

Undernutrition and Dietary Diversity of Children and Mothers Living in Poor Urban Settings in Dhaka, Bangladesh: A Cross-sectional Study

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Abstract

Undernutrition remains the most significant public health concern in Bangladesh, and the condition is even alarming among the poor urban dwellers living in informal settlements, such as squatter and street sides of Dhaka city. The present study assessed the prevalence of maternal and child malnutrition, dietary diversity, infant and early childhood feeding practices, and their association with undernutrition in children of squatter and street-side dwellers. The study was cross-sectional, and data were collected through a quantitative survey. A total of 340 households (340 mother-child dyads) were selected from the squatters (n=209) and the street-side dwellers (n=131) in Dhaka city using the convenience sampling method. Descriptive statistics were used to analyze socio-economic and demographic data, while the Chi-square test assessed the relationship between categorical variables. Logistic regressions were performed to identify factors associated with stunting and being underweight. Almost half of the children were stunted. The proportion of stunting was higher among children of squatter settlements than that of street-side settlements. Still, street settlements had a higher proportion of children wasting (34.4%) and underweight (47.3%) than squatter settlements, 14.1 and 29.2 percent, respectively. About 38 percent of the infants were breastfed exclusively, and 84 percent of them were fed colostrum. Eighty percent of children living in squatter and half of the street eat less than four food groups a day. Mothers from street settlements were more undernourished than squatter settlements (28.1% vs. 15.3%). Contrarily, a quarter of the mothers in squatter settlements and 10.7 percent of the mothers of

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street sides were overweight and obese. Maternal dietary diversity was low among mothers of street-side settlements than squatter settlements. As a result, maternal and child undernutrition is high among the squatter and street-side dwellers compared to the national average. This calls for health and nutrition assistance for these impoverished urban occupiers.

Keywords: Squatter and street-side dweller, Dietary diversity, Urban undernutrition, Infant and young child feeding, Bangladesh

Introduction

Undernutrition remains the most significant public health concern in Bangladesh, a developing country, even though it is regarded as one of the leading development issues under the sustainable development goals framework (Islam et al., 2020). The condition is especially alarming among the urban poor in the metropolitans like the capital city Dhaka, where approximately 5000 slums are scattered with millions of inhabitants (Ahmed, 2016; Gruebner et al., 2014). Squatters and street-side settlements (where people live on unoccupied land without permission) are predominant in this undeveloped slum zone. These settlements in a city like Dhaka are due to worsening conditions in the rural areas and uncontrolled urbanization, a means for improving their quality of living, getting better jobs and earnings (Gruebner et al., 2014). A squatter settlement occupied by the destitute and impoverished people who have no admittance to tenured land of their own. The street-side dwellers usually erect their dwelling places along the streets built on the footpaths or roads utilizing the walls or fences using cloth, cardboard, corrugated iron, plastic (Datta, 2016; Uddin et al., 2012). These places are characterized by overcrowding, filth, inadequate water supply, congestion, diarrhea outbreaks for long periods, poor drainage, and poverty; therefore, leading to poor health, undernutrition for these urban dwellers (Datta, 2016; Uddin et al., 2012).

Attributable to having unhealthy living conditions with lesser earning opportunities and being devoid of essential amenities, the state of mothers and children's nutritional status is far too grim in the urban squatter and street, the lowest socio-economic groups in Dhaka. One-fourth of non-pregnant mothers living in the slums suffer from severe undernutrition (Haque et al., 2014). Maternal undernutrition can result in fetal growth setbacks; nationally, around 24 percent of mothers are chronically energy deficient (National Institute of Population Research and Training (NIPORT) and ICF, 2020). Additionally, millions of children in Bangladesh suffer from one or more forms of undernutrition, and non-optimal infant and young child feeding are the fundamental drivers of poor growth and undernutrition in children under two years of age (National Institute of Population Research and Training (NIPORT) and ICF, 2020). Studies exhibit that ill-health and poor nutrition are more common features of children living in poor urban territories (Mostafa et al., 2018).

Undoubtedly poverty is a significant risk factor for undernutrition in the urban poor. Still, lack of appropriate practice and awareness regarding the importance of breastfeeding, improper complementary feeding, and early or delayed introduction of complementary foods is critical causal factors of undernutrition (Ali et al., 2011). Moreover, nutritional status is an outcome of biological processes that include food utilization, while dietary diversity ensures adequate micronutrient intakes (Styen et al., 2006). Therefore, low quality and low diversified diet are related to undernutrition in children's faltered growth, nutrient deficiencies, and the risk of chronic diseases (Rana et al., 2019). Admittedly, the extent of micronutrient inadequacy among young children and mothers in Bangladesh is alarming, owing to diets low in energy and little diversity of foods (Islam et al., 2020). This condition might further deteriorate in the bottom tiers -street and squatter dwellers- of an urban slum.

In developing countries, slums particularly represent the manifestation of undernutrition among low-income settlements. However, even though the problem is more severe among squatters and street-side dwellers, very few studies have investigated this issue in Bangladesh. Therefore, the present study examined the prevalence of maternal and child undernutrition and mothers' and children's dietary diversity in Dhaka's poor urban settings (squatter and street-side dwellers).

Materials and methods

Settings

The study was conducted in the Dhaka metropolitan area, consisting of households residing in designated urban squatter and street-side settlements. Mirpur and Mohammadpur sub-district regions for squatter settlements and Gabtoli, Kamalapur, Mouchak, Sadarghat, Gulistan, Mirpur, and Paltan areas for street people were selected. The majority of the squatter and street settlements consist of pitiable life standards with poor housing conditions (Gruebner et al., 2014). Gabtoli, Kamalapur, and Sadarghat are three important areas, especially for street dwellers. These are Dhaka city's three main entry points, having the largest bus, train, and riverine stations, respectively. The embankment of the Buriganga river in Sadarghat is government-owned land, with street occupants adjoining the embankment placed on privately owned land.

Study design and sampling

The study design was cross-sectional, and the data were collected through administering a standard questionnaire. The sample size was calculated by using standard statistical formulae. Three hundred forty households (mother-child dyads) were selected among the squatter and street-side dwellers, using the convenience sampling method. In public health studies, this method is applied to gain initial primary data (Bornstein et al., 2013). Households with -under-five children living in squatter and street settlements for at least two years were

included in this study. Information on household characteristics and members was collected from the eligible mothers through face-to-face interviews. A questionnaire was developed to obtain relevant information on socio-economic, anthropometric, and dietary diversity. Before carrying out the study, the questionnaire was modified after the pilot testing. To meet the study's objectives, eligible mothers who provided necessary information were considered respondents in most cases.

Measures

This study collected basic background information on respondents and families, including education, means of support and income, housing types, and specific information on children under five years and mothers. Anthropometric data like weight, height measurements of mothers and under-five children were taken with standard procedures (Pryer and Rogers, 2006). Stunting, underweight, and wasting in children are defined as Z-score below -2 standard deviations of the median height-for-age, weight-for-age, and weight-for-height, respectively (WHO Multicentre Growth Reference Study Group & de Onis, 2006). For the mother, chronic energy deficiency (CED) was calculated using the body mass index (BMI), and three cut-off points for BMI in kg/m² were identified: 18.5, 17.0, and 16.0. A BMI above 18.5 is classified as normal and below 16.0 as grade III CED. A diagnosis of grades I and II CED depends on finding the combination of a BMI of 16.0-16.9 or 17.0-18.4 (WHO Expert Consultation, 2004). Children's dietary diversity score (CDDS) and women's dietary diversity score (WDDS) were measured using standard guidelines (Vellema et al., 2016). Also, detailed information was collected on expenditures and savings, income from occupation and other sources, purchase and sale, food expenditures, additional expenses, safe water sources and sanitation facilities of households, and social relations (NGO memberships and activities). Occupations of the family members were classified into six categories (Pryer and Rogers, 2006). Mothers having under-five children were asked about knowledge and practice on different infant and young child feeding (IYCF) behaviors.

Statistical analyses

Data were analyzed to produce descriptive and inferential statistics using R-3.5.0. Anthropometric data for children were converted to Z-scores based on WHO reference using the software package Anthro-3.2.2 (WHO Multicentre Growth Reference Study Group & de Onis, 2006). Statistical comparisons were made across these two settlements. Parametric *t*-test was used to test for between-group differences in mean values, and chi-square tests used for categorical variables. Logistic regression analyses were performed for underweight and stunting of under-five children. The objective of this analysis was to predict the odds of being a case (underweight and stunted) based on the values of the independent variables (predictors); therefore, we performed binary logistic regression for the analyses (Peng et al., 2002). Logistic regression analysis

technique was used since the outcome variables were in binary format, determining the odds ratio, 95 percent confidence interval, and statistical significance of the association with stunting and underweight.

Results

This study included 209 and 131 mother-child dyads (340) from the squatters and streets in Dhaka, Bangladesh. The mean size of the households of these mother-child dyads was studied from squatters was similar to those in the streets. However, as shown in Table 1, households varied across these two settlements in household-head and occupation of children's fathers. Fathers headed most households in both settings, but approximately one-quarter of the households from the street were headed by mothers compared to 7.2 percent mother-headed households only in the squatter setting. Fathers from both settings generally worked as unskilled workers, but the proportion was higher in the street setting representing about three-quarters (74.8%) of unskilled fathers. On the contrary, the proportion of mothers with occupational involvement as skilled workers was higher in the street setting (51.2%) than their peer counterparts in the squatter setting (46.9%). Interestingly, the proportion of skilled workers was higher among mothers than fathers in both squatter and street settings (Table 1).

Table 1. Characteristics of the study population

Variable	Squatter	Street
	(n=209)	(n=131)
Household size, (mean)	4.4	4.5
Household type, (%)		
Father headed	89.0	73.3
Mother headed	11.0	26.7
Father's occupational category, (%)		
Skilled worker	40.3	25.2
Unskilled worker	59.7	74.8
Mother's occupational category, (%)		
Skilled worker	46.9	51.2
Unskilled worker	53.1	48.8

The nutritional status was measured by the commonly used anthropometric indicators [i.e., stunting (inadequate height for age), wasting (inadequate weight for height, and underweight (inadequate weight for age)] of the studied children, and the findings are shown in Table 2 by settings (i.e., squatter and street). Using the Child Growth Standards of the WHO (WHO, 2006), stunting at all levels was higher in the squatter children than street children. In contrast, squatter children

had lower levels of undernutrition in terms of wasting and being underweight compared to street children. Specifically, the overall stunting, wasting, and underweight levels were 47.8, 14.1, and 29.2 percent, respectively, in squatter children with corresponding proportions of 43.5, 34.4, and 47.3 percent in street children.

Table 2. Prevalence of undernutrition of under-five children by squatter and street

	Squatter (%)			Street (%)		
	Severe (≤ -3 SD)	Moderate (-2SD to 2.99 SD)	Overall (≤ -2 SD)	Severe (≤ -3 SD)	Moderate (-2 SD to 2.99 SD)	Overall (≤ -2 SD)
Underweight†	11.5	17.7	29.2	19.1	28.2	47.3*
Stunting	20.6	27.3	47.8	18.3	25.2	43.5
Wasting†	4.9	9.2	14.1	11.5	22.9	34.4*

Note: SD= Standard Deviation; †P value is based on Chi-Squared tests for differences; * P < 0.05 is considered significant

Maternal nutritional status, as measured by BMI, is shown in Table 3. At one extreme, approximately one-fifth of the measured mothers were found to be chronically energy deficient (CED) with varying levels of severity (i.e., 3.0%, 5.9%, and 11.4% at severe, moderate, and mild levels, respectively). On the other extreme, around 20 percent of mothers had BMI measured to be greater than 25 Kg/m². Three-fifth of the surveyed mothers fell in the BMI range considered normal, and the proportions of mothers with normal BMI did not vary considerably across settings (i.e., 61.1% in the street and 59.3% in squatter). However, (statistically) considerable variability across settings in both of the undernutrition indicators was observed in that CED individuals were more prevalent in street settings (28.1%) than squatter (15.3%), and, on the contrary, squatter setting had more (25.4%) overweight mothers than street setting (10.7%).

Table 3. Nutritional status of mother by Body Mass Index (BMI)

Place	Severe CED (BMI <16.00)	Moderate CED (BMI <16.00 16.99)	Mild CED (BMI 17.00- 18.49)	Mal nutrition (BMI <18.5)	Normal BMI (18.50- 24.99)	Over weight (≥ 25)
Squatter (%)	1.4	4.8	9.1	15.3	59.3	25.4
Street (%)†	5.3	8.4	14.5	28.1*	61.1	10.7
Overall (%)	3.0	5.9	11.4	20.3	60.0	19.7

Note: BMI = Body Mass Index; CED = Chronic Energy Deficiency; †P value is based on Chi-Squared tests for differences; * P < 0.05 is considered significant

Mothers were asked about several practices relating to infant feeding, and this study found differences in these practices across the settings. Caregivers from squatter reported—in a more significant proportion—desirable practices surrounding exclusive breastfeeding ($P < 0.05$) and colostrum feeding ($P < 0.01$) compared to caregivers from the street. However, the proportion of caregivers initiating breastfeeding within an hour of delivery was higher—although not significant—among street caregivers (46.9%) than squatter ones (41.1%). Regarding the proportion of exclusive breastfeeding, caregivers in both settings performed poorly—29.7 percent in squatter and 24.0 percent in the street—with seven in ten mothers reporting not having followed exclusive breastfeeding. However, colostrum feeding practice was satisfactory as 91.3 percent and 72.9 percent of mothers in squatter and street, respectively, reported feeding colostrum to their babies. Evidence on statistically significant differences in proportions of caregivers across settings reported taking government vaccination ($P < 0.01$) and anthelmintic drugs ($P < 0.01$) for their children. Virtually all (99.0%) caregivers in squatter reported taking government vaccination, while this proportion was 86.3 percent in the street. In contrast, a more significant proportion of caregivers from the street (64.9%) reported taking anthelmintic drugs for their children than squatter caregivers (46.4%).

Table 4. Infant and young child feeding and immunization behavior

	Squatter (%)	Street (%)	P-value†
Exclusively breastfed	29.7	24.0	.005*
Colostrum feeding	91.3	72.9	.000*
Breastfed within first hour of delivery	41.1	46.9	.129
Taking Govt. vaccination	99.0	86.3	.000*
Taking anthelmintic drugs	46.4	64.9	.001*

†P value is based on Chi-Squared tests for differences; * $P < 0.05$ is considered significant

Information about dietary diversity among mothers and children is given in Table 5. The mean dietary diversity score was 2.72 in squatter children, 3.44 in street children, 4.14 in squatter mothers, and 3.48 in street mothers. No statistically significant differences in dietary diversity score between squatter and street mothers (or children) were indicated. The majority of mothers (88.5% in squatter and 84.0% in the street) reported consuming 4 – 5 food groups in the 24-hours before the interview. On the other hand, most children were reported to consume 1 – 3 food groups, with half in the street setting and approximately four-fifths (79.3%) in the squatter setting. Overall, street children were reported to consume a more diverse diet than their peers in the squatter: 44.1 and 5.9 percent of street children consumed 4 – 5 and 6 – 8 food groups, respectively, compared to the corresponding percentage of 20.2 and 0.5 of squatter children.

Table 5. Children (under five) and women dietary diversity by squatter and street

CDD	Squatter (%)			Street (%)		
	U 5 Boy	U 5 Girl	Both	U 5 Boy	U 5 Girl	Both
1 – 3 groups	43.4	35.9	79.3	21.2	28.8	50.0
4 – 5 groups	13.1	7.1	20.2	22.0	22.0	44.1
6 – 8 groups	0.5	0	0.5	0.8	3.1	5.9
CDDS (mean)	2.72			3.44		
WDD	Squatter (%)			Street (%)		
1 – 3 groups	3.3			13.7		
4 – 5 groups	88.5			84.0		
6+ groups	8.1			2.3		
WDDS (mean)	4.14			3.48		

Note. CDD = Child Dietary Diversity; WDDS = Women Dietary Diversity Score; * P < 0.05 is significant

Table 6 represents logistic regression analysis for the prevalence of underweight among under-five children with socio-demographic and economic factors. Female children were almost identical to their male counterparts regarding their likelihood of being underweight (AOR = 0.918, 95% CI = 0.567-1.485; P = 0.728). In addition to gender, other factors that were found not contributing significantly to underweight included NGO or cooperative-society involvement and getting food from other sources. Conversely, child’s age had a significant effect on the underweight, with older age groups having lower risk than younger age groups. For example, AOR for children aged 36 to 47 months was 4.443 (compared to the reference category of children of 0 to 11 months) with an associated 95% CI of 1.957 to 10.085 and a P-value of 0.0001. Findings also show street settlements had significantly more underweight children than squatter (AOR=4.685, 95% CI= 1.426-15.396; P= 0.011). Although not statistically significant, receiving food from outside sources was associated with lower risks of being underweight in children.

Table 6. Logistic regression of underweight among under-five children by different socio-demographic, economic factors (adjusted)

Variables	Underweight (< - 2 SD)			
	AOR	P-value	95% CI	
			Lower	Upper
Sex				
Male	1			
Female	0.918	0.728	0.567	1.485
Age groups (months)				
0 – 11	1			
12 – 23	3.633	0.003*	1.572	8.398
24 – 35	3.693	0.004*	1.503	9.074
36 – 47	4.443	0.0001*	1.957	10.085
48 – 59	2.029	0.091	0.893	4.611
Type of slum				
Squatter	1			
Street	4.685	0.011*	1.426	15.396
Household income (in Taka)				
< 4000	1			
4000 – 5999	0.798	0.682	0.271	2.348
6000 – 7999	0.730	0.563	0.251	2.124
8000 – 9999	0.955	0.936	0.311	2.936
10000 +	0.262	0.035*	0.075	0.909
NGO, cooperative-society involvement				
Involved	1			
Not involved	1.029	0.952	0.400	2.650
Received food from other sources^a				
Yes	1			
No	2.143	0.081	0.909	5.050

Note. AOR=Adjusted Odd Ratio; NGO=Non-Government Organization; ^aOther sources=NGOs, day-care centers, and voluntary organizations; * $P < 0.05$ is considered significant

Logistic regression analysis for the prevalence of stunting among under-five children with socio-economic and demographic factors is illustrated in Table 7. Like underweight predictor analysis, female children were almost identical to their male counterparts in their likelihood of stunting (AOR=0.938, 95% CI= 0.959-1.450; $P = 0.785$). In addition to gender, other factors that were found not contributing significantly to underweight included types of slums, household income, and NGO or cooperative-society involvement. In contrast, child's age had a significant effect on stunting, with older age groups having a lower risk. For

example, AOR for children aged 24 to 35 months was 2.302 (compared to the reference category of children of 0 to 11 months) with an associated 95% CI of 1.046 to 5.067 and a P-value of 0.038. Findings also show that not getting food from outside sources significantly increases children’s chances of being stunted (AOR = 2.971, 95% CI = 1.318-6.697; P = 0.009).

Table 7. Logistic regression of stunting among under-five children by different socio-demographic, economic factors (adjusted)

Variables	Stunting (< - 2 SD)			
	AOR	P-value	95% CI	
			Lower	Upper
Sex				
Male	1			
Female	0.938	0.785	0.959	1.450
Age groups (months)				
0 – 11	1			
12 – 23	1.680	0.158	0.818	3.450
24 – 35	2.302	0.038*	1.046	5.067
36 – 47	0.889	0.746	0.437	1.809
48 – 59	0.583	0.141	0.284	1.197
Type of slum				
Squatter	1			
Street	0.506	0.227	0.168	1.527
Household income (Tk.)				
< 4000	1			
4000 – 5999	0.905	0.850	0.322	2.546
6000 – 7999	0.623	0.365	0.224	1.735
8000 – 9999	0.677	0.481	0.229	1.735
10000 +	0.540	0.290	0.171	1.691
NGO, cooperative-society involvement				
Involved	1			
Not involved	0.835	0.683	0.352	1.198
Received food from other sources^a				
Yes	1			
No	2.971	0.009*	1.318	6.697

Note. AOR=Adjusted Odd Ratio; NGO=Non-Government Organization; ^aOther sources= NGOs, day-care centers, and voluntary organizations; * P < 0.05 is considered significant

Discussion

This study is unique because it provides virtually non-existent information on the overall nutritional situation and dietary diversity of children of six to fifty-nine months and mothers of urban squatter and street dwellers residing in the Dhaka metropolitan area. We found high proportions of children with poor anthropometric status and co-existence of chronic energy deficiency (BMI < 18 kg/m²) and overnutrition (BMI ≥ 25 kg/m²) among mothers. As indicated by the diversity of food items and/or food groups, the diet quality in these population groups was also not promising. This study also determined age, setting (e.g., street), and household income to be significant predictors of underweight, while age, types of setting, and receiving of food from sources other than own sourcing are significant predictors of stunting in children.

As a point of departure, the squatter and street dwellers had the scope of availing some urban facilities such as water and gas connections, semi-hygienic latrines. Still, the overall health, nutrition, and sanitation situation were worse in urban squatters and street dwelling places. Consequently, the high stunting rates (47.8% in squatter and 43.5% in the street) as observed in this study represent critical public health challenges faced by urban slums (squatter) and street dwellers. Stunted children are susceptible to infections and diseases, have increased odds of mortality, and experience impaired growth, the consequences of which range from poor cognition and behavioral deficiency in childhood to compromised work performance and reduced earnings in adulthood. While stunting reflects chronic undernutrition, wasting may develop from acute inadequate dietary intake and/or episodes of infections/illnesses causing loss of body weight.

Our results demonstrated the co-existence of wasting with stunting, but at a lower proportion both in the street and squatter. The extents of stunting and wasting found in this study are at odds with those reported in the Bangladesh Demographic and Health Survey (BDHS), 2017-18 (Wali et al., 2020). While urban children had better nutritional status than rural children, according to the latest BDHS, we found a very high undernutrition rate. Our study only includes street and squatter children (usually the poorest ones) from urban locations. The 2011 – 2012 National Micronutrient Survey in Bangladesh reported a much higher (51.1%) prevalence of stunting among the slum-dwelling children, indicating a greater stunting burden among slum-dwellers corroborates our findings (Institute of Public Health Nutrition (IPHN), United Nation Children's Fund (UNICEF), ICDDR,B and Global Alliance for Improved Nutrition (GAIN), 2014). The proportions of wasting and stunting in our sample were similar to the 16, and 47 percent observed in the Mumbai informal settlement analysis of India's third National Family Health Survey (Ghosh, 2007).

This study revealed no significant association of child's gender with stunting regarding the predictors of their nutritional status. In contrast to the previous

findings reported from Ethiopia, Tanzania, Nigeria, and Uganda, few studies in South Asia reported nonsignificant associations between child gender and stunting, including Bangladesh (Fenske et al., 2013; Khan et al. 2019; Sultana et al. 2019). Several studies, however, reported that under-five male children are more likely to become malnourished than their female counterparts (Hien and Hoa, 2009) partly because boys are more prone to be influenced by environmental stress than girls (Asfaw et al., 2015). This study found that they become less likely to be stunted as children grow up but more vulnerable to being underweight. The findings from Bangladesh are inconsistent with those in other South Asian countries (Fenske et al., 2013; Khan et al., 2019). The nutritional outcome in children is a reflection of the general economic conditions of the home. As in previous literature, our data shows that children from families with lower income are more likely to be underweight than those from a higher income (Fenske et al., 2013). However, children from families who usually got outside food assistance such as cooked food and food items to cook at home from different voluntary organizations were less stunted. Increased income improves household food security, improving dietary quality, dietary diversity, and health conditions, thus increasing nutritional outcomes.

The findings of infant and young child feeding practices (IYCF) are quite unlike those found in the BDHS, 2018. Exclusive breastfeeding practice was not that prevalent in the study area. Nearly 40 percent of these children were exclusively breastfed and breastfed within the first hour of the delivery. Nationally, the rate of these two IYCF behaviors is 65 and 60 percent correspondingly (National Institute of Population Research and Training (NIPORT) and ICF., 2020). However, most children took all the government vaccinations, and the amount of colostrum fed to children was almost 85 percent. Street children fared better in breastfed within the first hour of delivery and taking anthelmintic drugs; the possible explanation relates to their receiving some health and medical support from different NGOs such as free-of-cost vaccinations and counseling to pregnant women lactating mothers. These findings confirm the vital importance of improving coverage and delivery of proven adequate nutrition, child, and maternal interventions, including appropriate infant nutrition, vaccination, and micronutrient supplement provision.

Maternal nutritional status varied between these two urban settlements. The street settlements possess more malnourished mothers, even though an equal portion (60%) of mothers in squatter and street were in the normal BMI range. In most street households, mothers are the last to take food and frequently cut down their food amounts to feed their children. Studies have found that BMI was worse in low-income households, and unskilled and dependent self-employed laborers had the worst BMI in Bangladesh (Pryer and Rogers, 2006). Overall, 21 percent of these urban slum mothers had a BMI of less than 18.5 kg/m². Nationally, the chronic energy deficient mothers are 12 percent (National Institute of Population Research and Training (NIPORT) and ICF, 2020), which is

lower than this study's findings. However, one-fourth of squatter mothers were overweight. Mothers from squatters possess a better nutritional status even with a high obesity rate as the majority of them did sedentary jobs in the garments such as sewing and cutting assistant, operator, helper, etc. (Pryer and Rogers, 2006). Additionally, we found that children of the study households had got food, shelter, and medical assistance from NGOs, which eventually helped their mothers to concentrate on their income and feeding.

Dietary diversity, the proxy measure of the nutritional quality evaluated in this study, was the count food groups that individuals ate over a 24-hour reference period as food groups better evaluate diet quality than individual food items (Ruel, 2003). This urban poor's dietary diversity score is very low; most mothers and children had consumed a few foods associated with their socio-economic condition. In developing countries, increased nutrient intake or better child nutritional status is positively associated with higher dietary diversity; slum children have a lower CDDS than four food groups per day (Islam et al., 2020). The mean CDDS was 2.7 and 3.4 for squatter and street dwellers, respectively, and most mothers had an intake of 3 to 5 groups of food. Diet was mainly cereal-based, lacking protein, meat, and poultry. Milk and milk products are the least regularly consumed foods. However, the study found that street children had a better dietary score. One explanation is that they got food assistance from different NGOs, day-care centers, voluntary organizations.

While this study has successfully filled the void of information on diet and nutritional status of squatter and street children and mothers, it is worth keeping in mind a few limitations this study comes along with. Firstly, as we used a convenience sampling strategy, the representativeness of the sample analyzed against all the children and mothers living in squatters and streets remains uncertain, limiting the findings of this study. While more rigorous sampling and recruiting methods could enable us to reach street- and squatter-subpopulations of children and mothers with potentially different nutritional status and its determinants, the convenience sampling method is frequently used to study populations in informal urban settlements. For instance, most of the studies reviewed by Woan et al. (2013) in their systematic review of children and youth's health status from informal urban settlements relied on a convenience sampling technique. The findings of our study are generally in line with the conclusion of those studies and offer indirect support for the validity of the results presented by us. Secondly, the proportions and risk factors of nutritional status this study shows originated from cross-sectional data limiting per se. However, a longitudinal study (prospective cohort) in Dhaka, Bangladesh by Islam et al. (2018) found a high proportion (48%) of stunting and its risk factors among slum-living children of age group (12 – 24 months), which is comparable to our study and corroborative of our findings. This is not to say that cross-sectional design can borrow the strength of longitudinal design to establish a temporality

of events or draw a causal inference. However, as Markovitz et al. (2012) suggested, cross-sectional studies may be a better source of data for policy judgments in the public health community than longitudinal studies when risk factors vary more across space at a fixed moment in time than at a fixed location across time. Thirdly, to indicate undernutrition among children, we used a discrete measure of anthropometric indicators with a cut-off of Z-score < -2.0 , which is arbitrary, with a little biological basis for a threshold (Perumal, 2018). Using such a binary dependent variable to indicate stunting or wasting can mask and discard important information about the entire distribution of outcomes. Still, the information conveyed through these anthropometric indexes in this study can track changes in nutritional status among slum children over time or assess the impact of future health/nutrition interventions targeting urban slum settlements.

Conclusions and recommendations

Low-income families from different rural areas flocked to the city and began squatting in slums and living as street dwellers to seek a better life. Still, their overall health, nutrition, and sanitation situation are generally worse than their urban counterparts. Since undernutrition is widespread among squatter and street-side dwellers, health and nutrition assistance is urgently needed for these inhabitants, including nutrition-specific and nutrition-sensitive interventions, provision of mobile clinics, the establishment of day-care centers for working people, and financial support under social safety net programs.

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