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Factors influencing Stunting, Wasting, and Underweight Among Under-Five Tribal Children in Kerala

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Abstract

This study investigates the socio-economic determinants of stunting, wasting, and underweight among children under five in the Attappady tribal region of Kerala. Using primary data from 378 households and applying ordered probit regression models, the research identifies key factors influencing child malnutrition. Findings reveal that gender, community affiliation, family structure, parental education, and employment significantly affect nutritional outcomes. Children from female-headed households are more likely to suffer from malnutrition, while joint family structures and parental employment provide protective benefits. The study underscores the importance of community-specific factors and targeted interventions to address the high malnutrition rates in this vulnerable population.

Keywords: Stunting; Wasting; Underweight; childhood development; malnutrition.

1. Introduction

Nutritional status is a fundamental indicator of childhood development, influencing health, learning, and productivity across a child's lifetime. In vulnerable communities like tribal populations, a complex interplay of socio-economic, cultural, and environmental factors heavily impacts children's access to adequate nutrition and healthcare. The tribal communities in Kerala face unique challenges that contribute to high malnutrition rates among children. In these communities, children under five years' experience high levels of stunting, wasting, and underweight, signalling chronic and acute malnutrition. Effectively addressing these malnutrition issues requires a comprehensive understanding of the factors that drive poor nutritional outcomes.

Despite significant national progress in child health and nutrition, tribal populations in India continue to suffer disproportionately from poor health indicators. Some regions in Kerala exemplifies this disparity, where socio-economic hardships, traditional cultural practices, and limited healthcare resources contribute to elevated rates of malnutrition among children. Poverty, food insecurity, and limited parental education hinder access to nutritious food for young children, while geographic isolation and traditional lifestyles limit access to essential health and nutrition services. Identifying the root causes of malnutrition among tribal children is crucial to developing interventions that improve child health, enhance nutrition, and promote community resilience against poverty and health disparities.

This study seeks to assess the prevalence of stunting, wasting, and underweight among children under five in the selected region and to examine the socio-economic and demographic factors influencing these nutritional outcomes. Using primary data collected from select regions in Kerala, this research applies an ordered probit regression model to analyse the determinants of three key nutritional indicators—stunting, wasting, and underweight. Factors examined include gender, family structure, and parental education and employment status. By providing insights into how various socio-economic, cultural, and household factors affect child nutrition within this vulnerable population, the study aims to lay a foundation for community-specific strategies to address malnutrition and improve the well-being of young tribal children in Kerala.

2. Review of Literature

Social determinants of health (SDH), as defined by the World Health Organization (2008), are non-medical factors that significantly impact health outcomes. These determinants include the conditions in which individuals are born, grow, work, live, and age, as well as the social, economic, and environmental factors that influence everyday life. Healthy People 2020 identifies five key SDH categories: economic stability (including factors like poverty and food access), education (such as high school graduation rates and early childhood education), social and community context (encompassing issues like immigration status and social support), health and healthcare (focusing on access to insurance and medical services), and neighborhood and built environments (including crime rates and housing quality). These factors play a significant role in determining health outcomes, particularly in children, where early-life conditions can have long-lasting effects on physical and mental well-being (Lu & Halfon, 2003). Research indicates that SDH can account for a substantial portion (30-55%) of health outcomes, often influencing health to a greater degree than healthcare services or individual lifestyle choices (WHO, 2008).

The impact of socio-economic factors on child health is well-documented, particularly in the context of malnutrition, which remains a critical global challenge affecting children's health and economic stability. Early childhood care and development are essential in shaping the physical, mental, and cognitive development of children, which in turn impacts their future health and educational success (Brooks-Gunn et al., 1997). In India, research by Agarwal and Srivastava (2009) identifies key socio-demographic determinants such as poverty, gender, maternal education, and parental occupation that influence child health and nutrition. Studies across diverse regions confirm the strong positive relationship between parental education and improved nutritional outcomes for children (Cochrane et al., 1982). Factors like parental age, employment, and education also play a critical role in shaping children's health, underscoring the importance of education and socio-economic interventions (Puri et al., 2020). However, despite various health initiatives, tribal communities in Kerala continue to face significant health challenges, highlighting the need for targeted research and intervention. This study seeks to fill this gap by investigating the socio-economic determinants of tribal child health in Kerala.

3. Methodology

Data Source

This study relies on primary data collected from a cross-sectional sample of 378 households in the Attappady block of Mannarkkad Taluk, located in the Palakkad district of Kerala. The sampling process began with the selection of Palakkad district, which, as per the 2011 Census, has the third-highest concentration of tribal populations in Kerala (10.1%). Within Palakkad, the Attappady block was chosen due to its unique status as Kerala's only tribal block. The sample was further stratified to include the Agali panchayat. Household data were gathered with the support of local Anganwadis, ensuring representation from each panchayat to accurately capture the community's demographic diversity.

Measurements of Nutritional Status

This study utilizes the World Health Organization's (WHO) latest classification standards for assessing child nutritional status. WHO's framework provides globally recognized indicators that reflect a child's growth and overall nutritional health, with stunting, wasting, and underweight identified as critical indicators. These measures are essential for understanding both acute and chronic malnutrition and are part of WHO's Global Reference List of 100 Core Health Indicators.

The definitions and cut-off values for these indicators, based on WHO Child Growth Standards, are as follows:

- **Stunting**: Defined as height-for-age less than -2 standard deviations (SD) from the WHO Child Growth Standards median. Stunting indicates chronic malnutrition and reflects prolonged periods of inadequate nutrition.
- **Wasting**: Defined as weight-for-height less than -2 SD from the WHO Child Growth Standards median. Wasting signifies acute malnutrition, often due to recent or ongoing food shortages or illness.
- **Underweight**: Defined as weight-for-age less than -2 SD from the WHO Child Growth Standards median. Underweight can indicate a combination of both chronic and acute malnutrition.

Each indicator was measured following these standardized cut-off values, providing a reliable and internationally comparable basis for assessing the nutritional health of children in the Attappady region.

Method

This study utilizes an Ordered Probit Regression model to investigate the determinants of nutritional status among tribal children, focusing on three key indicators: stunting, wasting, and underweight. Separate models are estimated for each indicator, which are treated as ordinal dependent variables measured on a scale ranging from 1 (Very Low) to 5 (Very High), reflecting varying levels of nutritional health. The independent variables include socio-demographic factors such as the child's gender and characteristics of the household head. The Ordered Probit model is particularly well-suited for analysing ordinal outcomes, enabling the assessment of how explanatory variables influence the likelihood of a child being classified into specific nutritional status categories. For each indicator, the model assumes an underlying continuous latent variable that represents the child's true nutritional status, modelled as a linear function of the explanatory variables and a random error term.

Specifically, the model can be expressed as:

$$\mathrm{NTi} = \mathrm{Xki}\beta + \mathrm{Ui}$$

where NTi is the latent nutritional status for child i; Xki denotes the k explanatory variables, β represents the regression coefficients, and Ui is a normally distributed error term. This latent variable NTi is mapped onto the observed ordinal nutritional status scale through a series of threshold values, which are estimated by the model. The Ordered Probit model uses maximum likelihood estimation to compute the parameters and threshold values that best fit the observed data

4. Results and Discussion

Table 1 presents the descriptive statistics for various nutritional status indicators and key socio-demographic variables. The nutritional indicators show that children, on average, fall between the "moderate" and "severe" categories for stunting, wasting, and underweight, with mean scores of 2.7, 2.4, and 2.5, respectively, on a Likert scale from 1 to 5. The gender distribution of children is nearly balanced, with 48% female and 52% male. The majority of children live in joint families (62%), while 16% have female-headed households. Parental education levels indicate that 58% of mothers and 43% of fathers have below 8th-grade education. Regarding employment, 54% of mothers and 71% of fathers are employed, highlighting a relatively high level of paternal employment.

Table 1: Descriptive Statistics for Nutritional Status Indicators and Key Variables

Variable	Mean	Min	Max
Stunting (1-5 lkert scale)	**2.7**	**1.7**	**4**
Wasting underweight	**2.4**	**1.5**	**5**
Underweight	**2.5**	**1.4**	**5**
Gender of child (female = 1; male = 0)	0.48	0	1

Type of family (joint = 1; nuclear = 0)	0.62	0	1
Household head (female = 1; male = 0)	0.16	0	1
Mother's education (below 8th = 1; 7th and above = 0)	0.58	0	1
Father's education (below 8th = 1; 7th and above = 0)	0.43	0	1
Mother's employment status (working = 1; not = 0)	0.54	0	1
Father's employment status (working = 1; not = 0)	0.71	0	1
Observation	378		

Source: Author's estimation, 2023

Model 1 in Table 2 presents the results of the ordered probit regression for stunting. The findings indicate that female children are 1.8% less likely to be stunted compared to male children, suggesting a slight protective effect for girls in this population. The structure of the family also appears to influence stunting rates, as children from joint families are 3.7% less likely to experience stunting than those from nuclear families. This could imply that the extended support system in joint families contributes positively to child nutrition. However, the data also reveal a significant challenge for children in female-headed households, where the likelihood of stunting increases by 78%. This suggests that female-headed households may encounter additional economic or social difficulties that negatively affect children's nutritional status. Furthermore, parental education plays a critical role, with children of mothers and fathers who have not completed the 7th grade being 42% and 39% more likely to experience stunting, respectively. This underscores the importance of parental education in improving child health and nutrition outcomes. Parental employment is another key factor in reducing the risk of stunting. Employed fathers are associated with a dramatic 180% reduction in the likelihood of stunting, while working mothers reduce the risk by 1.2%. This could be attributed to the additional financial resources that employed parents may bring to the household, enhancing the overall nutrition and well-being of their children.

Table 2: Ordered Probit Regression Results for Nutritional Status Indicators
Dependent Variables: Nutritional Status Indicators (Stunting, Wasting, Underweight)

Variable	**Model 1**	**Model 2**	**Model 3**
	Stunting Coefficient (p-value)	**Wasting Coefficient (p-value)**	**Underweight Coefficient (p-value)**
Gender of child (female = 1; male = 0)	-0.0180 ** (0.024)	-0.0420 *** (0.000)	-0.0516 *** (0.000)
Type of family (joint = 1; nuclear = 0)	-0.0372 *** (0.000)	-0.0799 *** (0.000)	-0.0528 *** (0.000)
Household head (female = 1; male = 0)	-0.7800 *** (0.000)	-0.6000 *** (0.000)	-0.1488 *** (0.000)
Mother's education (below 8th = 1; 7th and above = 0)	-0.4236 * (0.072)	-0.4800 (0.072)	-0.0604 *** (0.003)
Father's education (below 8th = 1; 7th and above = 0)	-0.3960 *** (0.000)	-0.2808*** (0.000)	-0.2808 *** (0.000)
Mother's employment status (working = 1; not = 0)	-0.0144*** (0.000)	-0.0386 *** (0.000)	-0.0048 *** (0.000)
Father's employment status (working = 1; not = 0)	1.8096 **** (0.001)	1.6836 *** (0.001)	1.6140 *** (0.001)
LR Chi-Square Test	234.66 (0.000)	241.13 (0.000)	221.661 (0.000)
Observation	378		

*Note: 1) *** indicates 1 percent level of significance; ** indicates 5 percent level of significance; * indicates 10 percent level of significance, The coefficients with respect constant are not reported*
Source: Estimated from field Survey, 2023

Model 2 in Table 2 presents the estimated results of the ordered probit model for wasting. The analysis reveals a similar gender pattern, with female children being 4.2% less likely to experience wasting compared to male children. This suggests that gender may influence nutritional status, with girls having a slight advantage in avoiding wasting. The type of family also affects the likelihood of wasting, as children from joint families are 7.9% less likely to suffer from wasting than those from nuclear families. This suggests that the extended support system in joint families may contribute to better child nutrition. In contrast, children in female-headed households have a 60% higher likelihood of being wasted, indicating that these households may face additional challenges in providing adequate nutrition for their children. Parental education continues to play a crucial role, as children of mothers with education below the 7th grade are 48% more likely to be wasted, and children with similarly educated fathers face a 28% increased likelihood of wasting. This highlights the importance of parental education in improving children's nutritional outcomes. Parental employment has a strong positive impact on reducing the likelihood of wasting. Children of employed fathers are 168% less likely to be wasted, while children of working mothers have a 3.8% lower risk of wasting. These findings emphasize the significant role of family income and employment stability in meeting the nutritional needs of children.

Model 3 in Table 2 displays the estimated results of the ordered probit model for underweight. Gender continues to influence nutritional outcomes, with female children being 5.1% less likely to be underweight compared to male children. This suggests a gender-based protective factor against underweight among girls. Family structure also plays a significant role in underweight rates, as children from joint families are 5.2% less likely to be underweight than those from nuclear families, implying that the support provided by extended families may positively impact child nutrition. On the other hand, children in female-headed households have a 14.8% higher likelihood of being underweight, highlighting the challenges faced by these households in ensuring their children's adequate nutrition. Parental education remains a critical factor, with children of mothers educated below the 7th grade being 6% more likely to be underweight, and children with similarly educated fathers facing a 28% higher likelihood of being underweight. This emphasizes the importance of parental education in influencing children's nutritional status. Parental employment, particularly that of fathers, plays a protective role in reducing the risk of underweight. Children of working fathers are significantly less likely to be underweight, while the presence of working mothers slightly reduces the risk of underweight for their children. These findings underscore the importance of family income and employment in ensuring that children receive adequate nutrition.

Conclusion

This study aimed to examine the socio-economic determinants of stunting, wasting, and underweight among children under five in the Attappady tribal region in Kerala, with a focus on how various socio-economic and demographic factors influence child malnutrition. Through an ordered probit regression model, this research reveals several critical factors that significantly impact the nutritional status of children in this vulnerable population. The findings indicate that gender, community affiliation, family structure, and parental education and employment status play a pivotal role in determining nutritional outcomes for children. Female children tend to have a slightly better nutritional status than their male counterparts, which suggests a potential protective factor. Family dynamics, particularly family structure, also have a significant impact on child nutrition. Children in joint families are less likely to experience malnutrition, suggesting that extended family support systems can play a crucial role in improving child health outcomes. However, children from female-headed households face a higher risk of stunting, wasting, and underweight, which indicates the added challenges these households face, potentially due to economic or social constraints. Parental education and employment status emerge as major determinants across all indicators of malnutrition. Children with less educated parents, particularly those with mothers who have not completed the 7th grade,

are significantly more likely to suffer from stunting, wasting, and underweight. Employment status, especially of fathers, is also a protective factor, as employed parents tend to provide more financial stability, thereby improving children's access to adequate nutrition.

In short, addressing malnutrition in tribal children requires strong interventions that focus on improving parental education, increasing employment opportunities, and strengthening healthcare access. Moreover, policies should consider community-specific and family structure differences to design planned nutritional and health programs that can effectively combat child malnutrition in this region. The findings of this study contribute to the field and providing a foundation for future interventions for improving the well-being of tribal children in Kerala and similar regions across India.

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