Scientific Research Publishing

Food and Nutrition Sciences, 2025, 16(5), 557-575
https://www.scirp.org/journal/fns
ISSN Online: 2157-9458
ISSN Print: 2157-944X

Malnutrition and Its Associated Factors among Children under Five: A Case Study of the Chattogram Division

Riyadh Hossain[1*], Shahinoor Jamal Muna[1], Nusrat Jahan Anu[2]

[1]Department of Statistics, Noakhali Science and Technology University, Noakhali, Bangladesh
[2]Department of Chemistry, National University, Dhaka, Bangladesh
Email: *riyadh7981@gmail.com, munajaman12@gmail.com, nusratanu2025@gmail.com

How to cite this paper: Hossain, R., Muna, S.J. and Anu, N.J. (2025) Malnutrition and Its Associated Factors among Children under Five: A Case Study of the Chattogram Division. *Food and Nutrition Sciences*, **16**, 557-575.
https://doi.org/10.4236/fns.2025.165031

Received: April 10, 2025
Accepted: May 24, 2025
Published: May 27, 2025

Abstract

Tackling malnutrition is a major global health priority for a developing country like Bangladesh. The main purpose of the study was to know the current malnutrition status of children under five years of age in the Chattogram division. A two-stage stratified random sampling design was used to collect the Bangladesh Demographic and Health Survey data, 2022-2023, from which 1446 children aged 0 - 59 months and their mothers were included in this study according to the study area. The association between the selected factors and nutritional status was assessed, and logistic regression models were fitted for the three indicators, and a Chi-square test was performed to find the association of outcome variables with selected socio-demographic factors. Results reveal that about 31.88% of children were stunted, 18.53% of children were wasted, and 28.63% of children were underweight in the Chattogram division. Prevalence of stunting, wasting and underweight was lowest among children aged 0 - 15 months and highest at the age of 16 to 30 months. The major contributing factors for under-five malnutrition were found to be child age, mothers' education, fathers' occupation, wealth index, birth order number, place of residence, mother's antenatal care taken during and after pregnancy, partner's occupation were significant factors for child malnutrition. Prevention of malnutrition in Bangladesh should, therefore, be seen as a significant public health issue and given top priority.

Keywords

Malnutrition, Stunted, Wasted, Underweight, Logistic Regression, Chi Square

1. Introduction

Malnutrition is a major public health issue in developing countries, particularly in Bangladesh. It's a serious condition resulting from an imbalance between intake and requirement, leading to poor anthropometric status and nutrient deficiency, causing health issues [1]. It is specifically defined as "a deficiency, excess, or imbalance of energy, protein, and other nutrients" that has adverse effects on the structure and tissues of the body [2]. According to the World Health Organization, Malnutrition, a silent emergency, is a pathological state resulting from deficiencies or excesses in essential nutrients, increasing infection rates and reducing the immune system [3].

BMI assessment is a key tool for identifying malnutrition categories such as under-nutrition, over-nutrition, micronutrient-related malnutrition, severe acute malnutrition, moderate acute malnutrition, and global acute malnutrition. Under-nutrition includes being underweight, wasting, stunting, and deficits in some micronutrients (such as a lack of important vitamins and minerals). When children are shorter than average for their age, it's referred to as stunting. Lower than normal weight for height is referred to as "wasting," whereas lower than normal weight for age is referred to as "underweight" [4]. Under-nutrition is a condition characterized by inadequate food supply and quality, often leading to frequent outbreaks of infectious diseases. The Millennium Development Goals (MDGs) are becoming closer to being achieved; nonetheless, under-nutrition remains the primary cause of death for nearly half of all children under five [5]. Over-nutrition including obesity, overweight, and non-communicable diseases (such as heart disease, stroke, diabetes). The World Health Organization (WHO) reports that 1.9 billion people are overweight or obese, and 462 million people are underweight. There are 155 million stunted children under the age of five, 52 million wasted children, 17 million severely wasted children, and 41 million overweight or obese children [6].

Studies on malnutrition divide the population into a number of categories, such as newborns, children under five, adolescents, adults, pregnant women, and the elderly. Worldwide, malnutrition affects people of all ages and groups, including pregnant women. It is not just an issue for the young or for those living in great poverty. It is associated with 52.2% of infant deaths worldwide and is recognized as the primary risk factor for disease and death [7]. Malnutrition is a major cause of 3.5 million deaths worldwide and accounts for 35% of morbidities in children under five [8]. Africa and Asia recorded the highest cases in the globe, with 29.1% and 21.8% of children under the age of five suffering from chronic malnutrition defined as stunting, and 6.4% and 9.1% of children suffering from acute malnutrition classified as wasting, respectively [9]. However, Sub-Saharan Africa remains the most afflicted region, with a frequency of 6.3% for acute malnutrition and 31.1% for chronic malnutrition, highlighting the need for immediate intervention [9].

According to recent nationwide surveys, about one-third of preschool-age chil-

dren are stunted, over one-fifth are underweight, and roughly one-tenth are wasted [10]. Nearly one-third of the estimated 167 million children under five were underweight in 1995 [11]. Although Bangladesh's stunting rate has significantly decreased over the past 20 years (from 51% in 2004 to 31% in 2017) [12]. The global required rate of 3.9% for stunting is still being reached by the average yearly rate of decline [13]. Because of this, the nation is still far behind in reaching Sustainable Development Goal (SDG) target 2.2, which calls for bringing the rate of stunting below 25% by 2022 [14] as well as the wasting level below 5% by 2020 [10]. Six million children under five were affected by the 37% incidence of stunting that was found in 13,500 children aged zero to fifty-nine months who were measured by Bangladesh's FSNSP in 2012. The rate is still below the "very high prevalence" cut-off even with dropping rates [15]. As of 2015, approximately 6 million children are stunted in Bangladesh and roughly 2.4 million children under the age of 5 suffer from wasting. The infant and child mortality rate in Bangladesh has decreased significantly, but the nation has not been as successful in tackling child nutrition, which is recognized by the Constitution as a fundamental human right. Bangladesh, its children, and its future are still being harmed by inadequate nutrition, despite significant advancements throughout the past 20 years. Improving nutrition is crucial to Bangladesh's Vision 21 and can result in both short- and long-term positive changes. Poor nutrition has an impact on health, education, and economic outcomes [16].

Malnutrition is the primary factor that determines childhood mortality. In addition to being the leading cause of disease and infant death, malnutrition has a negative impact on children's early physical and cognitive development [17]. There are many different, intricate, and connected factors that contribute to child malnutrition [18]. A number of causes, such as inadequate food intake, low-quality diet, and infectious disorders in early life, can lead to malnutrition. Children's malnutrition status is thought to be significantly influenced by their socio-demographic circumstances [19]. A study reveals a strong correlation between stunting and the mother's educational level, place of residence, and sex of the under-5 child. The family's age, sex, and economic status seemed to be the primary factors contributing to stunting. Mothers in the East Asia region who have a low body mass index are more likely to have wasted infants. This study also discovered a strong correlation between birth weight and wasting, with low-birth-weight children more likely to waste [20]. Malnutrition is a primary health issue resulting from a lack of essential nutrients like vitamins, minerals, or proteins, often leading to specific diseases [21]. One study found that malnutrition among children under five in Bangladesh is significantly influenced by household economic status, mother's education, prenatal visits, birth age, and BMI [21]. Another study reveals that children from low socioeconomic classes and mothers without degrees are more likely to suffer from severe malnutrition among children in Bangladesh under five [19]. A study found 22.7% of children under five in Padampur VDC were underweight, 37.3% stunted, and 25.7% wasted, with stunting risk increasing with age [19] [22]. Poverty, food insecurity, maternal education, climatic factors, and

socioeconomic situations are considered potential causes of malnutrition in sub-Saharan Africa [23]. A lack of nursing or a reduced breastfeeding duration can also cause malnutrition in children [24].

Existing literature has largely focused on malnutrition in Bangladesh as a whole, with relatively limited attention given to regional case studies that can capture localized determinants. Moreover, much of the available research is either outdated or lacks granular analysis specific to Chattogram. This study seeks to fill this critical gap by offering an updated, localized assessment of the prevalence and determinants of malnutrition among children under five in this division.

By focusing specifically on Chattogram, this study provides region-specific insights that can inform more targeted interventions and policies. The research not only updates the current understanding of child malnutrition in this area but also explores the interplay of contributing factors such as household income, maternal education, feeding practices, and access to healthcare. In doing so, the study contributes valuable evidence to the ongoing discourse on child health and nutrition in Bangladesh, and supports the development of context-specific strategies to address malnutrition in under-resourced regions.

2. Methodology

2.1. Data Source

The data used in this research were taken from the Bangladesh Demographic and Health Survey (BDHS), 2022-2023, which was created to generate accurate figures for important metrics at the national level, as well as for urban and rural regions, and each of the eight divisions of the nation. The National Institute of Population Research and Training (NIPORT), Health Education and Family Welfare Section of the Ministry of Health and Family Welfare, had oversight over the 2022-2023 BDHS. The primary goal of the 2022-2023 BDHS is to deliver up-to-date data on nutrition, nursing habits, mother and child health, childhood death rates, and conception and reproductive preferences. In order to track a variety of populations, the BDHS collects data from adults and children (both male and female) about demographic and socioeconomic traits as well as health and nutritional markers. It has a response rate of 99% and is nationally representative. The Bangladesh Bureau of Statistics (BBS) supplied the poll with a roster of enumeration areas (EAs) from the 2011 Population and Housing Census of the People's Republic of Bangladesh as a sampling frame (BBS 2011). A multistage stratified selection of homes is the foundation of the poll [25]. Then, a systematic sample of those households from each PSU was selected at the final stage using an equal probability systematic sampling technique. This multistage sampling technique, including its sampling weight, helps reduce potential sampling bias. In the BDHS data, sample weights were calculated in each sampling stage, and each cluster and stratum were considered and adjusted for non-response to obtain the final standard weights [25] [26]. In addition, all ever-married women from the preselected households were interviewed without replacement and change in the implementing stage to prevent se-

lection bias [27]. All survey-related issues were implemented by a Bangladeshi research organization "Mitra and Associate" with technical support from the Inner City Fund (ICF) International of Calverton, Maryland, USA [28]. Each BDHS used a standard questionnaire and the details, including sample design, data collection procedure and other issues, are discussed elsewhere.

2.2. Study Sample

Since our research region is the Chattogram division, the relevant data from the BDHS 2022-2023 dataset has been separated out. The survey's sample size was 2760 homes, of which 990 were in metropolitan areas and 1770 were in rural ones. A total of 2740 ever-married women between the ages of 10 and 59 were interviewed (982 in urban areas and 1758 in rural ones), and anthropometric measurements and weights were obtained for all living children (1446) who were under five years old at the time of the survey as well as their moms. Sampling weights were used to adjust for unequal probabilities of selection and non-responses and to ensure that the sample reflected the broader population structure within the Chattogram Division. The BDHS sample was gathered using a stratified random selection method with two stages. A total of 1446 kids under the age of 5 who were born in January 2018 or later were included in this research after missing data for a few factors was taken into account. To fulfill the objective of the study and to answer the questions in the study, the study used a quantitative research approach to assess the factors associated with malnutrition in children under five years of age in the Chattogram division.

2.3. Outcome Variables

Three physical measures have traditionally been used to quantify malnutrition. In this research, anthropometric measurements of children are used to evaluate their nutritional condition. Anthropometric measurements provide a good indication of the nutritional status of very young children and the resources available to them [29]. Age, Height and Weight measurements are important tools for assessing child's present and past nutritional status as well as for finding out malnourished children. When two of these variables are used together they are called an index. The following three indices are commonly used in assessing the nutritional status of children [30].

1) Length-for-age or Height-for-age
2) Weight-for-length or Weight-for-height
3) Weight-for-age

The above three indices are used to identify three nutritional conditions, such as

1) Stunting (low height for age)
2) Wasting (low weight for height) and
3) Underweight (low weight for age).

are considered as the response variables. Children are categorized into two groups, "suffering from malnutrition" and "not suffering from malnutrition", for each of

the three indicators following the guidelines in the national report of Bangladesh [31] and the World Health Organization [32]. Stunting is an indicator of past growth failure. It is related to a number of long-term variables, such as persistently low energy and protein consumption, recurrent infections, long-term improper feeding habits, and poverty. Wasting is a word used to characterize the nutritional state as it is right now or as it has recently changed. This indicator aids in identifying kids who are currently or recently malnourished. This index helps to identify children suffering from current or acute malnutrition. Underweight, based on weight-for-age, is a composite measure of stunting and wasting and is recommended as the indicator to assess changes in the magnitude of malnutrition over time [33]. Among these three indicators, the anthropometric index weight-for-age can be considered as a good overall index for understanding the nutritional status of children [31].

2.4. Independent Variable

Children and women's socioeconomic and demographic data were regarded as separate factors. Child age, gender, place of residence (urban, rural), division (Chattogram), partner's occupation (physical labor related, service/desk job/business, others), wealth index (poorest, poorer, middle, richer, others), and father's and mother's education (below secondary, secondary and above, child age group, respondent current age, antenatal care taken, birth order, month of breastfeeding, sex of household head, child ever had vaccination, maternal underweight are among the interrelated demographic, socioeconomic, and environmental factors that are related to child nutrition. According to the BDHS 2014 report's instructions, the wealth indicator and children's BMI [34].

2.5. Statistical Analysis

In order to determine the related variables for infant nutritional health and the causes of malnutrition in early children, data analysis techniques such as bivariate analysis, the Chi-square test, and logistic regression analysis are used. Only the P value from the likelihood ratio test of the model is given to establish the importance of the association. The logistic regression model was used to evaluate the association of undernutrition with each of the baseline variables individually. Three distinct logistic regression models were taken into account: stunting, wasting, and underweight, as the dependent variables, in order to assess the influence of these factors on nutritional status. The intensity of correlations was evaluated using odds ratios (ORs), and significance testing was performed using 95% confidence intervals. Descriptive statistics were computed to determine socio-demographic traits. The Chi-square test was used to determine the correlation between result variables and particular socio-demographic characteristics. To determine the strength of the linear relationship between the two variables under this research, statistical analysis was conducted. STATA (version 7) software has been used to carry out the logistic regression. Bivariate analysis and the Chi-square test are performed

using SPSS 16.0.

3. Result

In Table 1, the frequency distribution of malnutrition among children under the age of five in the Chattogram division, 759 (52.5%) of the under-five children in the survey were female, and 687 (47.5%) were male. About 34.9% of the children live in metropolitan areas, while 65.1% of the children being studied live in rural areas. There were 315 children aged 0 to 10 months (21.8%), 284 children aged 11 to 20 months (19.6%), 306 children aged 21 to 30 months (21.2%), 280 children aged 31 to 40 months (19.4%), and 261 children aged 41 to 50 months (18%). Respondents' present ages are 0 to 15, with 1176 (81.3%) of them being between the ages of 16 and 30, ages 31 - 45: 268 (18.5%), and ages 46 - 60: 2 (0.2%). The firstborn made up the majority of the offspring (35.7%). With a few exceptions (8.3%), (3.7%), (2.1%, 0.9%, 0.1% and 0.1%), second and third births were represented by 30.8% and 18.4% of the population, respectively. According to the distribution of children under the age of five by their moms' educational attainment, the majority of women (68.7%) had at least a secondary degree, while 31.3% had less than secondary education status. The majority of fathers (41.1%) work in skilled manual occupations, followed by sales (18.9%) and government services (15.1%), farmland ownership (4.8%), agricultural occupations (9.3%), and professional/technical occupations (7.6%), according to the percentage distribution of children under five by their partner's occupation. Few people work in unskilled manual jobs or for nonprofit organizations. The amount of household income was thought to depend on the parental occupation. According to the wealth indicator, 26.8% of people are the wealthiest, 21% are richer, 19.1% are from middle-class families, 15.7% are poorer, and 17.4% of people in our research are the lowest. Mothers of children make up 22.1% of those who have received prenatal care appointments, while 77.9% do not receive antenatal care at least four times during and after their pregnancies. 18.7% of toddlers are immunization-free. 83.1% of family heads are men, and 16.9% are women.

Table 1. Frequency distribution of respondents' socioeconomic and demographic attributes.

Categories	Frequency	Percentage (%)
Sex of Child		
Male	759	52.5
Female	687	47.5
Respondent's Current Age		
0 - 15	0	0
16 - 30	1176	81.3
31 - 45	268	18.5
46 - 60	2	0.2

Continued

Child Age Group		
0 - 10	315	21.8
11 - 20	284	19.6
21 - 30	306	21.2
31 - 40	280	19.4
41 - 50	261	18
Type of Place of Residence		
Urban	504	34.9
Rural	942	65.1
Sex of Household Head		
Male	1202	83.1
Female	244	16.9
Wealth Index Combined		
Poorest	252	17.4
Poorer	227	15.7
Middle	276	19.1
Richer	304	21
Richest	387	26.8
Partner's Occupation		
Did not work	31	2.1
Professional/technical/managerial	110	7.6
Sales	274	18.9
Agricultural—self-employed	69	4.8
Agricultural—employee	135	9.3
Household and domestic	3	0.2
Services	219	15.1
Skilled manual	594	41.1
Unskilled manual	7	0.5
Don't know	2	0.1
Father's Education		
Below secondary	614	42.5
Secondary and above	800	55.3
Ever Had Vaccination		
No	57	3.9
Yes	270	18.7
Don't know	1	0.1
At Least 4 ANC from Medically Trained Provider		
No	1127	77.9
Yes	319	22.1

Continued

Birth Order Number		
1	516	35.7
2	446	30.8
3	266	18.4
4	120	8.3
5	53	3.7
6	30	2.1
7	13	0.9
9	1	0.1
10	1	0.1
Maternal Underweight (BMI < 18.50)		
BMI > 18.50	1286	88.9
BMI < 18.50	117	8.1
Mother's Education		
Below secondary	453	31.3
Secondary and above	993	68.7

Table 2, which can be seen above, displays the nutritional condition of infants in the Chattogram division who are under five years old. According to the research, the Chattogram section had about 31.88% stunted children, 18.53% wasted children, and 28.63% underweight children. Stunting, wasting, and underweight are three anthropomorphic indicators of starvation that are common in children.

Table 2. Nutritional status of children under five years of Age in Chattogram.

	Stunted		Wasted		Underweight	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
No	985	68.12	1178	81.47	1032	71.37
Yes	461	31.88	268	18.53	414	28.63

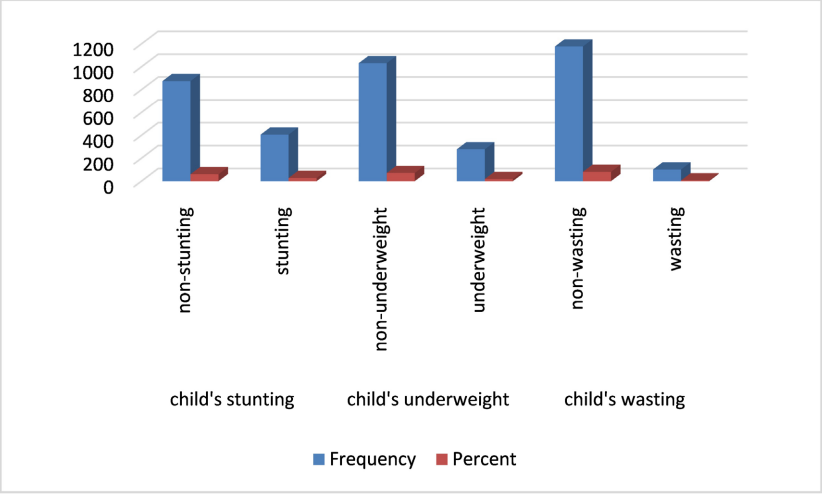

Figure 1. Bar graph for stunting, wasting and underweight among children under five years.

In Figure 1, the three nutritional indicator stunting, wasting and underweight, with their two categories in each indicator in the above graph, represent the nutritional status of children under five years in Chattogram division. Figure 1 shows that around 461 children were stunted, 268 were wasted, and 414 were underweight.

The logistic regression model's coefficients, along with the associated p-values and odds ratios, are used to assess the variables that contribute to stunting, wasting, and underweight in children under the age of five. According to the logistic chart in Table 3, children in rural areas had a 1.98 times higher risk of being stunted than those in urban areas. Similar outcomes were also seen in the case of underweight and wasted infants. Stunting in children was significantly associated with maternal underweight, as indicated by the 1.17 increase in odds of having stunted children among mothers who were underweight compared to mothers with normal BMI. Stunting of children was substantially associated with maternal underweight, as evidenced by the odds of having wasting children being 2.94 times higher among mothers who were underweight compared to those with normal BMI. When compared to mothers with normal BMI, the likelihood of having underweight children was 2.5 times higher, indicating a strong association between parental underweight and child stunting, which shows a strong correlation between mother underweight and wasting. Mothers (OR 1.66) and fathers (OR 1.36) with educational levels below secondary, compared to intermediate and above, had zero odds of having children who were short. Odds of having wasted children among mothers (OR 1.12) and fathers (OR 1.47) with lower secondary education levels compared to those with higher education levels. Children of mothers (OR 1.37) and fathers (OR 1.41) with education levels below intermediate were more likely to be underweight. It is seen that the odds of stunting among children whose mothers have had antenatal visits were 0.84 times significantly more compared with children whose mothers have had no antennal care visits. The odds of suffering from wasting and underweight also show similar results. Based on wealth index, richer (1.35), middle (1.59), poorer (1.69), and poorest (2.09) had higher odds compared with the richest household. There exists a significant association between the poorest households and child wasting. Children whose mother's age was less than 30 years at the time of birth were 0.12 times more likely to be stunted compared to children whose mother's age was 30 years or above. The odds of wasting and underweight children show similar results, and the results are significant for stunted and underweight children. Stunting and underweight children are strongly related to mothers between the ages of 31 and 45. The odds of a child in the age groups of 21 - 30 months (OR 1.16), 31 - 40 months (OR 2.54) and 41 - 50 months (OR 2.04) being short are higher than those of a child in the 0 - 10 months age group. Children between the ages of 31 and 40 months and 41 and 50 months are considerably more likely to be underweight and stunted. Comparing infants who were breastfed for 0 - 12 months to those who were breastfed for 13 - 24 months and 25 - 36 months, the odds of having stunting were 2.44 and 4.07, respectively.

Child hunger is strongly correlated with lactation duration. Children with birth orders of 2 - 3 and 4 or 4+ were more likely to be short, respectively, compared to children with birth order one. Similar to this, children with birth orders of 2 - 3 and 4 or 4+ have a greater likelihood of being wasted and underweight.

Table 3. Parameter estimation using a logistic regression model of child malnutrition under five years.

Logistic Regression Analysis Output						
	STUNTING		WASTING		UNDERWEIGHT	
Indicators	**OR (95% CI)**	**P VALUE**	**OR (95% CI)**	**P VALUE**	**OR (95% CI)**	**P VALUE**
Maternal BMI						
≥18.5	Reference		Reference		Reference	
≤18.5	1.17 (0.67, 2.02)	0.583	2.94 (1.44, 6)	0.003	2.5 (1.4, 4.47)	0.002
Antenatal Care Taken						
No	Reference		Reference		Reference	
Yes	0.84 (0.57, 1.24)	0.375	0.91 (0.59, 2.02)	0.785	0.97 (0.62, 1.52)	0.897
Mother's Education						
Secondary	Reference		Reference		Reference	
Below secondary	1.66 (1.11, 2.5)	0.014	1.12 (0.59, 2.31)	0.654	1.37 (0.84, 2.22)	0.204
Type of Place of Residence						
Urban	Reference		Reference		Reference	
Rural	1.98 (0.66, 1.44)	0.906	1.33 (0.71, 2.48)	0.374	1.82 (0.53, 1.29)	0.393
Sex of household head						
Female	Reference		Reference		Reference	
Male	1.1 (0.69, 1.75)	0.696	1.12 (0.54, 2.33)	0.759	2.13 (1.11, 4.07)	0.023
Wealth Index						
Richest	Reference		Reference		Reference	
Poorest	2.09 (1.15, 3.81)	0.015	0.64 (0.25, 1.67)	0.365	1.11 (0.55, 2.24)	0.032
Poorer	1.69 (0.89, 3.21)	0.105	0.57 (0.2, 1.58)	0.278	0.77 (0.35, 1.67)	0.509
Middle	1.59 (0.91, 2.79)	0.103	0.63 (0.26, 1.51)	0.302	1.2 (0.63, 2.3)	0.585
Richer	1.35 (0.8, 2.3)	0.260	0.68 (0.31, 1.52)	0.340	1.14 (0.63, 2.08)	0.659
Father's Education						
Secondary	Reference		Reference		Reference	
Below secondary	1.36 (0.93, 1.99)	0.109	1.47 (0.48, 1.74)	0.785	1.41 (0.9, 2.22)	0.134
Mother's Current Age						
1 - 15	Reference		Reference		Reference	
16 - 30	0.12 (0.05, 1.78)	0.020	0.47 (0.01, 1.25)	0.012	0.17 (0.55, 1.85)	0.121
31 - 45	0.391 (0.11, 1.29)	0	0.54 (0.11, 1.56)	0.320	1.12 (0.45, 1.68)	0.030
46 - 60	0.237 (0.05, 1.96)	0.070	0.07 (0.04, 1.45)	0.080	0.20 (0.00, 1.5)	0.080

Continued

Child Age Group						
0 - 10 months	Reference		Reference		Reference	
11 - 20 months	2.36 (1.55, 3.42)	0	0.77 (0.42, 1.39)	0.389	1.18 (0.75, 1.86)	0.499
21 - 30 months	1.16 (2.14, 4.66)	0	0.65 (0.35, 1.2)	0.179	1.56 (1.02, 2.38)	0.040
31 - 40 months	2.54 (1.7, 3.7)	0	0.78 (0.43, 1.43)	0.432	1.86 (1.2, 2.83)	0.005
41 - 50 months	2.04 (1.35, 3.09)	0.010	0.89 (0.30, 1.16)	0.130	2.05 (1.33, 3.1)	0.001
Child Sex						
Female	Reference		Reference		Reference	
Male	0.91 (0.65, 1.27)	0.568	0.68 (0.62, 1.85)	0.314	0.79 (0.67, 1.48)	0.023
Duration of Breastfeeding						
0 - 12 months	Reference		Reference		Reference	
13 - 24 months	2.44 (1.71, 3.47)	0	0.79 (0.46, 1.33)	0.609	1.18 (0.78, 1.77)	0.410
25 - 36 months	4.07 (2.40, 6.89)	0	0.92 (0.38, 2.18)	0.800	2.54 (1.4, 4.44)	0.010
Birth Order						
1	Reference		Reference		Reference	
2	0.98 (0.73, 1.32)	0.925	1.56 (0.75, 3.26)	0.235	1.47 (0.86, 2.52)	0.161
3	1.3 (0.96, 1.89)	0.083	1.18 (0.4, 3.51)	0.256	1.88 (0.88, 4)	0.103
4	1.58 (1.01, 2.46)	0.042	2.28 (0.55, 9.4)	0.256	2.24 (0.8, 6.27)	0.124
5	1.48 (0.79, 2.58)	0.214	1.73 (0.27, 11.17)	0.563	1.19 (0.31, 4.64)	0.801
6	2.08 (0.911, 4.74)	0.081	2.26 (0.17, 30.6)	0.540	1.73 (0.27, 11.13)	0.565
Partner's Occupation						
Not working	Reference		Reference		Reference	
Sales	0.35 (0.13, 0.92)	1.380	0.04 (0, 1.18)	0.063	0.27 (0.04, 1.78)	0.172
Agricultural self-employed	2.16 (0.86, 5.3)	0.098	0.13 (0.01, 3.04)	0.202	0.1 (0.01, 0.87)	0.037
Agricultural employee	1.17 (0.56, 2.74)	0.722	0.01 (0, 0.53)	0.021	0.16 (0.02, 1.07)	0.059
Household and domestic	0.9 (0.72, 1.12)	0.935	1 (0.03, 1.42)	0.014	1 (0.36, 1.30)	0.020
Service	0.82 (0.4, 1.91)	0.649	0.11 (0.01, 2.34)	0.159	0.34 (0.06, 2.08)	0.246
Ever Had Vaccination						
No	Reference		Reference		Reference	
Yes	0.95 (0.6, 1.5)	0.850	0.89 (0.27, 1.9)	0.530	0.98 (0.57, 1.6)	0.900

*significant at $p < 0.05$.

Table 4 shows that there were significant differences in the levels of malnutrition among children according to factors such as family income, mother's schooling, antenatal visits, mother's BMI, state of breastfeeding, and children's birth sequence. The chi-square findings also demonstrated a substantial correlation between these variables and children's stunting and underweight conditions. Similar outcomes were also observed in cases of waste. Children in low socioeconomic

status households, children of mothers without education, children of mothers who did not receive antenatal care, children without an enriched job of their guardian, children of malnourished mothers, children of mothers who never breastfed their children, and children with higher birth orders all had a higher prevalence of stunting, wasting, and underweight. A similar result was found in the case of a child who was underweight. The higher prevalence of wasting was found among children with a malnourished mother and parent's occupation.

Table 4. Associations between socio-demographic factors and malnutrition in children under five.

Independent Variable	Stunting (p-value)	Wasting (p-value)	Underweight (p-value)
Child age	0.01	0.04	0.06
Maternal underweight	0.03	0.00	0.04
Mother's current age	0.26	0.41	0.07
Mother's education	0.00	0.61	0.00
Father's education	0.23	0.17	0.01
Antenatal care taken	0.09	0.12	0.02
Place of residence	0.09	0.55	0.82
Sex of household head	0.34	0.35	0.27
Partner's occupation	0.00	0.06	0.11
Wealth index	0.00	0.64	0.00
Ever had vaccination	0.74	0.82	0.75
Birth order	0.04	0.93	0.02
Month of breastfeeding	0.00	0.70	0.00
Sex of child	0.19	0.34	0.07

4. Discussion

This study identified multiple socioeconomic, demographic, and maternal health-related factors significantly associated with child malnutrition outcomes in children under the age of five, including stunting, wasting, and underweight. The results provide important insights into how maternal, socioeconomic, and child-related factors contribute to child malnutrition.

In our study, the nutritional condition of infants in the Chattogram division had about 31.88% stunted, 18.53% wasted, and 28.63% underweight children. According to a cross-sectional research conducted in Dhaka, the prevalence of stunting, wasting, and underweight was 22.7%, 37.3%, and 25.7%, respectively [8]. The prevalence of infant stunting, wasting, and underweight is 28%, 12%, and 42.45%, respectively, according to the BDHS 2017-2018 study [35].

Our study showed that children residing in rural areas exhibited a higher risk of stunting compared to those in urban areas. The 2020 Global Nutrition Report highlighted that stunting and wasting prevalence are higher among children in rural areas and with less educated mothers [36]. Another study found that chil-

dren residing in rural areas had a significantly higher stunting rate compared to those in urban areas [37]. This finding aligns with earlier research indicating that rural children often face worse nutritional outcomes due to limited access to healthcare, education, and improved sanitation [38]. Maternal nutritional status demonstrated a strong and consistent association with child malnutrition. Mothers who were underweight were more likely to have stunted, wasted, and underweight children. The association between maternal underweight and child wasting is especially notable, suggesting that acute maternal undernutrition may be a direct contributor to child wasting. One study's findings reinforce the intergenerational nature of malnutrition, where poor maternal nutrition increases the likelihood of undernutrition in offspring [39]. Another study indicates the interrelated process of malnutrition—maternal undernutrition during pregnancy can impede fetal growth, and low nutritional reserves postnatally hamper infant development [39] [40].

Parental education also emerged as a significant determinant of child nutritional status. Children whose mothers and fathers had educational attainment below the secondary level had increased odds of being stunted, wasted, or underweight. These findings are consistent with earlier studies, indicating that parental education, particularly maternal education, is a major determinant of child health outcomes due to its influence on health-seeking behavior, childcare practices, and household resource allocation [41]. These findings confirm prior research correlating higher parental education to enhanced child nutrition via better health information, feeding behaviors, and healthcare utilization [42]. Access to antenatal care was another significant factor. Children whose mothers had no antenatal visits had higher odds of being stunted compared to those whose mothers received care. Antenatal visits provide opportunities for nutritional counseling and early detection of maternal health issues, which can directly impact fetal and postnatal growth [41].

Socioeconomic status, as measured by the wealth index, was inversely associated with malnutrition. Children from the poorest households had significantly higher odds of being stunted, wasted, or underweight compared to those from the richest households. This gradient indicates that income inequality remains a substantial barrier to achieving nutritional equity, with food insecurity and limited access to services being more prevalent in low-income households [43]. These results are consistent with global evidence showing that low-income families often lack access to diverse foods, quality healthcare, and sanitation—all key determinants of nutritional outcomes [44].

Maternal age at childbirth also influenced child nutritional outcomes. Children born to mothers over 30 years were more likely to be stunted, wasted, and underweight than those born to adult mothers. Moreover, stunting and underweight were more common among children whose mothers were aged 31 - 45, suggesting that both young and advanced maternal ages may carry specific risks [45]. Child age was another important predictor. Older children had significantly higher odds

of being stunted or underweight compared to younger children (0 - 10 months). This pattern may reflect the cumulative effects of prolonged exposure to inadequate nutrition and illness during early childhood [46].

Breastfeeding duration showed a strong protective effect. Children breastfed for 13 - 24 months and 25 - 36 months had significantly lower odds of being stunted, respectively, compared to those breastfed for less than 12 months. This supports global recommendations for continued breastfeeding beyond infancy to reduce the risk of undernutrition [47]. Lastly, birth order was positively associated with all three forms of malnutrition. Children with higher birth orders were more likely to be stunted, wasted, and underweight compared to firstborns. This finding suggests resource dilution and maternal depletion may be contributing factors, particularly in large families with limited means [48].

5. Limitations of the Study

A potential limitation is the use of an indirect measure of household wealth, because in developing countries like Bangladesh, it is hard to obtain reliable income and expenditure data and identify household food and non-food expenses. The definition of urban and rural areas in Bangladesh has changed over time, with the most rapid growth in urbanization. As a result, some areas, earlier classified as rural in the previous BDHSs, were considered urban in the more recent BDHS, which may bring in some error in urban-rural calculations.

6. Conclusion

The nutritional status of children under five is not only a reliable indicator of a nation's health and nutrition, but it can also be used as a measurement of quality of life and a development indicator. This study found that in the Chattogram division, where the majority of children are aged 16 to 30, 31.88% were stunted, 18.53% wasted, and 28.63% were underweight. According to the study's findings, there is a significant relationship between maternal BMI, income index, site of residence, partner's work, mother's antenatal care received, child age, breastfeeding status, mother's current age, and under-five child malnutrition. To reduce the burden on children's health, some successful, long-term programs involving government and non-governmental groups should focus on the most vulnerable population. Nutrition surveillance should be used to regularly monitor the poorest and undernourished people, as well as to strengthen the health system. Preventive malnutrition initiatives should also be implemented to improve children's health in the future. Future research should focus on evaluating the impact of specific intervention programs, exploring regional disparities in malnutrition, and incorporating qualitative assessments of cultural and behavioral factors influencing child nutrition.

Acknowledgements

We would like to thank the National Institute of Population Research and Train-

ing NIPORT, Bangladesh and MEASURE DHS for allowing us to use BDHS, 2022-2023 data for the analysis.

Ethical Statement

This study was approved by the Noakhali Science and Technology University Ethical Committee (NSTUEC), and the ethical approval number of this study is NSTU/SCI/EC/2022/90(B). The study did not involve any medical or surgical procedure on humans. The study was conducted following the Declaration of Helsinki.

Author's Contributions

1) Conceived and designed the experiments—RH, SJM, NJA;
2) Performed the experiments and analyzed—RH, SJM, NJA;
3) Interpretation and explanation of the results—RH, SJM, NJA;
4) Contributed reagents, materials, analysis tools or data—RH, SJM, NJA;
5) Wrote the paper—RH, SJM, NJA.

Conflicts of Interest

There is no conflict of interest among the authors. All authors read the final manuscript and approved it.

References

[1] Poulia, K., Katsilambros, N., Kontogianni, M., Dimosthenopoulos, C. and Manglara, E. (2010) Clinical Nutrition in Practice. Wiley-Blackwell.

[2] Franjić, S. (2019) Briefly about Nutrition. *Acta Scientific Nutritional Health*, **3**, 50-54. https://doi.org/10.31080/asnh.2019.03.0530

[3] Schaible, U.E. and Kaufmann, S.H.E. (2007) Malnutrition and Infection: Complex Mechanisms and Global Impacts. *PLOS Medicine*, **4**, e115. https://doi.org/10.1371/journal.pmed.0040115

[4] Dassie, G.A., Chala Fantaye, T., Charkos, T.G., Sento Erba, M. and Balcha Tolosa, F. (2024) Factors Influencing Concurrent Wasting, Stunting, and Underweight among Children under Five Who Suffered from Severe Acute Malnutrition in Low- and Middle-Income Countries: A Systematic Review. *Frontiers in Nutrition*, **11**, Article 1452963. https://doi.org/10.3389/fnut.2024.1452963

[5] Kanon, N. and Bari, W. (2020) Analyzing Malnutrition among Children of Urban Areas in Bangladesh: Penalized Logistic Regression Model. *Dhaka University Journal of Science*, **68**, 13-18. https://doi.org/10.3329/dujs.v68i1.54591

[6] Dukhi, N. (2020) Global Prevalence of Malnutrition: Evidence from Literature. In: Imran, M. and Imran, A., Eds., *Malnutrition*, IntechOpen. https://doi.org/10.5772/intechopen.92006

[7] Khaliq, A., Wraith, D., Miller, Y. and Nambiar-Mann, S. (2021) Prevalence, Trends, and Socioeconomic Determinants of Coexisting Forms of Malnutrition Amongst Children under Five Years of Age in Pakistan. *Nutrients*, **13**, Article 4566. https://doi.org/10.3390/nu13124566

[8] Islam, M.S. and Biswas, T. (2019) Prevalence and Correlates of the Composite Index

of Anthropometric Failure among Children under 5 Years Old in Bangladesh. *Maternal & Child Nutrition*, **16**, e12930. https://doi.org/10.1111/mcn.12930

[9] Das, S., Hossain, Z. and Nesa, M.K. (2009) Levels and Trends in Child Malnutrition in Bangladesh. *Asia-Pacific Population Journal*, **24**, 51-78. https://doi.org/10.18356/6ef1e09a-en

[10] Iqbal, A., Ahsan, K.Z., Jamil, K., Haider, M.M., Khan, S.H., Chakraborty, N., *et al.* (2021) Demographic, Socioeconomic, and Biological Correlates of Hypertension in an Adult Population: Evidence from the Bangladesh Demographic and Health Survey 2017-18. *BMC Public Health*, **21**, Article No. 1229. https://doi.org/10.1186/s12889-021-11234-5

[11] Smith, L. and Haddad, L. (2000) Explaining Child Malnutrition in Developing Countries. International Food Policy Research Institute.

[12] Amiti, M., Redding, S.J. and Weinstein, D. (2019) The Impact of the 2018 Trade War on U.S. Prices and Welfare. NBER Working Paper Series.

[13] de Onis, M., Dewey, K.G., Borghi, E., Onyango, A.W., Blössner, M., Daelmans, B., *et al.* (2013) The World Health Organization's Global Target for Reducing Childhood Stunting by 2025: Rationale and Proposed Actions. *Maternal & Child Nutrition*, **9**, 6-26. https://doi.org/10.1111/mcn.12075

[14] Kibria, G.M.A. and Crispen, R. (2023) Disparities, Distribution, and Determinants in Appropriate Timely Initiation, Number, and Quality of Antenatal Care in Bangladesh: Evidence from Demographic and Health Survey 2017-18. *PLOS Global Public Health*, **3**, e0002325. https://doi.org/10.1371/journal.pgph.0002325

[15] Das, S.K., Chisti, M.J., Malek, M.A., Das, J., Salam, M.A., Ahmed, T., *et al.* (2015) Changing Childhood Malnutrition in Bangladesh: Trends over the Last Two Decades in Urban-Rural Differentials (1993-2012). *Public Health Nutrition*, **18**, 1718-1727. https://doi.org/10.1017/s136898001500004x

[16] Talukder, A. (2017) Factors Associated with Malnutrition among Under-Five Children: Illustration Using Bangladesh Demographic and Health Survey, 2014 Data. *Children*, **4**, Article 88. https://doi.org/10.3390/children4100088

[17] Habicht, J. (2008) Malnutrition Kills Directly, Not Indirectly. *The Lancet*, **371**, 1749-1750. https://doi.org/10.1016/s0140-6736(08)60755-2

[18] Tette, E.M.A., Sifah, E.K. and Nartey, E.T. (2015) Factors Affecting Malnutrition in Children and the Uptake of Interventions to Prevent the Condition. *BMC Pediatrics*, **15**, Article No. 189. https://doi.org/10.1186/s12887-015-0496-3

[19] Ahsan, K.Z., Arifeen, S.E., Al-Mamun, M.A., Khan, S.H. and Chakraborty, N. (2017) Effects of Individual, Household and Community Characteristics on Child Nutritional Status in the Slums of Urban Bangladesh. *Archives of Public Health*, **75**, Article No. 9. https://doi.org/10.1186/s13690-017-0176-x

[20] Chowdhury, M.R.K., Khan, H.T.A., Mondal, M.N.I. and Kabir, R. (2020) Socio-demographic Risk Factors for Severe Malnutrition in Children Aged under Five among Various Birth Cohorts in Bangladesh. *Journal of Biosocial Science*, **53**, 590-605. https://doi.org/10.1017/s0021932020000425

[21] Hossain, S., Chowdhury, P.B., Biswas, R.K. and Hossain, M.A. (2020) Malnutrition Status of Children under 5 Years in Bangladesh: A Sociodemographic Assessment. *Children and Youth Services Review*, **117**, Article ID: 105291. https://doi.org/10.1016/j.childyouth.2020.105291

[22] Brown, I. (2024) The Pathology of Malnutrition and Malabsorption. In: Shepherd, N.A., *et al.*, Eds., *Morson and Dawson's Gastrointestinal Pathology*, *Fifth Edition*,

Wiley, 463-492.

[23] Chowdhury, M.R.K., Rahman, M.S., Khan, M.M.H., Mondal, M.N.I., Rahman, M.M. and Billah, B. (2016) Risk Factors for Child Malnutrition in Bangladesh: A Multilevel Analysis of a Nationwide Population-Based Survey. *The Journal of Pediatrics*, **172**, 194-201.e1. https://doi.org/10.1016/j.jpeds.2016.01.023

[24] Bain, L.E., Awah, P.K., Geraldine, N., Kindong, N.P., Sigal, Y., Bernard, N., *et al.* (2013) Malnutrition in Sub-Saharan Africa: Burden, Causes and Prospects. *Pan African Medical Journal*, **15**, Article 120. https://doi.org/10.11604/pamj.2013.15.120.2535

[25] Narayan, J., John, D. and Ramadas, N. (2018) Malnutrition in India: Status and Government Initiatives. *Journal of Public Health Policy*, **40**, 126-141. https://doi.org/10.1057/s41271-018-0149-5

[26] Gebreayohanes, M. and Dessie, A. (2022) Prevalence of Stunting and Its Associated Factors among Children 6 - 59 Months of Age in Pastoralist Community, Northeast Ethiopia: A Community-Based Cross-Sectional Study. *PLOS ONE*, **17**, e0256722. https://doi.org/10.1371/journal.pone.0256722

[27] Geberselassie, S.B., Abebe, S.M., Melsew, Y.A., Mutuku, S.M. and Wassie, M.M. (2018) Prevalence of Stunting and Its Associated Factors among Children 6 - 59 Months of Age in Libo-Kemekem District, Northwest Ethiopia; a Community Based Cross Sectional Study. *PLOS ONE*, **13**, e0195361. https://doi.org/10.1371/journal.pone.0195361

[28] Sakib, M.M.H., Alam, M.K., Yasmin, N. and Rois, R. (2025) Unveiling the Sociodemographic and Socioeconomic Determinants of Antenatal Care Utilization in Bangladesh: Insights from the 2017-18 BDHS. *Journal of Health, Population and Nutrition*, **44**, Article No. 159. https://doi.org/10.1186/s41043-025-00839-w

[29] Rahman, A. and Chowdhury, S. (2006) Determinants of Chronic Malnutrition among Preschool Children in Bangladesh. *Journal of Biosocial Science*, **39**, 161-173. https://doi.org/10.1017/s0021932006001295

[30] WHO Working Group (1986) Use and Interpretation of Anthropometric Indicators of Nutritional Status. WHO Working Group. *Bulletin of the World Health Organization*, **64**, 929-941.

[31] Permatasari, T.A.E. and Chadirin, Y. (2022) Assessment of Undernutrition Using the Composite Index of Anthropometric Failure (CIAF) and Its Determinants: A Cross-Sectional Study in the Rural Area of the Bogor District in Indonesia. *BMC Nutrition*, **8**, Article No. 133. https://doi.org/10.1186/s40795-022-00627-3

[32] Biswas, T. and Islam, A. (2015) Chronic Stunting among Under-5 Children in Bangladesh: A Situation Analysis. *Advances in Pediatric Research*, **2**, Article 18.

[33] Cogill, B. (2003) Anthropometric Indicators Measurement Guide. Food and Nutrition Technical Assistance.

[34] Tamanna, T., Mahmud, S., Salma, N., Hossain, M.M. and Karim, M.R. (2025) Identifying Determinants of Malnutrition in Under-Five Children in Bangladesh: Insights from the BDHS-2022 Cross-Sectional Study. *Scientific Reports*, **15**, Article No. 14336. https://doi.org/10.1038/s41598-025-99288-y

[35] Kundu, R.N., Hossain, M.G., Haque, M.A., Mahumud, R.A., Pal, M. and Bharati, P. (2024) Burden of Undernutrition among Under-Five Bengali Children and Its Determinants: Findings from Demographic and Health Surveys of Bangladesh and India. *PLOS ONE*, **19**, e0301808. https://doi.org/10.1371/journal.pone.0301808

[36] Sserwanja, Q., Kamara, K., Mutisya, L.M., Musaba, M.W. and Ziaei, S. (2021) Rural and Urban Correlates of Stunting among Under-Five Children in Sierra Leone: A

2019 Nationwide Cross-Sectional Survey. *Nutrition and Metabolic Insights*, **14**. https://doi.org/10.1177/11786388211047056

[37] Siramaneerat, I., Astutik, E., Agushybana, F., Bhumkittipich, P. and Lamprom, W. (2024) Examining Determinants of Stunting in Urban and Rural Indonesian: A Multilevel Analysis Using the Population-Based Indonesian Family Life Survey (IFLS). *BMC Public Health*, **24**, Article No. 1371. https://doi.org/10.1186/s12889-024-18824-z

[38] Akombi, B., Agho, K., Hall, J., Wali, N., Renzaho, A. and Merom, D. (2017) Stunting, Wasting and Underweight in Sub-Saharan Africa: A Systematic Review. *International Journal of Environmental Research and Public Health*, **14**, Article 863. https://doi.org/10.3390/ijerph14080863

[39] Black, R.E., Victora, C.G., Walker, S.P., Bhutta, Z.A., Christian, P., de Onis, M., *et al.* (2013) Maternal and Child Undernutrition and Overweight in Low-Income and Middle-Income Countries. *The Lancet*, **382**, 427-451. https://doi.org/10.1016/s0140-6736(13)60937-x

[40] Victora, C.G., Adair, L., Fall, C., Hallal, P.C., Martorell, R., Richter, L., *et al.* (2008) Maternal and Child Undernutrition: Consequences for Adult Health and Human Capital. *The Lancet*, **371**, 340-357. https://doi.org/10.1016/s0140-6736(07)61692-4

[41] Alderman, H. and Headey, D.D. (2017) How Important Is Parental Education for Child Nutrition? *World Development*, **94**, 448-464. https://doi.org/10.1016/j.worlddev.2017.02.007

[42] Smith, L.C. and Haddad, L. (2015) Reducing Child Undernutrition: Past Drivers and Priorities for the Post-MDG Era. *World Development*, **68**, 180-204. https://doi.org/10.1016/j.worlddev.2014.11.014

[43] Victora, C.G., Christian, P., Vidaletti, L.P., Gatica-Domínguez, G., Menon, P. and Black, R.E. (2021) Revisiting Maternal and Child Undernutrition in Low-Income and Middle-Income Countries: Variable Progress towards an Unfinished Agenda. *The Lancet*, **397**, 1388-1399. https://doi.org/10.1016/s0140-6736(21)00394-9

[44] UNICEF (2021) Protecting Child Rights in a Time of Crises. UNICEF Annual Report 2021.

[45] Chowdhury, M.A., Hasan, M.K. and Islam, S.L.U. (2022) Climate Change Adaptation in Bangladesh: Current Practices, Challenges and the Way Forward. *The Journal of Climate Change and Health*, **6**, Article 100108. https://doi.org/10.1016/j.joclim.2021.100108

[46] Bhutta, Z.A., Ahmed, T., Black, R.E., Cousens, S., Dewey, K., Giugliani, E., *et al.* (2008) What Works? Interventions for Maternal and Child Undernutrition and Survival. *The Lancet*, **371**, 417-440. https://doi.org/10.1016/s0140-6736(07)61693-6

[47] WHO (2025) For a Safer, Healthier, and Fairer World. 1-8.

[48] Arimond, M. and Ruel, M.T. (2004) Dietary Diversity Is Associated with Child Nutritional Status: Evidence from 11 Demographic and Health Surveys. *The Journal of Nutrition*, **134**, 2579-2585. https://doi.org/10.1093/jn/134.10.2579