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Nutritional Status of Reproductive-Aged Women and Children Under The Age of Five in Nepal

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Abstract

Aim: Despite the presence of economic improvements and the execution of many policies, the issue of malnutrition continues to persist as a significant worry for women and children in Nepal. This study provides a comprehensive examination of the nutritional outcomes among women of reproductive age and children within the country.

Subject and Methods: Drawing upon data obtained from the Demographic Health Survey, this study examines the significant degree of malnutrition and investigates the various factors that contribute to its occurrence. The study objectives were accomplished through the utilization of binary logistic regression and multinomial logistic regression analyses.

Results: The results of the study reveal that almost 49% of children in Nepal exhibit stunting, 11% exhibit wasting, and 34% are classified as underweight. There is a correlation between wealth quintiles and a decrease in the likelihood of stunting and underweight conditions. It is worth noting that there is an increased likelihood of severe stunting and wasting among infants born to moms between the ages of 25 and 49. Insufficient sanitation facilities have been found to be correlated with increased likelihood of stunted growth and underweight conditions. In relation to the female population, it is observed that 17% exhibit underweight, 17% exhibit overweight, and 5% exhibit obesity. There is an observed correlation between advancing age in women and a higher likelihood of becoming overweight or obese. Women who depend on tube wells or borewells for their water supply are at a heightened risk of being underweight. Moreover, there is a positive correlation between the absence of adequate bathroom facilities for women and an increased likelihood of being underweight.

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Conclusion: The research findings showed that there is a persistent high frequency of malnutrition among older and rural children, as well as those with mothers who have lower levels of education and come from economically disadvantaged homes. The possibilities of fluctuating BMI among women are influenced by factors such as education, marital status, and wealth quintile. Moreover, the absence of adequate sanitation facilities and the presence of contaminated drinking water sources contribute to an elevated susceptibility to underweight conditions. The aforementioned statement underscores the necessity for Nepal to embrace a holistic strategy that is in accordance with the Sustainable Development Goals in order to tackle the deteriorating nutritional status of women and children.

Keywords: Nepal, children under five, Reproductive-aged women, Nutritional Policies, Nutritional Status.

Introduction

Nepal, a homeland with diverse cultural and geographical characteristics, has shown significant progress in improving its nutritional status of women and children over the past few decades. However, persistent challenges and disparities continue to hinder the achievement of optimal nutrition for all segments of its population. The nutritional status of children under five remains a major concern in Nepal. Despite significant reductions in malnutrition rates, the prevalence of stunting, wasting, and underweight among children is still substantial (Ministry of Health [Nepal], New ERA, & ICF, 2017). Stunting, often indicative of chronic undernutrition, affects long-term growth and cognitive development (Black et al., 2013). Similarly, wasting, a measure of acute malnutrition, poses immediate health risks (Rytter et al., 2014). Factors contributing to these conditions include poor dietary diversity, inadequate access to healthcare, low maternal education, and inadequate sanitation facilities (Na et al., 2018). Data suggest there is no improvement in the protein energy undernutrition status in the country in the last 35 years (Pahari, 2011). Malnutrition in children and women is a major public health problem in most of the developing countries and Protein Energy Malnutrition (PEM) is more common among under five-year children. Childhood malnutrition is major underlying cause (>50%) of the under 5-year children's deaths. Every year 7.6 million children die such preventable malnutrition and its related causes (Bhandari & Chhetri, 2013). Nepal is one of the poorest nations in the world. For example, the reported average per capita income was only $ 140/yr as of 1980. Infant mortality has been estimated to be about 165 per thousand for the Terai region of Nepal using 1974 child survivorship data. Nepali children were found to have one of the highest reported prevalence of stunting (65% were <90%

National Study for Health Statistics median height for age) (Martorell et al. 1984). Maternal nutrition in Nepal is another significant concern. Anemia prevalence among reproductive-aged women is alarmingly high (Ministry of Health [Nepal], New ERA, & ICF, 2017). Iron-deficiency anemia, in particular, is a critical issue during pregnancy, affecting maternal health and contributing to adverse pregnancy outcomes (Galloway et al., 2000). Low dietary diversity and cultural practices often result in inadequate nutrient intake among women, further exacerbating the problem (Na et al., 2018).

The efforts of several study have been made at different times to find out about nutrition and related burden. The first health survey was conducted in 1966 by the University of Hawaii, providing valuable information on the diet and nutritional status of the Nepales (Pahari, 2011). Numerous factors contribute to the persistent nutritional challenges in Nepal. Socioeconomic factors, including poverty and lack of education, play a crucial role (Aguayo et al., 2013). Cultural practices and traditional beliefs surrounding infant and young child feeding practices also impact nutritional outcomes (Hetherington, 2018). Moreover, food security and agriculture-related challenges, including subsistence farming and unequal food distribution, affect dietary quality and availability (Fraval et al., 2017).

To address these issues, the Nepalese government has implemented several initiatives. These includes programs to improve maternal and child health, promoting exclusive breastfeeding, and provide micronutrient supplementation (World Food Programme, 2020). International collaborations, involving organizations like UNICEF and the World Food Programme, have further supported efforts to enhance nutrition in Nepal. The Nepal government has adopted several policy/strategy and programs at different times and implemented them to improve nutritional status. These include the National Nutrition Strategy in 1978, the National Nutrition Strategy for Nepal in 1986, the Nepal National Plan of Action for Nutrition in 1998, the Nepal Health Sector Programme- Implementation Plan for 2004-2009, the National Nutrition Policy and Strategy in 2004, the National Plan for Action on Nutrition (NPAN) in 2007, the National Nutrition Policy and Strategy in 2008, and the current national Nutrition Program (Pahari, 2011). Additionally, the government has implemented the School Health and Nutrition Strategy in 2006 to implement better quality programs for the School Health and Nutrition program. These range from direct or nutrition 'specific' programs such as micronutrient supplements to children under five, to women during pregnancy and lactation, as well as micronutrient fortification - salt iodization, flour fortification, awareness raising and behaviour change communication on optimal infant and young child feeding, and management of acute malnutrition. Indirect or nutrition

'sensitive' programs include non-conditional cash and in-kind transfers, including child cash grants, transportation subsidies for food, school feeding program, and parental education among others. These programs are being implemented by the Ministry of Health and Population, the Ministry of Education, Ministry of Federal Affairs and Local Development, Ministry of Agriculture and Development, and the Ministry of Commerce and Supplies. The Govt. of Nepal is committed to addressing the complex set of determining factors for improving nutritional status through a multi-sector approach (National Planning Commission, 2012).

Despite these interventions, challenges persist. Inconsistent data collection methods and variations in data availability hinder a comprehensive understanding of the nutritional situation across regions (Ministry of Health [Nepal], New ERA, & ICF, 2017). Effective implementation of nutrition programs at the community level remains a challenge due to logistical and resource constraints (Ruel et al., 2018).

Despite these efforts, Nepal is among ten countries with the highest stunting prevalence, a measure of chronic under-nutrition, and one of the top twenty countries with the largest number of stunted children (UNICEF, 2009; National Planning Commission, 2012). Forty-one per cent of Nepalese children suffer from chronic malnutrition. The process of stunting occurs between conception and two years of age and is an irreversible process. Furthermore, the population of Nepal, especially women and children, are affected by major micronutrient deficiencies. Almost a quarter of mothers (23%) give birth before 18 years of age, while about half give birth by 20 years of age 20 (DHS, 2011). They are often involved in heavy manual work, including farming, immediately after delivery, plus 13% of these women smoke, and 18% of women of reproductive age (15-49 years of age) are thin or undernourished (Body Mass Index or BMI<18.5kg/m2) (National Planning Commission, 2012).

Conceptual Overview

Nepal is a unique context in its own right, at a different stage of development in terms of nutrition policies and programs, and has adopted varying approaches to strengthen its nutrition services for women and children. The country provides valuable insights into ongoing efforts to improve the nutritional status of women and children and highlights areas where further action is needed. The emerging double burden of malnutrition in Nepal is of increasing concern, with the prevalence of overweight among women being greater than underweight. These challenges present powerful narratives of diverse country agendas for enhancing women and children's nutrition.

However, despite progress, women's and children's nutrition in Nepal remains unfinished business. As the country acknowledges, much more must be done to enable women to avoid the perils of undernutrition and the growing risk of overweight/obesity. This study seeks to identify the influencing factors affecting the nutritional status of children and the nutritional status of women and children. The findings from this study have the potential to make a significant impact by guiding future nutrition policies and programs in the country.

Data and Methods

Data

The study utilized Demographic Health Survey (DHS) data from Nepal in 2016 (NDHS-5). The DHS is considered a nationally representative sample as it covers households from across the country using a well-specified sampling procedure. All DHS surveys use multi-stage stratified sampling for sample selection. The survey collected information on reproductive and child health, family planning, fertility, water and sanitation, nutrition, lifestyle, violence, and other topics using a prescribed format of the questionnaire by DHS with some country-specific modifications.

The sample size of households interviewed was 11,040, with 12,862 eligible women and 4,063 men interviewed in Nepal. For the current study, only the household and eligible women schedule were used for the analysis. The survey also collected anthropometric parameters (height and weight) of women and children. In Nepal, all children aged 0-59 months and women and men aged 15 and above in selected households were eligible for height and weight measurements.

Variable Description

Dependent variable: The present study is divided into two sections: the nutritional status of women aged 15-49 years and the nutritional status of children aged less than five years in Nepal. The nutritional status of women is examined through the body mass index (BMI). It is categorised into Underweight, Normal weight, Overweight and Obese. However, the nutritional status of children is examined through Z-scores of three parameters: Stunting, Wasting, and Under-weight & Overweight for age. Stunting is categorised into two categories (Severe and Moderate); Wasting is categorised into three categories (Severe, Moderate, and Over-weight); Weight for age is categorised into three categories (Severe underweight, Moderate underweight, and Overweight) (Arnold et al., 2004).

Women nutritional status: Cut-off limit for BMI (Weight for Height:

Underweight: BMI<18.5 kg/m^2, Normal weight: BMI>=18.5 & <24.9 kg/

m^2, Overweight: BMI>=30.0 & <29.9 kg/m^2, Obese: BMI>=30.0 kg/m^2

Children nutritional status: Cut-off limit for Stunting (Height-for-Age):

- Severely Stunted: Z-score <-3.0 SD below mean
- Moderately Stunted: Z-score <-2.0SD below mean

Cut-off limit for Wasting (Weight-for-Height):

- Severely Wasted: Z-score <-3.0 SD below mean
- Moderately Wasted: Z-score <-2.0 SD below mean
- Overweight: Z-score > +2.0 SD below mean

Cut-off limit for Weight-for-age:

- Severely underweight: Z-score < -3.0 SD below mean
- Moderately underweight: Z-score < -2.0 SD below mean
- Overweight: Z-score > +2.0 SD below mean

Independent variables: Socioeconomic and demographic characteristics of women and children are considered to understand the nutritional status based on selected background characteristics. The selected socioeconomic and demographic characteristics include place of residence (Rural, Urban), religion (Hindu, Muslim, Others), age (continuous), marital status (Married, Unmarried, Others), educational attainment, working status (Yes, No), source of drinking water, type of cooking fuel, type of toilet facility, and wealth index. In addition to the variables mentioned above, the number of children and dietary patterns (food composition) of women are considered. For children, the number of siblings, sex, breastfeeding pattern, immunization, and dietary patterns are considered for the analysis.

Methods

Descriptive statistics and bivariate analysis have been used to understand the nutritional status among women aged 15-49 and children aged 0-59 months in Nepal. Multinomial logistic regression model has been used to determine factors associated with Body Mass Index among women. This allowed us to assess the independent effect of background characteristics in determining the prevalence of BMI. Multinomial logistic regression is an expansion of logistic regression in which one equation is set up for each logit relative to the reference outcome. BMI consist of four categories: normal, underweight, overweight, and obese. For a dependent variable with four categories, this requires the estimation of three equations, one for each category relative to the reference category (not related), to describe the relationship between the dependent and independents variables:

$$\ln [\{P(Y_i = 2) \mid X_i\}/\{P(Y_i = 1) \mid X_i\}] = \alpha_2 + \beta_1{}^2X_1 \ldots \beta_k{}^2X_{ik} \quad \ldots\ldots\ldots 1$$

$$\ln [\{P(Y_i = 3) \mid X_i\}/\{P(Y_i = 1) \mid X_i\}] = \alpha_3 + \beta_1{}^3X_1 \ldots \beta_k{}^3X_{ik} \text{ .....} 2$$

$$\ln [\{P(Y_i = 4) \mid X_i\}/\{P(Y_i = 1) \mid X_i\}] = \alpha_4 + \beta_1{}^4X_1 \ldots \beta_k{}^4X_{ik} \text{.....} 3$$

Where α_2, α_3, and α_4 are the intercepts for the category underweight, overweight, and obese, respectively, and $\beta_k{}^2$, $\beta_k{}^3$, and $\beta_k{}^4$ are the slope coefficient of the X_i variables for respective category of the dependent variable.

We also used binary logistic regression to determine the factors associated with severe and moderate stunting, severe and moderate wasting, and severe and moderate underweight among children aged 0-59 months. In this analysis, the response variable 'no' was recoded as 0 if the child was not malnourished and, and 1 if with child was malnourished:

$$\log_e [P(Y_i = 1 \mid X_i) / 1 - P(Y_i = 1 \mid X_i)] = \log_e [\pi \mid 1 - \pi] = \alpha + \beta_1 Xi_1, \ldots, \beta_k X_{ik} \text{ .....} 4$$

Where Y_i is the binary response variable; X_i is the set of explanatory variables, such as sociodemographic characteristics as mentioned in case of multinomial model; and $\beta_1, \ldots, \beta_k$ are the coefficients of the X_i variables.

Results

Evolution of Nutritional Policies and Prevalence of Anemia

The government has launched various policies to improve the nutritional status of Nepal. Figure 1 shows the prevalence of anemia among reproductive-aged women and children aged 0-59 months. The government has attempted multiple measures to address nutritional problems in the country, recognizing it as a fundamental human right enshrined in the 'Convention on the Rights of the Child (CRC) 1989.' However, the literature finds no improvement in the country's protein-energy undernutrition status over the last 35 years (Pahari, 2011). After the National Nutrition Strategy in 1978, Figure 1 shows that Nepal had a 66% prevalence of anemia among women and 74% prevalence among children in 1990, respectively.

The government has also implemented the National Plan of Action for Nutrition 1998 and the Nepal Health Sector Programme- Implementation Plan for 2004-2009. In 2000, prior to starting these initiatives, Nepal had a 51.5% prevalence of anemia among women and 64.1% prevalence among children (Figure 1). Subsequently, the National Nutrition Policy and Strategy 2004, National Plan for Action on Nutrition (NPAN) 2007, National Nutrition Policy and Strategy 2008, and the current National Nutrition Program (Pahari, 2011) were implemented. Furthermore, the government also implemented the School Health and Nutrition Strategy in 2006 to improve health and nutrition status of school-aged children. Despite these efforts, Nepal remains among the top ten countries with the highest

stunting prevalence, a measure of chronic undernutrition, and one of the top twenty countries with the largest number of stunted children, according to UNICEF, 2009 (National Planning Commission, 2012). Over time, there has been some progress in reducing anemia prevalence. The prevalence of anemia decreased from 51.5% among women and 64.1% among children in 2000 to 35.1% among women and 42.7% among children in 2016 (Figure 1).

Nutrition Profile of Children

Table-1 presents the distribution of nutritional status among children in Nepal across various background characteristics varies. Approximately 13% of children are severely stunted, while 36% are moderately stunted. For moderate wasting, it is 10%. Regarding severe and moderate underweight, approximately 5% of children are severely underweight, and 28% are moderately underweight. As the child's age increases, the prevalence of severe and moderate stunting, severe and moderate wasting, and severe and moderate underweight among children also increases significantly. Children aged 25-60 months carried a significant burden of moderate stunting, with a prevalence exceeding 40%, and the highest prevalence (43.9%) was observed within the 25-36 months age group. Severe and moderate wasting were prevalent in 0-12 months, followed by children aged 13-24 months. The age group of 49-60 months exhibited the highest prevalence of severe and moderate underweight, with rates of 7% and 32%, respectively.

Regarding rural-urban disparities, it becomes evident that rural children face higher vulnerability than their urban counterparts in all malnutrition categories. Among children in rural areas, 41% suffered from moderate stunting, while 31% experienced moderate underweight. In contrast, urban children displayed lower rates, with 32% experiencing moderate stunting and 24% were moderately underweight. The prevalence of stunting, wasting, and underweight decreases with higher levels of maternal education. Children of mothers with no education faced higher rates, with 19% experiencing severe stunting and 46% facing moderate stunting. Moreover, 13% of these children faced moderate wasting, while 37% were moderately underweight. In contrast, children born to mothers with higher education displayed significantly lower rates, with 22% experiencing moderate stunting, 7% facing moderate wasting, and 15% being affected by moderate underweight conditions.

Concerning the drinking water source, households relying on protected wells exhibit the highest prevalence of severe and moderate stunting, while for severe and moderate underweight, the prevalence is higher in the Tube well/borewell and protected well categories. It has been observed that children of households using clean fuel for cooking have a lower prevalence

of stunting, wasting, and underweight. A high prevalence of severe and moderate stunting is observed in the crop residual utilization category for cooking fuel. Furthermore, the type of toilet facilities impacts severe and moderate wasting and severe underweight, indicating that the prevalence of all forms of malnutrition is lower among children from households utilizing flush or pit toilets than in other categories.

Moreover, results show a clear pattern where children from the lower quintiles faced higher rates of all forms of malnutrition. Among this poorest quintile, severe stunting was prominent at 22%, along with 50% experiencing moderate stunting. Moreover, 9% faced moderate wasting, and 33% grappled with moderate underweight. In contrast, children in the richest quintile exhibited significantly lower rates, with 6% exhibiting severe stunting, 18% facing moderate stunting, 7% suffering from moderate wasting, and 13% affected by moderate underweight conditions.

Nutrition Profile of Women

Table-2 illustrates the distribution of women across different BMI categories (underweight, normal, overweight, and obese) in Nepal in 2016 by selected background characteristics. Results show that 17% of women fall under the underweight category, while the majority, 61%, have a normal BMI. Additionally, 17% are overweight, and 5% fall into the obese category. It is observed that the percentage of women with underweight and normal BMI decreases as maternal age increases, whereas it rises for overweight and obese BMI categories. The obesity prevalence decreases in the 45-49 age group compared to the 40-44 age group. Regarding place of residence, rural women exhibit higher rates of underweight, while urban women demonstrate a higher prevalence of overweight and obesity. In terms of maternal education, women without education have a higher prevalence of underweight compared to those with higher education. Contrarily, the overweight and obese categories show an increasing trend from no education to higher education levels. Concerning the mother's marital status, never-married women are notably underweight (27.6%) or normal-weight (67.2%). In contrast, overweight and obese categories are prevalent among currently married or other marital status groups. In families headed by males, underweight women (17.9%) outnumber those in female-headed families (14.7%). Conversely, obese and overweight women are more prevalent in female-headed households.

The source of drinking water shows a high percentage in the Tube well/ borewell category, whereas a low percentage is observed in the protected well category of underweight. The percentage of the normal category varies from 46% (protected well) to 73% (River/dam/springs). The overweight category shows high utilization of protected well water (33%) and low use

of Tube well/borewell (12%). The percentage changes in the obese category, with the lowest percentage observed in the River/dam/springs category (1.2%) and the highest in the protected well category (15%). Regarding fuel utilization for cooking, the underweight category records the highest percentages for crop residual (31.8%) and animal dung (32%). Among normal-weight women, percentages range from 50% to 68%. Conversely, the obese category exhibits the highest percentages for crop residual (2.7%) and Animal dung (1.2%), inverting the pattern seen in the underweight category. The overweight category follows a similar trend as the obese category.

Analyzing the type of toilet facilities by household indicates that the highest prevalence of underweight women (32%) was among households with no toilet facilities. However, women with access to flush or pit toilets have a higher prevalence of obesity and overweight. Additionally, wealth quintiles highlight that the poorest women are more likely to be underweight (18.4%) compared to the wealthiest women (8.4%). Conversely, overweight and obese women are found in the richer or richest categories, underlining the direct link between wealth and obesity.

Results of Multivariate Analysis

Table 3 presents the results of binary logistic regression odds ratios of stunting, wasting, and underweight among children aged 0-59 months. The findings indicate a noteworthy trend, an escalation in wealth quintile is associated with a substantial reduction in the probability of severe stunting, moderate stunting, severe underweight, and moderate underweight. Maternal age, sex of the child, and place of residence did not exhibit any significant correlations with stunting, wasting, and underweight. Nevertheless, it was discovered that the likelihood of severe stunting [AOR=2.1; $p<0.01$] and severe wasting [AOR=1.03; $p<0.001$] was higher for children whose mothers belonged to the 25-49-year age group. Additionally, children from households reliant on unprotected wells for drinking water were notably more prone [AOR=1.06; $p<0.01$] to severe wasting. Furthermore, the odds of severe stunting [AOR=1.85; $p<0.001$], moderate stunting [AOR=1.69; $p<0.001$], severe underweight [AOR=1.60; $p<0.05$], and moderate underweight [AOR=1.55; $p<0.001$] were elevated among children whose households lacked proper toilet facilities.

Table 4 showcases the results of multinomial logistic regression relative risk ratios related to the body mass index (BMI) of women aged 15-49. The analysis reveals a distinct pattern where with increase in women's age, the probability of overweight and obesity experiences a noteworthy rise, starting from ages 15-19 and extending to 45-49, with the reference point being a normal BMI. The place of residence did not yield any significant

connections with BMI among Nepalese women. Nonetheless, women from households relying on tube wells/borewells for drinking water are more inclined [AOR=1.79; p<0.001] to be underweight and, conversely, less prone to be overweight and obese. Women are notably 1.59 times (p<0.001) more likely to be underweight in households lacking toilet facilities. Similarly, education exhibits a positive influence on BMI likelihood. For instance, lower levels of education among women correlate with a decreased probability of being underweight, while raising the chances of being overweight and obese. Furthermore, it was evident that married women are significantly 2.8 times (p<0.001) and 4.1 times (p<0.001) more prone to being overweight and obese. As household wealth quintile increases, the odds of being underweight experience a noteworthy decline. Similarly, as household wealth grows, the likelihood of encountering overweight and obesity significantly increases.

Discussion

Nepal is progressing towards achieving several maternal, infant, and young child nutrition targets. Additionally, there has been notable advancement in reducing anemia among reproductive-aged women, with the current rate at 35.1%. While the country has made some headway in reducing stunting, 36.1% of children remain affected. Progress has also been seen in tackling wasting, although 9.6% of children continue to be affected, presenting a significant concern for the country. Additionally, the country has shown no progress towards achieving the target for obesity, with an estimated 5.4% of adult (aged 18 years and over) women and 2.7% of adult men living with obesity. Nepal's obesity prevalence is lower than the regional average of 8.7% for women (Global Nutrition Report, 2022).

Understanding the decline in maternal and child undernutrition in Nepal requires a comprehensive examination of both nutrition-specific factors, like Infant and Young Child Feeding (IYCF) practices, and nutrition-sensitive variables, including wealth, education, access to healthcare, and Water, Sanitation, and Hygiene (WASH) facilities. The outcomes indicate that four crucial determinants have contributed significantly to Nepal's success in reducing maternal and infant undernutrition. These include improved access to healthcare services, enhanced coverage and utilization of sanitation facilities, rapid advancements in education (particularly among women), and better coverage and use of sanitation facilities.

The study reveals that malnutrition is most prevalent among older children, those residing in rural areas, those with mothers with lower education levels, and those from impoverished households. These findings align with other studies conducted in Nepal (Conway et al. 2020; Bhandari et al. 2016; Choufani et al. 2019). The multivariate analysis underscores the

importance of household wealth status in reducing stunting, wasting, and underweight among children aged 0-59 months and in managing overweight and obesity among women aged 15-49 years. However, maternal age, child gender, and place of residence did not exhibit a significant association with stunting, wasting, and underweight among children in Nepal. The study also highlights the significant role of improved drinking water sources and sanitation facilities in lowering malnutrition among children in Nepal. For women, factors such as belonging to a higher age group, having a higher level of education, and being currently married were identified as principal factors contributing to increased BMI among women.

Several studies have identified that living in rural areas, household wealth index, and maternal education are the key determinants of stunting (Shively et al. 2011; Devkota et al. 2016; Gurung et al. 2009, Nisar et al. 2016, Thapa et al. 2013, Gaire et al. 2016, Shively and Sununtnasuk, 2015, Tiwari et al. 2014, Devkumar et al. 2018, Osei et al. 2010, Heady et al. 2016, Heady et al. 2017, Niraula et al. 2013, Pradhan et al. 2011, and Dorsey et al. 2018). Gaire et al. (2016) specifically found that children in the hill region were 1.24 times more likely to be stunted compared to those in the Terai plains region, and children in the mountain region were 1.52 times more likely to be stunted, with statistical significance observed only in the mountain region. Regarding the influence of the wealth index on child growth, multiple studies indicated that children from the poorest households had a higher likelihood of stunting compared to those from more affluent households (Devkota et al. 2016; Nisar et al.,2016; Gaire et al. 2016; Shively and Sununtnasuk 2015; Tiwari et al. 2014; Devkumar et al. 2018; Osei et al. 2010; Kim et al. 2017).

Nepal has made remarkable progress in reducing the prevalence of stunting (chronic undernutrition) nationally. The prevalence decreased from 57 percent in 2001 to 36 percent in 2016, attributed to implementing policies and programs aimed at reducing malnutrition (MOH et al. 2017; Family et al. 2002). However, Nepal still faces significant challenges in improving nutrition. The country contends with various nutritional issues, including deficits in energy intake and imbalances in the consumption of specific macro and micronutrients. While previous concerns were primarily about dietary inadequacies or losses, the issue of excess intake is also emerging due to changing dietary patterns. Notably, 11 percent of women are now overweight (BMI 25-29 kg/m2), and 2 percent are obese (BMI 30 kg/m2 and above), reflecting a 5-percentage-point increase in overweight and obesity since 2006 (National Planning Commission, 2012).

Conclusion

The findings of the study conclude that despite the implementation of increased programs and policies for nutrition, malnutrition remains

highest among older children, those living in rural areas, mothers having lower levels of education, and belongs to economically disadvantaged families. Nonetheless, a significant decline in the nutritional status of women and children in Nepal is observed. Nepal has a long history of nutritional policy implementation; however, only a few policies are currently in place to address nutritional issues. The government must prioritize these nutritional concerns and enhance the development of policies and programs to improve the nutritional status of women and children. Nepal should adopt a comprehensive approach to prevent and manage malnutrition, aligned with the Sustainable Development Goals (SDGs). Such a program should encompass various dimensions, including dietary support, encouragement of exclusive breastfeeding, appropriate supplementary feeding, micronutrient fortification and supplementation, improved access to education, enhancement of health literacy for teenage girls and families, expanded immunization coverage to combat infectious diseases, as well as efforts towards poverty reduction and ensuring food security.

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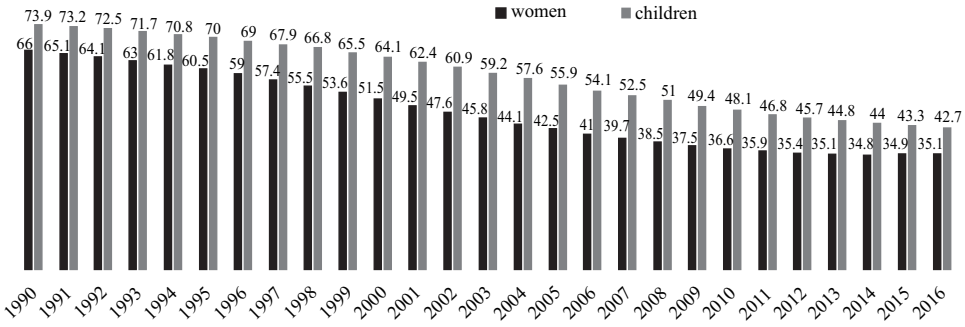
Figure : 1 : Prevalence of anemia among women aged 15-49 years and children aged 0-59 months, Nepal : 1990-2016



***Source**: World Health Organization, Global Health Observatory Data Repository/ World Health Statistics (apps.who.int/gho/data/node.main.1?lang=en)*

Table 1: Percentage distribution of nutritional status of children according to background characteristics in Nepal, 2016

Characteristics	Severe stunting	Moderate stunting	Severe wasting	Moderate wasting	Severe under weight	Moderate under weight
Age in months						
0-12	5.85	17.80	4.40	26.56	5.44	19.89
13-24	10.52	38.54	1.84	19.39	4.95	28.59
25-36	15.28	43.90	0.70	16.83	5.21	30.37
37-48	15.76	40.40	1.89	16.04	5.51	27.45
49-60	15.71	41.42	0.63	16.08	6.52	31.85
Place of residence						
Urban	11.17	32.23	1.90	9.45	5.02	24.12
Rural	13.97	40.56	1.98	10.41	6.06	31.28
Educational attainment of mother						
No Education	18.50	46.07	1.89	12.65	8.57	37.22
Primary	13.24	37.45	2.79	9.21	5.66	27.94
Secondary	7.80	30.46	1.96	8.53	3.33	21.96
Higher	7.13	22.45	0.75	7.16	2.65	15.13
Source of drinking water						
Piped water	12.64	36.20	1.40	6.46	4.00	21.38
Tube well/ borewell	13.00	37.02	2.37	13.46	6.73	34.07

Protected well	34.50	51.68	0	18.29	18.29	18.29
Unprotected well	9.66	45.11	0	0.63	0.63	27.20
River/dam/ springs	19.48	42.29	2.42	6.14	9.48	30.96
Others	5.21	27.24	2.46	11.31	4.62	23.76
Type of fuel used for cooking						
Clean	8.46	23.31	1.29	7.41	1.66	14.65
Wood	13.58	39.20	1.94	9.52	5.96	29.46
Crop residual	24.96	60.46	3.02	15.38	12.65	45.19
Animal dung	15.69	43.81	2.19	15.31	10.3	40.26
Others	6.78	31.22	3.21	13.65	6.01	30.89
Current marital status of mother						
Currently married	12.55	36.19	1.95	9.97	5.55	27.60
Others	3.77	32.74	0	0	0	12.87
Sex of household H						
Male	12.58	36.38	2.14	9.99	5.86	27.95
Female	12.28	35.64	1.51	9.70	4.77	26.51
Type of toilet facilities						
Flush toilet	10.03	31.90	1.41	7.92	3.72	21.65
Pit latrine	15.79	41.88	0.98	11.79	8.52	32.28
Open	20.93	50.06	3.21	13.64	9.93	42.89
Other	7.01	28.29	3.71	13.81	5.16	28.79
Wealth quintile						
Poorest	21.53	49.57	2.74	9.33	8.59	33.22
Poorer	11.96	39.12	1.93	9.28	5.42	28.69
Middle	11.53	35.50	2.4	10.67	6.03	33.46
Richer	9.42	32.66	1.50	11.78	3.46	23.65
Richest	6.06	17.55	0.66	7.44	3.37	12.97
Total	12.49	36.15	1.94	9.90	5.51	27.49

Source: *Demographic and Health Survey, Nepal-2016*

Table 2: Percentage distribution of women by body mass index according to background characteristics in Nepal, 2016

Characteristics	Under weight	Normal	Over weight	Obese
Age of mothers				
15-19	29.05	67.37	3.04	0.54
20-24	18.51	69.25	9.96	2.28
25-29	14.80	61.78	20.29	3.13
30-34	10.67	56.89	25.37	7.08
35-39	10.58	55.92	24.04	9.46
40-44	13.01	52.90	23.96	10.13
45-49	12.18	53.93	25.01	8.88
Place of residence				
Urban	15.35	58.71	19.14	6.79
Rural	19.29	65.45	13.22	2.04
Educational attainment mother				
No education	18.39	62.42	15.21	3.98

Primary	16.93	56.61	20.26	6.20
Secondary	17.24	62.45	15.08	5.23
Higher	12.00	60.67	21.72	5.61
Current marital status of mother				
Never union	27.58	67.20	4.43	0.79
Currently married	14.11	59.48	20.23	6.18
Others	10.64	64.08	20.13	5.15
Sex of household H				
Male	17.87	60.72	16.66	4.74
Female	14.65	62.22	17.52	5.62
Source of drinking water				
Piped water	12.33	61.52	20.18	5.97
Tube well/borewell	24.24	60.68	12.42	2.65
Protected well	6.38	45.51	33.05	15.06
Unprotected well	13.07	61.52	21.60	3.80
River/dam/springs	14.28	73.26	10.83	1.63
Others	13.12	58.34	18.16	10.38
Type of fuel used for cooking				
Clean	9.94	50.59	27.69	11.77
Wood	18.78	66.74	12.57	1.92
Crop residual	31.81	59.08	6.42	2.70
Animal dung	31.96	55.94	10.91	1.20
Others	17.41	68.32	10.75	3.52
Type of toilet facilities				
Flush toilet	13.80	60.30	Flush or	6.32
Pit latrine	19.38	62.71	15.87	2.04
Open	32.10	60.89	6.19	0.82
Other	15.65	69.81	11.63	2.91
Wealth quintile				
Poorest	18.35	71.95	9.10	0.60
Poorer	20.77	63.78	13.41	2.04
Middle	20.41	65.70	11.86	2.03
Richer	16.86	59.80	18.31	5.03
Richest	8.35	47.17	30.13	14.35
Total	16.81	61.21	16.94	5.03

Source: *Demographic and Health Survey, Nepal-2016*

Table 3: Results of binary logistic odds ratio of moderating stunting, wasting and underweight among children age 0-59 month in Nepal, 2016

Characteristics	Severe stunt	Moderate stunt	Severe waste	Moderate waste	Severe under weight	Moderate under weight
Wealth quintile						
Poorest ®						
Poorer	0.39***(0.26,0.57)	0.63***(0.48,0.82)	0.54(0.22,1.36)	0.67*(0.43,1.06)	0.54**(0.31,0.93)	0.61***(0.46,0.82)
Middle	0.32***(0.21,0.5)	0.44***(0.33,0.6)	0.6(0.23,1.56)	0.68(0.42,1.10)	0.51**(0.28,0.94)	0.6***(0.44,0.82)
Richer	0.33***(0.2,0.55)	0.47***(0.34,0.66)	0.49(0.16,1.47)	0.83(0.5,1.37)	0.49**(0.24,0.99)	0.51***(0.35,0.72)
Richest	0.24***(0.11,0.52)	0.27***(0.17,0.45)	0.3(0.05,1.82)	0.61(0.3,1.27)	0.68(0.24,1.90)	0.37***(0.22,0.63)
Age of mothers						
15-19 ®						
20-24	0.9(0.53,1.53)	0.9(0.64,1.26)	1.006(0.36,2.79)	0.76(0.47,1.23)	0.89(0.44,1.80)	0.91(0.63,1.32)
25-29	1.36(0.8,2.31)	1.03(0.73,1.45)	1.17(0.41,3.35)	0.68(0.41,1.12)	1.04(0.51,2.11)	1.30(0.9,1.89)
30-34	1.58(0.89,2.8)	1.32(0.9,1.94)	0.56(0.14,2.19)	0.62(0.35,1.10)	0.80(0.36,1.80)	1.44*(0.96,2.17)
35-39	2.05**(1.04,3.86)	1.15(0.71,1.85)	1.60(0.39,6.56)	0.73(0.36,1.50)	1.57(0.65,3.77)	1.2(0.72,2.006)
40-44	1.48(0.62,3.51)	0.90(0.47,1.73)	1.03***(0.89,1.07)	0.61(0.21,1.74)	1.009(0.29,3.49)	0.82(0.40,1.7)
45-49	2.16(0.48,9.74)	2.58(0.61,10.85)	1.05***(0.87,1.08)	1.28(0.25,6.66)	2.19(0.4,12.08)	3.55*(0.97,13.07)
Place of residence						
Urban ®						
Rural	0.94(0.71,1.23)	1(0.83,1.21)	0.89(0.47,1.67)	0.82(0.61,1.11)	0.83(0.57,1.22)	0.99(0.81,1.21)
Sex of household Head						
Male ®						
Female	0.94(0.71,1.23)	0.99(0.82,1.2)	0.74(0.37,1.45)	1.09(0.81,1.47)	0.81(0.54,1.22)	1.01(0.82,1.24)
Source of drinking water						
Piped water ®						

Tube well/borewell	0.98(0.67,1.43)	0.86(0.67,1.11)	1.47(0.62,3.48)	1.87***(1.27,2.75)	1.25(0.72,2.17)	1.53***(1.17,1.99)
Protected well	5.80***(1.61,20.86)	2.62(0.8,8.56)	1.04***(0.86,1.09)	3.18(0.66,15.26)	5.53**(1.05,29.1)	0.92(0.19,4.35)
Unprotected well	1.04(0.34,3.18)	1.2(0.54,2.68)	1.06***(0.87,1.10)	0.47(0.06,3.53)	0.7(0.09,5.43)	1.29(0.54,3.07)
River/dam/springs	1.26(0.77,2.05)	0.93(0.64,1.36)	1.29(0.37,4.56)	0.99(0.49,1.97)	1.73(0.88,3.39)	1.35(0.91,2.01)
Others	0.17(0.01,2.33)	0.49(0.17,1.46)	0.15(0.10,0.81)	0.53(0.09,3.19)	0.38(0.02,8.32)	0.17*(0.02,1.34)
Type of fuel used for cooking						
Clean ®						
Wood	0.85(0.51,1.42)	1.05(0.76,1.44)	0.92(0.31,2.75)	0.92(0.58,1.47)	1.84(0.82,4.11)	1.13(0.8,1.59)
Crop residual	1.84(0.84,4.05)	2.42***(1.31,4.47)	1.44(0.23,9.04)	1.04(0.43,2.52)	3.51**(1.13,10.93)	1.55(0.83,2.89)
Animal dung	1.28(0.64,2.56)	1.5(0.92,2.44)	1.06(0.21,5.2)	1.1(0.55,2.18)	3.18**(1.19,8.52)	1.49(0.90,2.46)
Others	3.77(0.26,55.39)	5.85**(1.29,26.46)	6.02(0,8361.55)	3.28(0.41,26.32)	21.27*(0.74,611.91)	12.26**(1.37,109.34)
Type of toilet Facilities						
Flush toilet ®						
Pit latrine	1.32(0.87,2.02)	1.09(0.79,1.49)	0.47(0.11,2.03)	1.06(0.64,1.76)	1.31(0.72,2.38)	1.08(0.77,1.51)
Open	1.85***(1.29,2.65)	1.69***(1.29,2.22)	1.48(0.64,3.41)	1.12(0.74,1.68)	1.60*(0.98,2.63)	1.55***(1.18,2.05)
Other	1.07(0.29,4.01)	0.35*(0.12,1.01)	2.38(0.3,19.01)	1.05(0.32,3.4)	0.36(0.02,7.66)	0.82(0.33,2.05)
Educational attainment						
No education ®						
Primary	0.87(0.62,1.23)	0.8*(0.62,1.04)	1.65(0.75,3.63)	0.69*(0.45,1.03)	0.71(0.43,1.19)	0.76**(0.58,0.99)
Secondary	0.80(0.55,1.15)	0.85(0.66,1.09)	1.38(0.59,3.21)	0.79(0.54,1.16)	0.72(0.43,1.21)	0.86(0.66,1.12)
Higher	0.59*(0.34,1.01)	0.74*(0.53,1.03)	0.42(0.09,2.11)	0.67(0.39,1.14)	0.57(0.26,1.23)	0.65**(0.45,0.95)

Note:CI-95%, Significance ***p < .001., ** p <0.01, *p < 0.05

Table 4: Results of multinomial logistic regression relative risk ratio of BMI among women in Nepal, 2016

Characteristics	Under-weight	Overweight	Obese
Age of women			
15-19 ®			
20-24	0.74***(0.59,0.93)	2.11***(1.4,3.18)	2.39*(0.96,5.94)
25-29	0.63***(0.48,0.83)	4.29***(2.86,6.45)	3.01**(1.20,7.55)
30-34	0.48***(0.35,0.65)	6.01***(3.98,9.05)	7.42***(3.03,18.17)
35-39	0.44***(0.32,0.62)	6.56***(4.29,10.04)	12.2***(4.94,30.09)
40-44	0.60***(0.43,0.84)	6.87***(4.44,10.63)	13.51***(5.42,33.71)
45-49	0.56***(0.39,0.81)	7.51***(4.77,11.81)	12.9***(5.04,33)
Place of residence			
Urban ®			
Rural	0.95(0.82,1.11)	1.06(0.89,1.27)	0.85(0.59,1.22)
Sex of household H			
Male ®			
Female	0.85**(0.73,1.002)	1.03(0.88,1.21)	1.31**(1.02,1.71)
Source of drinking water			
Piped water ®			
Tube well /borewell	1.79***(1.48,2.17)	0.61***(0.51,0.74)	0.46***(0.32,0.64)
Protected well	0.70(0.30,1.63)	1.89**(1.11,3.21)	2.05**(1.02,4.15)
Unprotected well	0.89(0.4,2.01)	1.47(0.74,2.94)	1.31(0.32,5.43)
River/dam/springs	0.85(0.59,1.23)	0.69*(0.45,1.04)	0.50(0.19,1.34)
Others	1.01(0.56,1.81)	1.36(0.92,2.01)	2.25***(1.41,3.58)
Type of fuel used for cooking			
Clean ®			
Wood	0.96(0.75,1.24)	0.66***(0.52,0.84)	0.53***(0.34,0.81)
Crop residual	1.28(0.80,2.03)	0.48*(0.22,1.03)	1.18(0.35,3.94)
Animal dung	1.40*(0.97,2.01)	0.73(0.46,1.16)	0.43(0.13,1.38)
Others	1.91*(0.9,4.07)	0.56(0.27,1.18)	1.44(0.28,7.45)
Type of toilet Facilities			

Flush toilet ®			
Pit latrine	1.10(0.84,1.43)	1.23(0.92,1.64)	0.86(0.43,1.74)
Open	1.59***(1.3,1.94)	0.60***(0.44,0.83)	0.52(0.23,1.19)
Other	0.66(0.38,1.14)	0.63(0.36,1.12)	0.20**(0.04,0.92)
Current marital status			
Never in union ®			
Currently married	0.59***(0.48,0.74)	2.81***(2.01,3.93)	4.11***(1.99,8.49)
Others	0.48***(0.28,0.83)	1.98**(1.17,3.35)	2.03(0.73,5.65)
Educational attainment			
No education ®			
Primary	0.94(0.75,1.17)	1.64***(1.32,2.04)	1.85***(1.27,2.7)
Secondary	0.72***(0.57,0.89)	1.38***(1.11,1.72)	1.45**(1.01,2.08)
Higher	0.68**(0.5,0.91)	1.42**(1.08,1.86)	0.98(0.62,1.55)
Wealth quintile			
Poorest ®			
Poorer	1.02(0.81,1.28)	1.85***(1.39,2.45)	4.33***(1.8,10.42)
Middle	0.75**(0.59,0.96)	1.74***(1.28,2.35)	4.66***(1.91,11.4)
Richer	0.77*(0.58,1.01)	2.43***(1.77,3.35)	9.36***(3.85,22.74)
Richest	0.60***(0.42,0.87)	3.66***(2.53,5.3)	19.93***(7.86,50.55)

Note:CI-95%, Significance ***p < .001., ** p <0.01, *p < 0.05