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Prevalence and sociodemographic determinants of household-level double burden of malnutrition in Bangladesh

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Abstract

Objective: To investigate the prevalence and sociodemographic determinants of household-level mother–child double burden (MCDB) of malnutrition in Bangladesh.
Design: The analysis was done using Bangladesh Demographic and Health Survey 2014 data. Multivariable logistic regression identified the sociodemographic factors associated with double-burden households.
Setting: Nationally representative cross-sectional survey.
Participants: A total of 5951 households were included in the analysis.
Results: A coexistence of overweight or obese mother and underweight or stunted or wasted child (OWOBM/USWC) was found in 6·3 % households. The prevalence of overweight or obese mother and underweight child (OWOBM/UWC) was 3·8 %, of overweight or obese mother and stunted child (OWOBM/STC) was 4·7 %, and of overweight or obese mother and wasted child (OWOBM/WSC) was 1·7 %. Mother's age 21–25 years at first birth, middle wealth index group, having two or three children and having four or more children showed statistically significant ($P < 0·05$) associations with OWOBM/UWC. Households with mother's age 21–25 years at first birth, middle wealth index group, no exposure to information media, having two or three children and having four or more children had higher odds of OWOBM/STC and OWOBM/USWC which were statistically significant ($P < 0·05$). Delivery of child through caesarean section was significantly associated with OWOBM/USWC ($P < 0·05$).
Conclusions: Although the prevalence of MCDB of malnutrition in Bangladesh is low, prevention programmes must consider the nutrition concerns of the entire household to prevent future risks. Such programmes also need to be tagged with family planning and increasing awareness through social and behaviour change counselling and exposure to information media.

Keywords
Double burden of malnutrition
Mother–child double burden
Malnutrition
Bangladesh Demographic and Health Survey
Bangladesh

Double burden of malnutrition (DBM) refers to the coexistence of undernutrition and overnutrition in the same setting[1,2]. This phenomenon can occur at individual level, household level and even at population level[1]. DBM becomes evident when the slower reduction rate of undernutrition is coupled with a faster increasing rate of overnutrition[3]. Evidence suggests that along with demographic and socio-economic transitions, developing countries are experiencing a nutritional transition[4]. Rapid urbanization, economic development, consumption of less plant-based, more refined and energy-dense foods, and decreased physical activity are the factors reported to be responsible for this[5]. Over- and undernutrition – both axes of malnutrition – are equally harmful. Undernutrition hinders physical and intellectual development[6], whereas overnutrition acts as a significant contributor to various non-communicable diseases[7]. At household level the most common duo is the coexistence of undernourished children and overweight or obese mothers, which is commonly known as mother–child dual burden (MCDB) of malnutrition[8,9].

Studies done in different parts of the world have reported the presence of MCDB of malnutrition at household level. In Brazil the prevalence of MCDB was 11·0 % and in China it was 8·0 %[8]. A study done in rural west Java reported the prevalence of household-level

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MCDB as 30·6 %, whereas in the Gaza Strip of Palestine it was 15·7 %[5]. According to the Bangladesh Nutritional Surveillance Project (2003–2006), the prevalence of MCDB of malnutrition in rural Bangladesh was 4 %[10–12]. Reports from national surveys indicate that the trend of being overweight or obese among Bangladeshi women of reproductive age is on a steady rise, whereas the prevalence of childhood undernutrition is not declining at a desired rate[10]. Among Bangladeshi children under 5 years of age, 36 % are stunted, 14 % are wasted and 33 % are underweight, whereas the prevalence of overweight/obesity among ever-married Bangladeshi women is 24 %[10]. But to our knowledge, no analysis has been done using countrywide data to explore the existing scenario of household-level DBM among mother–child pairs living in Bangladesh.

Household-level DBM is an important concern from a public health perspective. The burden has been accelerated in low- and middle-income countries (LMIC) over the past few decades and confers serious impact on health, productivity and economic growth[13]. It has already been reported that the malnutrition double burden is linked with persistence of adverse conditions such as high level of food insecurity, intake of energy-dense foods, higher prevalence of infection, and inadequate access to water and health-care services[3]. These factors, in association with rapid population growth and urbanization, may lead to an increase in the prevalence of DBM and subsequent adverse effects in the country. Hence, identifying the determinants of MCDB of malnutrition can help nutritionists as well as policy makers to direct effective and specific interventions for preventing and controlling malnutrition in all its forms. Understanding the DBM and its determinants is essential to meet the health-related Sustainable Development Goals[13]. Considering the above-mentioned context, we aimed to measure the prevalence and to identify sociodemographic determinants of household-level MCDB of malnutrition in Bangladesh.

Methods

Study design

The present study is based on analysis of Bangladesh Demographic and Health Survey (BDHS) 2014 data. The 2014 BDHS was a nationally representative cross-sectional survey conducted between 28 June and 9 November of 2014 by the National Institute of Population Research and Training, ICF International (USA), and Mitra and Associates. Participants in the BDHS were selected using probability-proportional-to-size sampling based on a two-stage cluster sample of households and stratified by rural and urban areas in the seven administrative regions of Bangladesh. The detailed protocol and methods have been published elsewhere[10]. The survey selected 18 000 residential households, where 17 565 were found occupied. Interviews were successfully completed in 17 300 (99 %) households with a response rate of 98 % from ever-married women aged 15–49 years. Informed consent was obtained from the participants after notifying them about the purpose of the survey.

Anthropometric measurements and nutritional status

In order to assess nutritional status, height and weight of the participants were measured by trained field research staff using standardized procedures. For mothers, BMI was calculated as [weight (kg)]/[height (m)]^2. The BMI cut-off used for overweight was 25·0 to <30·0 kg/m^2, and for obesity it was ≥30·0 kg/m^2[14]. Children were referred as undernourished when they were stunted, wasted or underweight. Stunting was defined as length-for-age or height-for-age less than 2 SD below the median length-for-age or height-for-age of the WHO reference population (i.e. length-for-age *Z*-score (LAZ) or height-for-age *Z*-score (HAZ) < −2). Wasting was defined as having a weight-for-length *Z*-score (WLZ) or weight-for-height *Z*-score (WHZ) of < −2, and underweight as having a weight-for-age *Z*-score (WAZ) of < −2, compared with the respective median of the WHO reference population.

Outcome variables

The extent of our current analysis was limited to household-level DBM where the mother was overweight or obese (OWOBM) and at least one of her children under 5 years of age was undernourished. We had four different forms of DBM in the analysis as outcome variables. In all the forms, the mother was either overweight or obese. If the child was underweight, then the DBM was termed as OWOBM/UWC; OWOBM/STC indicates that the child was stunted, OWOBM/WSC indicates that the child was wasted; and OWOBM/USWC indicates the overweight or obese mother was paired with her child having at least one form of undernutrition (underweight or stunted or wasted).

Sociodemographic factors

Sociodemographic characteristics of the participants were collected using a validated questionnaire which was administered during a face-to-face interview. Education variables were categorized as no education (indicating 0 grade), primary education (indicating completed grade 1–5), secondary education (indicting completed grade 6–10) and higher education (indicating completed more than grade 10). Households were categorized based on living in urban or rural areas. A composite score named the 'household wealth index', which was calculated using principal components analysis and already included in DHS data set, was used for the current analysis. The index

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was calculated based on the household's ownership of selected assets, availability of electricity supply, television and bicycle; materials used for housing construction; types of water access and sanitation facilities; use of health and other services; and health outcomes. Information on child's size at birth was collected according to the recall statement of the mother.

Statistical analysis

A total of 5951 households where a mother had at least one child under 5 years of age were included in the analysis. If a family had two or more children within the age range (0–59 months), the oldest one was selected for the mother–child pair. Prevalence was calculated by dividing the number of DBM households by the total number of households and multiplying by 100. We applied frequency distribution to summarize the categorical variables and descriptive statistics to summarize the continuous variables. Firth's logistic regression analysis was performed to identify the sociodemographic factors associated with the DBM. Firth's penalization stabilizes the bias in predicted probabilities when the outcome of interest is rare[15]. The variables found to be statistically significant ($P<0·05$) in the bivariate analysis were considered for the multivariable analysis. Households having normal-weight mother (BMI = 18·5–24·9 kg/m^2) and non-malnourished child pairs (1778 households, 29·9 %) were counted as the comparison group for regression analysis. We reported OR with 95 % CI and considered $P<0·05$ as the cut-off level of statistical significance. The complex sampling design with weighted sample was adjusted for in all statistical analyses. We performed likelihood ratio tests to evaluate the model goodness-of-fit (see online supplementary material, Supplemental Table 1) and the statistics suggested that all the models were a good fit (likelihood ratio test values for OWOBM/UWC, OWOBM/STC, OWOBM/WSC and OWOBM/USWC models are 74·79221 ($P=0·0014$), 74·46098 ($P=0·00083$), 25·76653 ($P=0·04$) and 112·8807 ($P=0·0014$), respectively). Firth's logistic regression analyses were performed using the 'logistf' package in *R*[16].

Results

Sociodemographic characteristics

Table 1 describes the sociodemographic characteristics of the participants. The mean age of the mothers was 25·65 (SD 5·98) years. Only 14·8 % of mothers did not receive any formal education and 11·1 % had higher education. Only half of the mothers (47·1 %) and one-third of the fathers (31·3 %) attained secondary education. Approximately 75 % of the mothers did not have any employment and the remaining 25 % were working to earn money. Almost two-thirds of the participants lived in rural areas. Two-thirds (63·5 %) of the families had never been exposed to any type of information media. The mean age of the mothers at first pregnancy was 18·27 (SD 3·33) years. Of the mothers, 60 % delivered their child at home and 76 % of the deliveries were normal deliveries. A total of 18·8 % of the children were born smaller than average.

Table 1 Sociodemographic characteristics of the respondents (*n* 5951). Data from the Bangladesh Demographic and Health Survey 2014

Characteristic	Mean or *n*	SD or %
Mother's age (years), mean and SD	25·65	5·98
Child's age (months), mean and SD	30·9	16·9
Mother's age at first birth (years), mean and SD	18·27	3·33
Total children ever born, mean and SD	2·3	1·5
Mother's education, *n* and %		
No education	881	14·80
Primary	1608	27·02
Secondary	2801	47·07
Higher	661	11·11
Mother currently working, *n* and %		
Yes	1513	25·4
No	4437	74·6
Father's education, *n* and %		
No education	1412	23·7
Primary	1779	29·9
Secondary	1863	31·3
Higher	896	15·1
Father's occupation, *n* and %		
Farmer	1404	23·6
Labour	1194	20·1
Service/businessman	3176	53·4
Others (unemployment, retired)	138	2·3
Place of residence, *n* and %		
Urban	1926	32·4
Rural	4025	67·6
Wealth index quintile, *n* and %		
Poorest	1232	20·7
Poor	1101	18·5
Middle	1178	19·8
Rich	1239	20·8
Richest	1201	20·2
Family exposed to media, *n* and %		
Television/radio/newspaper	2173	36·5
Not at all	3778	63·5
Received deworming drug, *n* and %		
Yes, last two week	2281	38·4
No	3662	61·6
Reported fever (*n* 2948), *n* and %		
Yes, last two week	1024	34·7
No	1924	65·3
Ever vaccinated, *n* and %		
Yes	1872	31·5
No	4071	68·5
Place of delivery (*n* 3977), *n* and %		
At home	2373	59·7
Government hospital	551	13·9
Private hospital/clinic	931	23·4
Others (NGO)	122	3·1
Had C-section delivery (*n* 3976), *n* and %		
Yes	950	24·0
No	3026	76·0
Size of child at birth, *n* and %		
Larger than average	538	13·5
Average	2693	67·7
Smaller than average	748	18·8

NGO, non-governmental organization; C-section, caesarean section.

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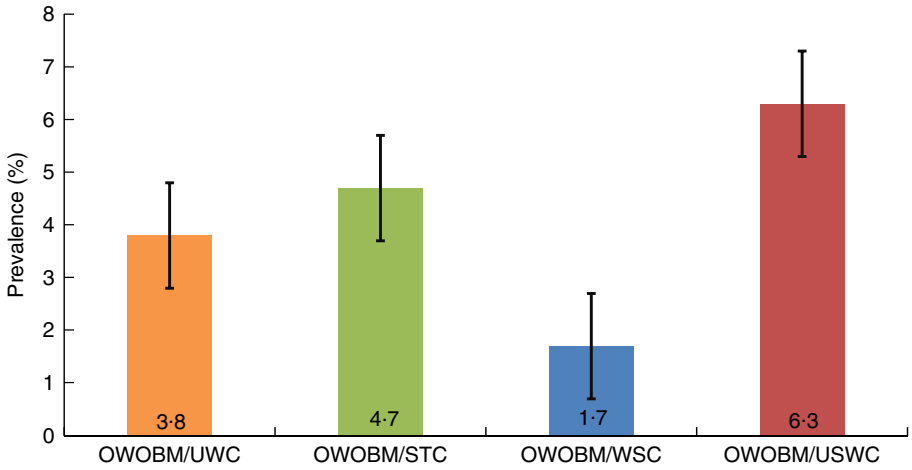

Fig. 1 (colour online) Prevalence of household-level mother–child double burden of malnutrition in Bangladesh (*n* 5951), with 95 % CI represented by vertical bars. Data from the Bangladesh Demographic and Health Survey 2014 (OWOBM/UWC, overweight or obese mother and underweight child; OWOBM/STC, overweight or obese mother and stunted child; OWOBM/WSC, overweight or obese mother and wasted child; OWOBM/USWC, overweight or obese mother and underweight or stunted or wasted child)

Prevalence of double burden of malnutrition

Figure 1 represents the prevalence of different forms of DBM among mother–child pairs. The prevalence of overweight or obese mother and underweight child was 3·8 (95 % CI 3·3, 4·3) %, of overweight or obese mother and stunted child was 4·7 (95 % CI 4·2, 5·3) % and of overweight or obese mother and wasted child was 1·7 (95 % CI 1·4, 2·1) %. The coexistence of overweight or obese mother and undernourished child (underweight or stunted or wasted) was observed in 6·3 (95 % CI 5·8, 7·1) % of households.

Factors associated with household-level double burden of malnutrition

Table 2 presents the factors associated with DBM among mother–child pairs at household level in the bivariate analysis, and Table 3 presents the results of the multivariable analysis. The presence of OWOBM/UWC showed statistically significant positive associations (all $P<0·05$) with mother's age being 21–25 years at first birth (OR = 2·40; 95 % CI 1·32, 4·52), middle wealth index group (OR = 3·23; 95 % CI 1·56, 7·22), family never exposed to information media (OR = 1·90; 95 % CI 1·13, 3·27), having two or three children (OR = 2·71; 95 % CI 1·07, 4·47) and having four or more children (OR = 4·03; 95 % CI 2·14, 7·54). Size of the child larger than average at birth was found to be protective against OWOBM/UWC (OR = 0·41; 95 % CI 0·18, 0·83; $P<0·05$).

A similar result was found for OWOBM/STC households. The statistically significant determinants (all $P<0·05$) of OWOBM/STC included mother's age at first birth being 16–20 years (OR = 1·83; 95 % CI 1·10, 3·24) and 21–25 years (OR = 2·45; 95 % CI 1·32, 4·70), middle wealth index group (OR = 1·96; 95 % CI 1·07, 3·70), having two or three children (OR = 2·49; 95 % CI 1·66, 3·80) and having four or more children (OR = 4·09; 95 % CI 2·35, 7·06). No history of being vaccinated was found to be protective against OWOBM/STC (OR = 0·67; 95 % CI 0·47, 0·97; $P<0·05$).

For OWOBM/USWC, households with mother's age being 21–25 years at first birth (OR = 1·97; 95 % CI 1·18, 3·32; $P<0·05$), no exposure to information media (OR = 1·47; 95 % CI 1·01, 2·22; $P<0·05$), delivery of child through caesarean section (C-section; OR = 1·68; 95 % CI 1·20, 2·33; $P<0·05$), having two or three children (OR = 2·59; 95 % CI 1·84, 3·71; $P<0·05$) and having four or more children (OR = 4·72; 95 % CI 2·93, 7·60, $P<0·05$) were associated with significantly higher odds of MCBD of malnutrition. No such statistically significant associations were found between selected sociodemographic determinants and OWOBM/WSC households.

Discussion

Our study found a low prevalence of household-level MCDB of malnutrition in Bangladesh. This finding is in line with the results from other studies conducted in LMIC. The proportion of OWOBM/STC was less than 10 % in most of the countries, except in some African and Latin American countries such as Egypt (12·5 %), Ghana (12·5 %), Nicaragua (12·5 %), Bolivia (15 %), Peru (16 %) and Guatemala (23 %)[17]. Previous studies conducted in rural Indonesia and Bangladesh estimated the prevalence of OWOBM/STC at household level to be 11 and 4 %, respectively[12]. Our result regarding household-level OWOBM/UWC burden is in accordance with the reports from eighteen LMIC of South Asia, Africa and Latin America, where the prevalence of OWOBM/UWC ranged from 0·3 to 5·3 %[18,19]. We found that the prevalence of OWOBM/WSC is only 1·7 % in Bangladesh. The prevalence of wasting (14 %) is much lower in the country compared with stunting (36 %) and underweight (33 %)[10]. This

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Table 2 Bivariate analysis of unadjusted OR with 95 % CI for different forms of household-level mother–child double burden of malnutrition in Bangladesh, by maternal and child characteristics (*n* 5951). Data from the Bangladesh Demographic and Health Survey 2014

		OWOBM/UWC		OWOBM/STC		OWOBM/WSC		OWOBM/USWC	
Characteristic	Response	OR	95 % CI	OR	95 % CI	OR	95 % CI	OR	95 % CI
Mother's education	No education		Ref.		Ref.		Ref.		Ref.
	Primary	0·81	0·54, 1·24	0·99	0·68, 1·46	1·08	0·55, 2·21	1·01	0·72, 1·43
	Secondary	0·82	0·56, 1·2	0·96	0·68, 1·38	1·10	0·60, 2·16	1·06	0·77, 1·46
	Higher	1·06	0·65, 1·72	1·09	0·68, 1·72	2·33*	1·17, 4·86	1·42	0·96, 2·10
Mother's age at first birth	≤ 15 years		Ref.		Ref.		Ref.		Ref.
	16–20 years	1·27	0·88, 1·91	1·74*	1·21, 2·56	1·47	0·83, 2·84	1·71*	1·24, 2·39
	21–25 years	1·77*	1·12, 2·83	1·88*	1·21, 2·96	2·16*	1·08, 4·48	2·11*	1·44, 3·12
	≥ 26 years	1·28	0·56, 2·65	0·79	0·28, 1·83	2·17	0·72, 5·73	1·04	0·48, 2·04
Mother currently working	Yes		Ref.		Ref.		Ref.		Ref.
	No	1·19	0·87, 1·66	1·16	0·88, 1·55	1·35	0·84, 2·25	1·16	0·91, 1·49
Father's education	No education		Ref.		Ref.		Ref.		Ref.
	Primary	1·05	0·72, 1·53	1·11	0·8, 1·57	0·97	0·52, 1·86	1·18	0·87, 1·60
	Secondary	0·98	0·68, 1·43	1·09	0·78, 1·53	1·64	0·94, 2·97	1·32	0·99, 1·79
	Higher	1·41	0·93, 2·13	1·36	0·93, 1·99	2·33*	1·27, 4·38	1·70*	1·22, 2·37
Father's occupation	Farmer		Ref.		Ref.		Ref.		Ref.
	Labour	1·27	0·83, 1·93	1·27	0·88, 1·86	0·85	0·43, 1·62	1·19	0·84, 1·67
	Service/businessman	1·33	0·95, 1·91	1·31	0·97, 1·8	1·27	0·79, 2·13	1·51*	1·15, 2·00
	Others (unemployment, retired)	1·29	0·46, 2·94	0·63	0·17, 1·63	1·66	0·44, 4·63	0·94	0·37, 2·00
Place of residence	Urban	1·65*	1·26, 2·15	1·78*	1·39, 2·26	1·35	0·89, 2·01	1·71*	1·38, 2·10
	Rural		Ref.		Ref.		Ref.		Ref.
Wealth index quintile	Poorest		Ref.		Ref.		Ref.		Ref.
	Poor	1·37	0·83, 2·27	1·23	0·76, 1·98	1·61	0·76, 3·53	1·50	0·99, 2·29
	Middle	2·05*	1·30, 3·29	2·14*	1·41, 3·30	1·60	0·77, 3·48	2·22*	1·52, 3·28
	Rich	1·61*	1·01, 2·62	2·09*	1·39, 3·22	1·61	0·78, 3·47	2·24*	1·54, 3·30
	Richest	2·40*	1·55, 3·80	2·50*	1·67, 3·83	3·51*	1·87, 7·14	3·13*	2·19, 4·57
Family exposed to media	Television/radio/newspaper		Ref.		Ref.		Ref.		Ref.
	Not at all	1·49*	1·12, 2·02	1·52*	1·17, 1·99	2·03*	1·29, 3·32	1·66*	1·32, 2·11
Child's age	0–23 months		Ref.		Ref.		Ref.		Ref.
	24–59 months	2·42	1·76, 3·38	1·89	1·45, 2·50	1·11	0·74, 1·68	1·66*	1·33, 2·10
Received deworming drug	Yes, last 2 weeks	1·59*	1·22, 2·08	1·36*	1·07, 1·73	1·03	0·68, 1·54	1·28*	1·04, 1·58
	No		Ref.		Ref.		Ref.		Ref.
Fever	Yes, last 2 weeks	1·00	0·71, 1·40	1·00	0·72, 1·37	1·21	0·69, 2·08	0·84	0·61, 1·13
	No		Ref.		Ref.		Ref.		Ref.
Ever vaccination	Yes		Ref.		Ref.		Ref.		Ref.
	No	0·71*	0·54, 0·94	0·63*	0·49, 0·81	0·90	0·59, 1·41	0·69*	0·56, 0·86
Size of child at birth	Larger than average	0·41*	0·18, 0·83	0·72	0·40, 1·20	0·70	0·26, 1·55	0·64	0·38, 1·01
	Average		Ref.		Ref.		Ref.		Ref.
	Smaller than average	0·88	0·53, 1·38	0·83	0·52, 1·26	0·75	0·34, 1·47	0·88	0·60, 1·25
Total children ever born	1 (single child)		Ref.		Ref.		Ref.		Ref.
	2 or 3	1·86*	1·34, 2·61	1·97*	1·46, 2·69	1·57	0·98, 2·57	1·83*	1·42, 2·38
	4 or more	2·28*	1·53, 3·41	2·38*	1·64, 3·44	1·37	0·70, 2·59	2·17*	1·58, 2·98
Delivery by C-section	Yes	1·33	0·88, 1·98	1·78*	1·25, 2·50	1·94*	1·12, 3·31	1·84*	1·37, 2·45
	No		Ref.		Ref.		Ref.		Ref.

OWOBM/UWC, overweight or obese mother and underweight child; OWOBM/STC, overweight or obese mother and stunted child; OWOBM/WSC, overweight or obese mother and wasted child; OWOBM/USWC, overweight or obese mother and underweight or stunted or wasted child; C-section, caesarean section; ref., reference category.
*Statistical significance at $P < 0·05$.

might be the possible cause behind finding a lower proportion of OWOBM/WSC in the current analysis.

Over 6 % of households had a coexistence of an overweight or obese mother and an undernourished child (OWOBM/USWC). It is well established that such coexistence of over- and undernutrition is a consequence of nutrition transition in LMIC[20]. Nutrition transition brings changes in dietary habits and consumption of high-energy-dense foods which, along with less physical activity, result in excessive weight gain among mothers as well as adults in the family[20,21]. Foods with high energy density are poor in nutrient content[20]. So, the children receive inadequate nutrition which leads to undernutrition[3,20]. This can be a possible explanation of MCDB of malnutrition in Bangladesh, as the country has been experiencing a shift in dietary habits over the past few years.

Previous studies showed that MCDB was associated with middle-income households[1,22]. Similar to those reports, we also found the middle wealth index category to be associated with OWOBM/STC and OWOBM/UWC. This indicates that poverty is not the cause of MCDB of malnutrition in Bangladesh. Adults from the middle wealth quintile might be more exposed to changes in dietary habits due to nutrition transition in the country, which is evident in many LMIC[1]. Due to increased per capita income, families from the middle wealth quintile are having access to Western foods which is causing

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Table 3 Multivariable analysis using Firth's logistic regression to determine the factors associated with different forms of household-level mother–child double burden of malnutrition in Bangladesh (*n* 5951). Data from the Bangladesh Demographic and Health Survey 2014

		OWOBM/UWC		OWOBM/STC		OWOBM/WSC		OWOBM/USWC	
Characteristic	Response	OR	95 % CI	OR	95 % CI	OR	95 % CI	OR	95 % CI
Mother's education	No education						Ref.		
	Primary					1·73	0·61, 6·24		
	Secondary					1·14	0·38, 4·29		
	Higher					1·33	0·33, 6·13		
Mother's age at first birth	≤ 15 years		Ref.		Ref.		Ref.		Ref.
	16–20 years	1·07	0·64, 1·88	1·83*	1·1, 3·24	1·17	0·56, 2·82	1·35	0·89, 2·09
	21–25 years	2·40*	1·32, 4·52	2·45*	1·32, 4·70	1·08	0·39, 3·08	1·97*	1·18, 3·32
	≥ 26 years	0·83	0·16, 2·81	0·29	0·01, 1·55	0·93	0·16, 4·06	0·52	0·12, 1·53
Mother currently working	Yes								
	No								
Father's education	No education						Ref.		Ref.
	Primary					0·83	0·32, 2·19	1·41	0·88, 2·28
	Secondary					1·92	0·80, 4·97	2·05	1·29, 3·33
	Higher					1·86	0·59, 5·95	1·42	0·79, 2·57
Father's occupation	Farmer								Ref.
	Labour							0·73	0·44, 1·19
	Service/businessman							1·03	0·69, 1·54
	Others (unemployment, retired)							0·26	0·03, 0·95
Place of residence	Urban	1·28	0·81, 2·00	1·20	0·8, 1·79			1·33	0·94, 1·88
	Rural		Ref.		Ref.				Ref.
Wealth index quintile	Poorest		Ref.		Ref.		Ref.		Ref.
	Poor	2·14	1·00, 4·86	1·11	0·57, 2·16	2·08	0·85, 5·57	1·39	0·80, 2·46
	Middle	3·23*	1·56, 7·22	1·96*	1·07, 3·70	0·83	0·26, 2·61	1·60	0·92, 2·85
	Rich	1·89	0·86, 4·44	1·56	0·82, 3·05	0·67	0·20, 2·20	1·37	0·76, 2·51
	Richest	2·01	0·88, 4·9	1·21	0·59, 2·53	1·83	0·63, 5·76	1·39	0·73, 2·69
Family exposed to media	Television/radio/newspaper		Ref.		Ref.		Ref.		Ref.
	Not at al	1·90*	1·13, 3·27	1·57	0·99, 2·53	1·25	0·61, 2·63	1·47*	1·01, 2·22
Child's age	0–23 months		Ref.		Ref.		Ref.		Ref.
	24–59 months	1·22	0·80, 1·85	0·89	0·61, 1·29			0·99	0·72, 1·37
Received deworming drug	Yes, last 2 weeks	0·67	0·42, 1·04	0·80	0·53, 1·18			0·72	0·51, 1·01
	No		Ref.		Ref.				Ref.
Fever	Yes, last 2 weeks								
	No				Ref.				Ref.
Ever vaccination	Yes		Ref.		Ref.				Ref.
	No	0·82	0·55, 1·24	0·67*	0·47, 0·97			0·84	0·62, 1·17
Size of child at birth	Larger than average	0·41*	0·18, 0·83						
	Average		Ref.		Ref.				
	Smaller than average	0·93	0·56, 1·47						
Total children ever born	1 (single child)		Ref.		Ref.				Ref.
	2 or 3	2·71*	1·70, 4·47	2·49*	1·66, 3·8			2·59*	1·84, 3·71
	4 or more	4·03*	2·14, 7·54	4·09*	2·35, 7·06			4·72*	2·93, 7·60
Delivery by C-section	Yes			1·78	1·20, 2·60	1·37	0·73, 2·54	1·68*	1·20, 2·33
	No				Ref.		Ref.		Ref.

OWOBM/UWC, overweight or obese mother and underweight child; OWOBM/STC, overweight or obese mother and stunted child; OWOBM/WSC, overweight or obese mother and wasted child; OWOBM/USWC, overweight or obese mother and underweight or stunted or wasted child; C-section, caesarean section, ref., reference category.
*Statistical significance at $P < 0·05$.

excess energy intakes[5,22]. Excess energy intake contributes to adult overweight and obesity[23], but the phenomenon is complex in children. Childhood undernutrition is interlinked with biological responses to environmental conditions, caring behaviours in the family, diet quality, micronutrient adequacy and morbidity[24]. Perhaps families with excess energy intake lack improvement in most of those factors as well as sufficient micronutrient intakes for children, which ultimately leads to DBM. In addition, there might be some social or cultural norms pertaining to food choices and intra-family food distribution that need to be investigated. Several studies revealed that the coexistence of overweight or obese mother and underweight child is more common in urban settings[1,17]. We also found the same result for OWOBM/UWC, OWOBM/STC and OWOBM/USWC in bivariate analyses. In urban areas, adult family members have to work outside the home to earn money; hence the family depends on commercially available low-priced foods which are poor in nutrient content. Commercially prepared foods are usually energy-dense and provide energy to adults, but adversely affect the nutritional status of children[17,25]. This can be the probable explanation for higher risks of MCDB among those living in urban areas. However, the findings became insignificant after adjusting for the confounders in our multivariable analyses.

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We found maternal age at first child birth and having more than one child to be significantly associated with the risk of MCDB of malnutrition. Females are prone to attaining excess BMI with increase of age and parity[17]. Several studies have also suggested that mother's age is positively associated with MCDB[19]. Whether this is related to poor postpartum resolution of the weight gained during pregnancy is not known for Bangladesh. Moreover, a larger number of young children in the same household is known to affect the availability of foods for children[17]. This might be indicative of rendering less care and attention towards the younger children of the family.

The present study revealed that households not at all exposed to information media are more at risk of developing MCDB of malnutrition, especially in the forms of OWOBM/UWC and OWOBM/USWC. Television, radio and newspapers can influence behaviour and prevent negative health-related practices[26]. Therefore, exposure to mass media campaigns may reduce the risk of MCDB of malnutrition.

Child delivery through C-section was found to be a significant contributor to DBM in Bangladesh. C-section was significantly associated with OWOBM/STC, OWOBM/WSC and OWOBM/USWC in bivariate analyses. After adjustment, only OWOBM/USWC was significantly associated with C-section delivery of the child. Studies have confirmed that undernutrition and obesity, both forms of malnutrition, are linked with gut microbiota alterations in children[27]. It is also reported that C-section delivery contributes to microbial alterations in the small intestine[28,29]. Therefore, the association of DBM with delivery through C-section is consistent with the previous study results.

Size of the child at birth larger than average was found to be protective against OWOBM/UWC. Since data regarding size at birth were subjective, there might be chance of recall bias. We observed that history of no vaccination was protective against DBM, especially against OWOBM/UWC. However, we did not find any scientific explanation supporting this finding and recommend future prospective studies to elucidate the association of vaccination with the presence of DBM.

The present study depicts the current scenario of different forms of household-level DBM and its relationship with important sociodemographic correlates. The use of a nationwide representative sample from both urban and rural areas is the strength of the study. However, the study has some limitations. Because the study design was cross-sectional, establishment of causality between the identified factors and DBM was not possible. The BDHS 2014 was not designed to address and analyse the presence of household-level DBM. Therefore, we were not able to follow any conceptual framework to comprehensively explain the burden in the context of Bangladesh. We only analysed the sociodemographic determinants of DBM. Determinants such as dietary intake, physical activity, caregiving practices, postpartum weight resolution and cultural influences were not evaluated. So, further exploration is warranted to ascertain the contribution of these potential determinants on development of various forms of MCDB of malnutrition in Bangladesh.

Conclusion

Nutrition and socio-economic transition are playing crucial roles in pulling the trend of DBM upwards in Bangladesh and other LMIC. The current study indicates the existence of MCDB of malnutrition in Bangladesh with the persistence of potential sociodemographic correlates contributing to the burden. The findings of the current study reinforce that malnutrition prevention programmes must not ignore the nutrition concerns of the whole household to prevent the burgeoning risk of MCDB in Bangladesh. Such programmes also need to be tagged with family planning and increasing awareness through social and behaviour change counselling and exposure to information media.

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Supplementary material

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