First, better economic stability enables households to access essential resources such as nutritious food, clean water, and healthcare services, which are crucial for children's growth and development (Hoddinott *et al*., 2013). Improved access to these resources can help prevent stunting and improve the overall health of children. Second, employed household heads are more likely to afford better housing and sanitation facilities, leading to healthier living conditions for their children (Irianti *et al*.,2016). Access to safe and clean environments can positively impact children's well-being and reduce their risk of stunting. A stable income can provide security and support, positively influencing children's health. These findings were consistent with those of a study conducted in Tanzania (Akombi *et al.*,2017

6. Conclusions and Policy Recommendations.

This paper examined the relationship between mother's education and childhood malnutrition, as measured by stunting, underweight, and wasting, using data from the National Panel Survey of Tanzania 2020/21. Both univariate and multivariate approaches were employed to examine the association between mothers' education and childhood malnutrition in Tanzania. The findings revealed a significant impact of maternal and paternal education, household economic stability, and employment status on children's nutritional outcomes in Tanzania. Specifically, increased maternal education, paternal primary education, and employment status of the household head are associated with a reduced likelihood of stunting, wasting, and being underweight among children.

The study recommends promoting and supporting access to education, particularly for women and girls, is crucial as higher mother's education is linked to improved child health outcomes. This can be achieved by developing and implementing programs that encourage female enrollment in schools and provide financial support or incentives for girls to continue their education. Finally, the study recommends, that promoting and supporting initiatives that aim to improve agricultural practices and dietary diversity, particularly in rural areas. Encouraging cultivating and consuming a diverse range of crops can help address malnutrition among children in agricultural households.

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