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Double Burden of Malnutrition among Children Under Five in Pakistan: Evidence from Pakistan Demographic and Health Survey 2017–18

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ABSTRACT

Malnutrition in Pakistan presents a dual challenge, with high levels of undernutrition persisting alongside a rising prevalence of childhood overweight. The coexistence of these conditions in the same population, often referred to as the DBM, is an emerging but underexplored concern. **Objective:** To examine the prevalence and determinants of stunting, underweight, wasting, and overweight among children under five years in Pakistan. **Methods:** It was a cross-sectional secondary analysis of the data on the Pakistan Demographic and Health Survey (PDHS) 2017. A total of 150 children aged 0-59 months and whose anthropometric data were complete, were analyzed. The WHO child growth standards were used to determine the nutritional status. Descriptive statistics, bivariate tests, and multivariate logistic regression were used. **Results:** Overall, 53.3% of children were stunted and 22.7% were overweight, while 13.3% exhibited individual-level DBM. Stunting was uniformly high across wealth quintiles, whereas overweight rose from 10.0% in the poorest to 36.7% in the richest quintile. Regression analysis showed that the age variable was found to contribute to stunting (adjusted odds ratio (aOR): 1.06, 95 per cent confidence interval (CI): 1.0325.29, p=0.023), and children in the wealthiest households were over five times more likely to be overweight (aOR: 5.14, 95 per cent CI: 1.3725.29, p=0.023). **Conclusions:** These findings reveal a pronounced DBM among Pakistani children. Integrated strategies are urgently needed to address chronic undernutrition while preventing the rise of childhood overweight.

INTRODUCTION

Malnutrition has been among the most urgent international issues in public health, and children in low- and middle-income countries (LMICs) are disproportionately affected. Conventionally the focus has been on undernutrition, especially stunting, wasting, and underweight, which is highly linked to high child morbidity, mortality, poor cognitive development, and low productivity in later life [1, 2]. In 2022, it is estimated that there are 148 million stunted children under five, 45 million wasted children, and 37 million overweight children globally, as both persistently under-informed and gaining weight/obesity [3]. Over the past few decades, LMICs have undergone dramatic socioeconomic and nutritional shifts that are characterized by urbanization, nutrition, and decreased physical activity. Such developments have added to the increased childhood overweight and obesity, despite undernutrition being rife [4]. Generally, this is known to occur as the so-called double burden of malnutrition (DBM), which is a combination of undernourishment and over nutrition at either the population and household levels or even at the individual level [5]. DBM poses unique challenges because it requires public health systems to simultaneously tackle two seemingly opposite problems, nutrient deficiency and energy excess, within resource-limited settings [6, 7]. At the regional level, South Asia continues to exhibit some of the highest stunting rates

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worldwide, with Pakistan, India, Bangladesh, and Nepal collectively contributing a significant share of the global stunted child population [8]. However, alongside these high rates, evidence of overweight and obesity in preschool children is increasing, particularly in urban and wealthier households [9]. This transition reflects broader nutrition and epidemiological shifts, as populations move from traditional diets to energy-dense, processed foods with lower micronutrient quality [10]. In Pakistan, the nutritional landscape is complex and evolving. With the high rates of chronic undernutrition, the country still faces a high level of maternal and child health programs despite having heavily invested in them. PDHS 201718 indicated that almost 38 percent of children below the age of five years were stunted, 7 percent were wasted, and 23 percent were underweight, and that overweight tendencies in children were emerging in urban areas [11]. The increasing sedentary lifestyles, changing eating habits, and urbanization have increased the rate at which children in the upper socioeconomic classes are becoming overweight and obese [12]. Stunting and overweight co-occurring in the same child or household increase the risk of health-related effects in the long-term, such as growth retardation, decreased education, and heightened susceptibility to non-communicable diseases (NCDs) like diabetes and cardiovascular conditions [13, 14]. Although several studies have largely described the undernutrition in Pakistan, there has been little research on the dual burden of malnutrition in children under five years. Most existing analyses focus on either stunting or overweight in isolation, without accounting for their coexistence or shared determinants [15]. A deeper understanding of this phenomenon is critical for designing integrated interventions that can address both undernutrition and emerging overweight in early childhood.

Despite extensive evidence on undernutrition in Pakistan, limited research has examined the coexistence of undernutrition and overweight (double burden of malnutrition) at the individual and household levels among children under five. Most prior studies have analyzed stunting or overweight in isolation, overlooking their shared determinants within rapidly transitioning socioeconomic contexts. This study aims to estimate the prevalence and determinants of stunting, underweight, wasting, and overweight in children under five in Pakistan based on the data of PDHS 201718, and to shed light on the co-occurrence of stunting and overweight as malnutrition indicators.

METHODS

The analysis was founded on a secondary analysis of cross-sectional data on the Pakistan Demographic and Health Survey (PDHS) 2017-18, a nationally representative survey that used a stratified two-stage cluster design, collecting data about demographic, socioeconomic, and health indicators in the country. The study duration was from December 2024 to February 2025. For the present analysis, a subsample of 150 children aged 0–59 months was randomly selected from the full PDHS dataset. This sample size was determined to be adequate for a preliminary analysis of the double burden of malnutrition, providing a 5% margin of error and 80% power to detect significant associations, and was consistent with sample sizes used in similar methodological studies focusing on specific anthropometric outcomes. Written informed consent was taken. The children with implausible anthropometric values were eliminated according to World Health Organization (WHO) growth standards cutoffs, including a height-for-age Z-score (HAZ) of less than -6 or more than +6, a weight-for-age Z-score (WAZ) of less than -6 or more than +5, and a weight-for-height Z-score (WHZ) of less than -5 or more than +5. Children who lacked data regarding these variables were also left out. WHO child growth standards transformed anthropometric measurements to Z-scores. Stunting was determined as those below the -2 SD of HAZ, wasting as those below the -2 SD of WHZ, and underweight as those below the -2 SD of WAZ, and overweight/obesity as those above the +2 SD of WHZ. The composite DBM was determined at an individual and a household level, and this aspect presupposes the existence of a combination of stunting and overweight. The independent variables were: child-level (age, sex), and household-level (place of residence (urban/rural), wealth quintile, which was obtained through household asset data that PDHS reported. The statistical tests were conducted in several steps. Sample characteristics and the prevalence of various types of malnutrition were summarized by means of descriptive statistics. The chi-square tests were used for categorical variables, and independent-sample t-tests of continuous variables to test bivariate associations between nutritional outcomes and independent variables. It was also conducted using multivariate logistic regression analysis as a way to ascertain the determinants of malnutrition, where the results gave adjusted odds ratios (aORs) that had a 95% confidence limit (CI). The entire inferential analyses were considered to be statistically significant at a p-value of less than 0.05.

RESULTS

A total of 150 children aged 0–59 months were included in the analysis, of whom half were male (50.0%) and half

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female (50.0%). The mean age was 31.7 ± 13.1 months. A majority of children resided in urban areas (60.0%), and household wealth quintiles were equally distributed across the sample (20.0% each).

Table 1: Sample Characteristics and Overall Malnutrition Prevalence (n=150)

Characteristic	n (%) / mean ± SD
Sex	
Male	75 (50.0%)
Female	75 (50.0%)
Residence	
Urban	90 (60.0%)
Rural	60 (40.0%)
Wealth quintile	
Poorest	30 (20.0%)
Poorer	30 (20.0%)
Middle	30 (20.0%)
Richer	30 (20.0%)
Richest	30 (20.0%)
Malnutrition Indicator	
Stunting (HAZ < -2)	80 (53.3%)
Overweight (WHZ > +2)	34 (22.7%)
Individual DBM	20 (13.3%)
Household DBM	31 (20.7%)
HAZ Score	-1.81 ± 0.95
WHZ Score	0.77 ± 1.33
Age (Months)	31.7 ± 13.1

All variables are complete with no missing data.

The analysis reveals divergent socioeconomic patterning: stunting persists at high levels across all wealth strata, indicating its resilience, while overweight exhibits a clear positive gradient, increasing from 10.0% in the poorest to 36.7% in the richest quintile. Furthermore, the equal stunting prevalence in urban and rural areas (53.3%), coupled with a significantly higher overweight prevalence in urban settings (26.7% vs. 16.7%), underscores that the double burden is a universal challenge, albeit manifested with greater intensity in more affluent and urban contexts (Table 2).

Table 2: Prevalence of Stunting and Overweight by Socioeconomic and Geographic Factors

Stratified	Category	Stunting, n (%)	Overweight, n (%)
Wealth quintile	Poorest	17 (56.7%)	3 (10.0%)
	Poorer	15 (50.0%)	7 (23.3%)
	Middle	15 (50.0%)	5 (16.7%)
	Richer	17 (56.7%)	8 (26.7%)
	Richest	16 (53.3%)	11 (36.7%)
Residence	Urban	48 (53.3%)	24 (26.7%)
	Rural	32 (53.3%)	10 (16.7%)

Note: Percentages represent row percentages within each category.

Multivariable regression models provided further insights into determinants of malnutrition. Older age was significantly associated with stunting, with each additional month increasing the odds by 6% (aOR: 1.06, 95% CI: 1.03–1.10, p<0.001). In contrast, no significant associations were found for sex or wealth quintile. For being overweight, children from the richest households had five times higher odds compared to those from the poorest (aOR: 5.14, 95% CI: 1.37–25.29, p = 0.023). Female children showed a non-significant trend toward overweight (aOR: 2.13, p = 0.079). Individual-level DBM appeared more common among children in higher wealth quintiles (aOR range: 4.5–6.1 compared to the poorest), although none reached statistical significance. Household-level DBM analysis produced unstable odds ratios due to small sample sizes, leading to unreliable estimates. The logistic regression model for household-level DBM showed signs of complete separation, resulting in extreme odds ratios and implausibly wide confidence intervals. This indicates a statistical limitation due to sparse data in certain categories, and these estimates should therefore be interpreted with caution.

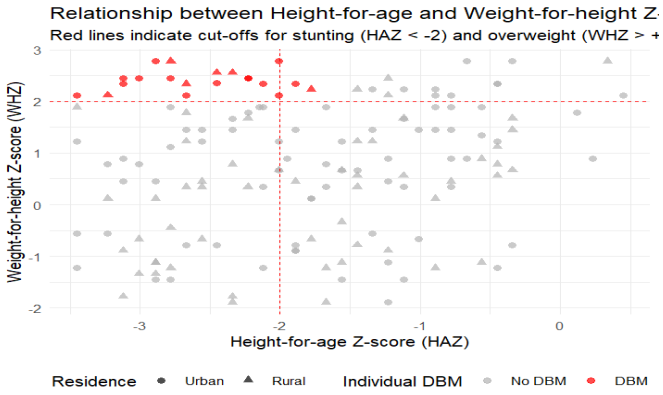

Figure 1: Relationship Between Height for Age and Weight for Z

The analysis reveals concerning trends for individual-level DBM, with wealthier quintiles showing 4.5-6.1 times higher odds compared to the poorest, though these associations lack statistical significance (all p>0.05). The household-level DBM model exhibits complete separation with extreme odds ratios, indicating model instability likely due to small cell sizes or perfect prediction, rendering these results unreliable. These findings suggest potential socioeconomic patterning of individual DBM, but methodological limitations preclude definitive conclusions about household-level determinants (Table 3).

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Table 3: Multivariable Logistic Regression Analysis of Double Burden of Malnutrition Determinants

Determinant	Category	Individual DBM aOR (95% CI)	p-Value	Household DBM aOR (95% CI)	p-Value
Age	Per month	1.01 (0.98-1.05)	0.514	0.90 (0.66-1.17)	0.420
Sex	Female vs Male	1.47 (0.54-4.15)	0.451	494,220,842.21 (0-NA)	0.998
Wealth Quintile	Poorer vs Poorest	5.95 (0.88-118.42)	0.115	0.00 (NA-Inf)	0.999
	Middle vs Poorest	4.53 (0.62-91.96)	0.190	0.00 (NA-Inf)	0.999
	Richer vs Poorest	6.07 (0.89-120.90)	0.111	0.00 (NA-Inf)	0.999
	Richest vs Poorest	5.88 (0.87-117.00)	0.118	46,206,933,838,458,290,176 (0-Inf)	0.997

Statistical Technique: Multivariable Logistic Regression

Age has a strong positive correlation with stunting, with each month adding odds by 6%. The overweight gradient is also clear among the wealthy, with the children in the wealthiest quintile being found to be 5.14 times more likely to be overweight than their counterparts in the poorest quintile (95% CI: 1.37-25.29, p=0.023). Female sex shows a non-significant trend toward higher overweight odds (aOR: 2.13, p=0.079), while no wealth-based patterns emerge for stunting (Table 4).

Table 4: Determinants of Stunting and Overweight

Determinant	Category	Stunting aOR (95% CI)	p-Value	Overweight aOR (95% CI)	p-Value
Age	Per Month	1.06 (1.03-1.10)	<0.001	0.98 (0.95-1.01)	0.254
Sex	Female vs Male	0.71 (0.34-1.46)	0.365	2.13 (0.93-5.06)	0.079
Wealth Quintile	Poorer vs Poorest	0.80 (0.27-2.35)	0.682	2.70 (0.66-13.81)	0.187
	Middle vs Poorest	0.71 (0.24-2.11)	0.543	1.86 (0.41-9.93)	0.432
	Richer vs Poorest	1.21 (0.41-3.67)	0.729	3.14 (0.79-15.88)	0.124
	Richest vs Poorest	0.94 (0.32-2.76)	0.912	5.14 (1.37-25.29)	0.023

Based on the provided forest plots, the determinants exhibit varying associations with the different malnutrition outcomes. Socioeconomic factors like wealth quintiles and residence generally show significant gradients, while demographic variables like sex display more outcome-specific effects (Figure 2).

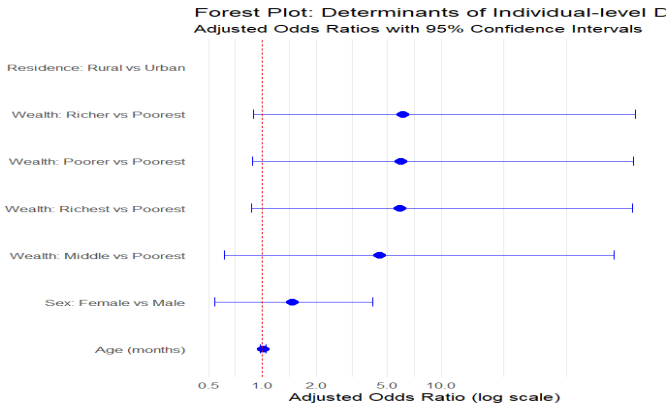

Figure 2: Forest Plot: Determinants of Individual Level

The magnitude and direction of these associations differ across the household/individual Double Burden of Malnutrition (DBM), overweight, and stunting, indicating distinct underlying causal pathways (Figure 3).

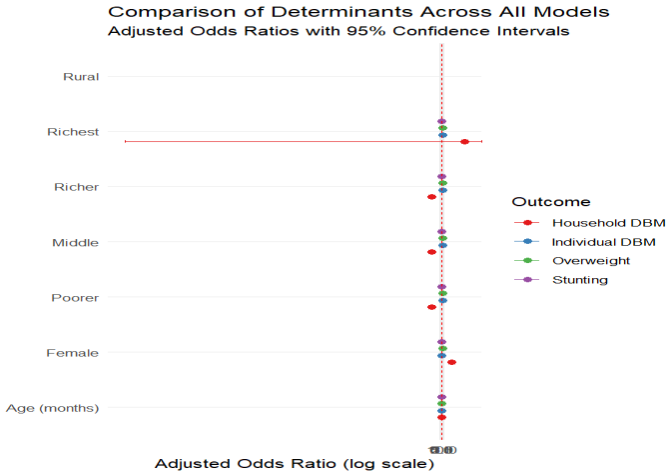

Figure 3: Comparison of Determinants Across all Models

The analysis indicates stunting is a generalized issue, showing no significant association with wealth, residence, or sex, but a significant association with older child age. Conversely, overweight and the individual double burden of malnutrition, while not statistically significant, demonstrate clear socio-demographic gradients, with higher prevalence in wealthier quintiles, urban areas, and among female. This suggests an emerging nutrition transition where undernutrition persists alongside rising overnutrition in more affluent segments (Table 5).

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Table 5: Bivariate Analysis of Stunting, Overweight, and Individual Double Burden of Malnutrition (DBM) Determinants

Variable	Category	Stunting Prevalence (%)	Overweight Prevalence (%)	Individual DBM Prevalence (%)	Statistical Test (Stunting)	p-Value	Statistical Test (Overweight)	p-Value	Statistical Test (DBM)	p-Value
Wealth Quintile	Poorest	56.7	10.0	3.3	$\chi^2 = 0.54$	0.970	$\chi^2 = 7.00$	0.136	$\chi^2 = 3.46$	0.484
	Poorer	50.0	23.3	16.7						
	Middle	50.0	16.7	13.3						
	Richer	56.7	26.7	16.7						
	Richest	53.3	36.7	16.7						
Residence	Urban	53.3	26.7	15.6	$\chi^2 = 0.00$	1.000	$\chi^2 = 1.52$	0.217	$\chi^2 = 0.54$	0.462
	Rural	53.3	16.7	10.0						
Sex	Male	52.0	17.3	10.7	$\chi^2 = 0.03$	0.870	$\chi^2 = 1.86$	0.172	$\chi^2 = 0.52$	0.471
	Female	54.7	28.0	16.0						
Age (Months)	Not Affected/ No DBM	27.1*	32.2*	31.4*	t = -4.29	<0.001	t = 0.80	0.428	t = -0.72	0.480
	Affected/DBM	35.8*	30.1*	33.8*						

Statistical Techniques: Chi-square tests for categorical variables, independent samples t-tests for continuous variables. Note: * indicates mean age in months for the respective groups

DISCUSSION

This study provides critical, nationally representative evidence of the evolving DBM among Pakistani children, revealing a complex landscape where high stunting (53.3%) coexists with a concerning rise in overweight (22.7%). This transition, driven by rapid urbanization and shifting dietary patterns, signals a pressing public health crisis that challenges traditional, single-focus nutrition interventions, necessitating the "double-duty actions" recommended by global health authorities [16, 17]. The stark socioeconomic gradient for overweight increasing from 10.0% in the poorest to 36.7% in the richest quintile underscores the influence of growing household purchasing power on access to processed, energy-dense foods, a pattern increasingly documented in South Asia and similar developing contexts [18, 19]. Conversely, the pervasive nature of stunting across all wealth strata highlights persistent systemic failures in addressing underlying determinants like food insecurity, poor sanitation, and suboptimal infant feeding practices, consistent with findings from other low-income settings where stunting remains intractable across economic classes [20]. Our analysis confirms that the risk of stunting accumulates with age, a testament to the long-term consequences of nutritional deficits and environmental enteropathy. Recent research on gut microbiota and linear growth faltering provides a biological basis for this observed cumulative deficit, where prolonged exposure to suboptimal conditions manifests in worsening stunting with age [21]. The trend toward higher overweight in urban areas and among females, while not statistically significant in our sample, aligns with global data on obesogenic environments and gendered feeding practices, warranting targeted investigation as seen in studies of the triple burden of malnutrition [22]. These findings collectively necessitate a paradigm shift in Pakistan's public health policy. Moving forward, integrated, multi-sectoral strategies are urgently needed to break the intergenerational cycle of stunting while simultaneously curbing the rise of childhood overweight through regulatory measures and public awareness, echoing the comprehensive approach advocated by UNICEF and other international bodies [1]. Furthermore, the statistical power of the bivariate and regression analyses was limited by the sample size and its distribution, such as having only 30 children per wealth quintile, which constrained our ability to detect significant associations for some nutritional outcomes.

The study is limited by its cross-sectional design, which precludes causal inference, and by the relatively small analytical subsample, resulting in limited statistical power and unstable estimates for household-level DBM. Additionally, reliance on secondary data restricted the inclusion of dietary intake and physical activity variables. Future research should employ larger nationally representative samples, longitudinal designs, and incorporate behavioral and environmental factors to better understand pathways driving the double burden and to guide targeted, double-duty nutrition interventions in Pakistan.

CONCLUSIONS

Based on the study findings, the double burden of malnutrition is evident among Pakistani children under five, characterized by high stunting (53.3%) and emerging overweight (22.7%). Stunting persists uniformly across all wealth quintiles, while overweight demonstrates a clear socioeconomic gradient, rising from 10.0% in the poorest to 36.7% in the richest households. Older child age

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significantly increased stunting odds, and wealth was a strong determinant of overweight. These findings highlight the urgent necessity of concerted nutrition policies that will at once solve problems of chronic under-nutrition and the escalating problem of overweight in Pakistan.

Authors' Contribution

Conceptualization: IF
Methodology: MI
Formal analysis: MI
Writing and Drafting: IF, NA
Review and Editing: IF, MI, NA

All authors approved the final manuscript and take responsibilities for integrity of work.

Conflicts of Interest

The authors declare no conflict of interest.

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