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Article

Title: Double burden of malnutrition (DBM) and anaemia under the same roof: A Bangladesh perspective.

Sumaiya Mamun [1], Christopher Guy Nicholas Mascie-Taylor [2]

[1] Assistant Professor, Institute of Nutrition and Food Science, University of Dhaka; sumaiya.mamun@du.ac.bd
[2] Professor, Department of Archaeology and Anthropology and Department of Public Health and Primary Care, University of Cambridge; nmt1@cam.ac.uk
* Correspondence: sumaiya.mamun@du.ac.bd; Tel.: +880 1780 489011

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Abstract: Double burden of malnutrition (DBM) and anaemia is a growing concern in developing countries. 5,763 mother-child pairs were selected from a cross-sectional study (Bangladesh Demographic Health Survey, 2011) to examine DBM and anaemia in households. Overweight mothers had stunted (24.5%), underweight (19.8%), wasted (9.3%) and anaemic (51.7%) children. Region and drinking water were positively associated with both DBM and anaemia ($p < 0.001$). Father's occupation and wealth index were positively associated with DBM ($p < 0.001$) only. More policies and awareness programmes are needed to address the coexistence of child undernutrition and maternal overweight/obesity and anaemia in the same household.

Keywords: Double burden of malnutrition, anaemia, undernutrition, overweight, obesity.

Introduction:

The number of undernourished people in the world increased from 777 million to an estimated 815 million in 2016. At the same time, adult obesity continues to rise in all regions. Multiple forms of malnutrition therefore coexist, with countries experiencing simultaneously high rates of child undernutrition and adult obesity [1]. Maternal and Child Double Burden (MCDB), can be defined as an overweight mother paired with an undernourished child. Nutrition disparities are more evident in low and middle income countries (LMICs) with higher prevalence of undernutrition; overweight or obesity (overnutrition); or both [2,3]. The social determinants of health (SDoH) has been consistently associated with both undernutrition in children and overweight in mothers [4,5,6]. The overall anaemia prevalence among children less than 5 years old is 54.2% in 52 low, lower-middle, and upper-middle countries according to the Demographic and Health Survey (DHS) data, collected between 2005 and 2016 [7].

In Bangladesh [Fig 1], prevalence of child undernutrition decreased from 51% to 36% due to economic growth. On the other hand, maternal overnutrition increased from 9% to 24% [8,9]. The association between socio-demographic factors and DBM was examined by several studies [10-20] around the world. In Bangladesh only small-scale community based were performed regarding DBM which may be hypothesized to increase the risk of bias [21]. The intergenerational transmission of both stunting and obesity has been documented by numerous research focusing on women of childbearing age living in socioeconomically deprived circumstances [22,23,24]. Social, economic, and gender inequalities influence the presence of intergenerational transmission of risk for [22,25]. The challenges associated with facilitating optimal pre-conception nutrition are rooted in many societal processes and sectors. These need to be tackled by equity focused policies and systems through changes in community capacity building, advocacy, and political will [23,26,27,28].

Methods:

The data source for this research was the Bangladesh Demographic and Health Survey (BDHS), 2011. The Demographic and Health Survey (DHS) programmes are nationally-representative household surveys. They provide a wide range of information mainly related to population, health and nutrition. The sample design used in DHS surveys are mainly based on a two-stage cluster format. In the first stage, Enumeration Areas (EA) is generally drawn up from census information. Secondly, a sample household is drawn from each selected EA. DHS data are representative at national level, residence level and regional level.

Fig. 1: The map of Bangladesh showing seven administrative divisions.
Source:http://ihuang.me/bangladesh-map-asia/large-detailed-administrative-divisions-map-of-bangladesh-with-asia/

BDHS 2011 obtained informed consent from the participants before the survey. The contents of the household and individual questionnaires were based on the MEASURE DHS model questionnaires. The 2011 BDHS measured the height and weight of ever-married women age 12-49. Because there were only ninety ever-married women age 12-14 (less than one percent), these women were excluded. Children aged from 0 to 59 months were selected. Only the first child of each family was selected. Only children and their mothers having anthropometric information (height and weight) and all the socio-economic variables were included.

The new cut-offs recommended by the WHO (2006) were used for child z-scores. Following WHO recommendations, any children with HAZ and WAZ either above +6 or below -6 and WHZ above +5 and below -5 were excluded. For women, anthropometric measurement above and below 4 SD were considered as outliers and were excluded (WHO, 2006) from the data. Children and women lacking information on any of the socio-economic variables of the study were also excluded. In total 5,763 mother-child pair with complete information were analysed. The total number of mother-child pairs having haemoglobin data was 1,661. The smaller sample size for haemoglobin concentration data were because BDHS chose to only take a sample of blood from every third household.

Compliant and Non-compliant groups were generated to examine the representativeness of the sample. Two sets of compliant and non-compliant groups were selected; i) Compliant vs. non-compliant group of the total sample and ii) Compliant vs. non-compliant group for Hb concentration. Later the association between the compliant and non-compliant groups were examined to ensure the representativeness of the selected samples.

The nutritional status was defined by anthropometry (BMI in mothers and stunting, underweight and wasting in children) and anaemia status of mother-child pairs. Maternal BMI was categorized in various ways (a) as three categories of underweight (BMI <18.5), normal (18.5 to 24.9) and overweight (≥25.0) following the WHO classification. Eight combinations of mother-child pairs were formed to examine the double burden of malnutrition in a household (Table 1). Maternal overweight was defined using WHO and Asian cut-offs for BMI. Later the association between those pairs was examined in relation to socio-demographic variables. All mother-child combinations were included in the regression analysis but only overweight mothers with undernourished children were presented in the results for double burden of malnutrition.

Sequential multiple regression analysis was performed to examine the association between maternal and child nutritional status. Analyses were carried out in two stages. Analysis-I adjusted for linear and quadratic effects of age and analysis-II adjusted for linear and quadratic effects of age and all other variables except the variable of interest.

Results:

The occurrence of maternal overnutrition and child undernutrition in the same household was observed in the current study. Chittagong had 22.4% overweight mothers with stunted children (Fig 2). Rural areas had higher number of overweight mothers with stunted children (58.8%). Fathers/husbands working in services, had high number of overweight

mothers with stunted children. Fathers/mothers with primary and secondary education level had highest percentages of overweight mothers with stunted children (>30%). Households with three possession score. (32.9%) and 'richer' on wealth index (35.3%) had the highest percentages of overweight mothers with stunted children. Households using flush toilets, tube-well water, coal/wood as cooking fuel and more than five family members had more overweight mothers with stunted children.

In sequential logistic regression, only region, father's occupation and wealth index showed significant ($p < 0.05$) association with overweight mothers and stunted children. Overweight mothers with stunted children were more likely to be from households where fathers/husbands had primary/secondary education. Richer families had overweight mothers with stunted children (30%). Household using coal as a cooking fuel had 60% overweight mothers with stunted children. Households with tin houses had high numbers of overweight mothers with stunted children.

In a multinomial regression analysis, region, father's/husband's occupation and wealth index were significantly associated with double burden of malnutrition in mother-child pairs (Table 2). Richer families are 70% more likely to have overweight mothers with stunted children than poorest families. Chittagong had 25% overweight mothers with underweight children. More than half of the overweight mothers with underweight children were found in urban areas. Parental occupation followed similar trend with overweight mothers with stunted children. the occurrence of overweight mothers with underweight children increased with an improvement of father's/husband's educational status. Overweight mothers with underweight children were more observed in parents having secondary level education. The percentages of overweight mothers with underweight children were high in richer families with improved toilet facilities (Table 1).

Dhaka had more overweight mothers with wasted children among the seven regions. Urban area had more overweight mothers with wasted children than rural areas. Parental occupation, type of housing showed similar trend to overweight mothers with stunted/underweight children. The number of overweight mothers with wasted children increased with improvements of parental education, wealth index, possession score, toilet facilities (Table 2). The results showed similar pattern while using Asian cut-off for BMI to define maternal overweight. In a multinomial regression analysis, father's/husband's occupation and wealth index were significantly associated with double burden of malnutrition in mother-child pairs (Supplemental Table S1).

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Table 1: Distribution of DBM through the socio-demographic variables

Variables	Categories	Overweight Mother and Stunted Child		Overweight Mother and Underweight Child		Overweight Mother and Wasted Child		Overweight Mother and Anaemic Child	
		N	%	N	%	N	%	N	%
Region	Barisal	16	18.8	14	14.1	3	4.2	12	13.8
	Chittagong	19	22.4	25	25.3	13	18.1	13	14.9
	Dhaka	15	17.6	20	20.2	15	20.8	15	17.2
	Khulna	11	12.9	10	10.1	10	13.9	17	19.5
	Rajshahi	8	9.4	5	5.1	14	19.4	15	17.2
	Rangpur	10	11.8	10	10.1	6	8.3	6	6.9
	Sylhet	6	7.1	15	15.2	11	15.3	9	10.3
Location	Urban	35	41.2	55	55.6	39	54.2	36	41.4
	Rural	50	58.8	44	44.4	33	45.8	51	58.6
Father's occupation	Service	38	44.7	46	46.5	44	61.1	38	43.7
	Skilled manual	18	21.2	19	19.2	10	13.9	18	20.7
	Unskilled labour	10	11.8	15	15.2	6	8.3	12	13.8
	Agricultural work	16	18.8	16	16.2	10	13.9	15	17.2
	Unemployed	3	3.5	3	3	2	2.8	4	4.6
Mother's occupation	Service	5	5.9	1	1	4	5.6	10	11.5
	Skilled manual	0	0	2	2	2	2.8	1	1.1
	Unskilled labour	2	2.4	3	3	2	2.8	0	0
	Agricultural work	5	5.9	2	2	2	2.8	2	2.3
	Unemployed	73	85.9	91	91.9	62	86.1	74	85.1
Father's education	Higher	18	21.2	20	20.2	27	37.5	19	21.8
	Secondary	26	30.6	39	39.4	20	27.8	33	37.9
	Primary	26	30.6	19	19.2	19	26.4	25	28.7
	No education	15	17.6	21	21.2	6	8.3	10	11.5
Mother's education	Higher	11	12.9	9	9.1	15	20.8	16	18.4
	Secondary	40	47.1	42	42.4	31	43.1	41	47.1
	Primary	26	30.6	26	26.3	21	29.2	24	27.6
	No education	8	9.4	22	22.2	5	6.9	6	6.9
Possession score	≥4	11	12.9	17	17.2	17	23.6	11	12.6
	3	28	32.9	27	27.3	20	27.8	29	33.3
	2	20	23.5	35	35.4	14	19.4	21	24.1
	1	10	11.8	10	10.1	11	15.3	11	12.6
	0	16	18.8	10	10.1	10	13.9	15	17.2
Wealth index	Richest	25	29.4	43	43.4	32	44.4	36	41.4
	Richer	30	35.3	33	33.3	14	19.4	25	28.7
	Middle	10	11.8	11	11.1	13	18.1	10	11.5
	Poorer	7	8.2	8	8.1	8	11.1	8	9.2
	Poorest	13	15.3	4	4	5	6.9	8	9.2
Source of drinking water	Pipe	12	14.1	20	20.2	23	31.9	17	19.5
	Tube well	71	83.5	79	79.8	48	66.7	67	77
	Rest	2	2.4	0	0	1	1.4	3	3.4
Toilet facility	Flush	30	35.3	56	56.6	39	54.2	47	54
	Pit with slab	28	32.9	24	24.2	16	22.2	21	24.1
	Unimproved	27	31.8	19	19.2	17	23.6	19	21.8
Cooking fuel	Gas/Electricity	16	18.8	22	22.2	26	36.1	17	19.5
	Coal/Wood	49	57.6	62	62.6	33	45.8	53	60.9
	Agricultural crops	20	23.5	15	15.2	13	18.1	17	19.5
House type	All brick/Brick wall	33	38.8	51	51.5	36	50	44	50.6
	All tin	45	52.9	39	39.4	31	43.1	38	43.7
	Tin roof	5	5.9	9	9.1	5	6.9	4	4.6
	All thatch	2	2.4	0	0	0	0	1	1.1
Number of household members	1 to 4	24	28.2	32	32.3	26	36.1	26	29.9
	≥ 5	61	71.8	67	67.7	46	63.9	61	70.1

Table 1: Multinominal logistic regression analysis* of DBM in mother-child pairs by socio-demographic variables.

DBM	Variables	Categories	OR	CI	χ^2	p	R^2	Effect size
Overweight mother with stunted child	Region	Barisal	3.79	2.81,4.78	64.9	0.004	0.3	Small
		Chittagong	1.87	1.41,2.33				
		Dhaka	1.70	1.31,2.10				
		Khulna	1.74	1.33,2.15				
		Rajshahi	1.40	1.15,1.65				
		Rangpur	1.80	1.37,2.24				
		Sylhet	1	Ref.				
	Wealth index	Richest	0.40	0.68,0.92	48.1	<0.001	0.3	Small
		Richer	0.69	0.49,0.87				
		Middle	0.35	0.42,0.88				
		Poorer	0.36	0.41,0.88				
		Poorest	1	Ref.				
Overweight mother with underweight child	Region	Barisal	0.92	0.88.0.96	68.9	<0.001	0.3	Small
		Chittagong	0.87	0.80,0.94				
		Dhaka	0.73	0.56,0.89				
		Khulna	0.45	0.42,0.88				
		Rajshahi	0.31	0.35,0.87				
		Rangpur	0.47	0.46,0.88				
		Sylhet	1	Ref.				
	Father's occupation	Service	1.33	1.14,1.53	40.5	0.002	0.3	Small
		Skilled manual	0.86	0.76,0.96				
		Unskilled labour	1.04	1.01,1.07				
		Agricultural work	1.05	1.02,1.08				
		Unemployed	1	Ref.				
	Wealth index	Richest	1.04	1.02,1.06	53.1	<0.001	0.3	Small
		Richer	0.93	0.89,0.97				
		Middle	0.82	0.72,0.93				
		Poorer	1.18	1.10,2.10				
		Poorest	1	1				
Overweight mother with wasted child	Region	Barisal	0.41	0.30,0.92	60.7	0.001	0.3	Small
		Chittagong	0.82	0.70,0.95				
		Dhaka	0.90	0.83,0.97				
		Khulna	1.43	1.20,1.66				
		Rajshahi	1.72	1.38,2.06				
		Rangpur	0.79	0.64,0.94				
		Sylhet	1	Ref.				
	Father's occupation	Service	1.15	1.10,1.25	42.7	0.002	0.3	Small
		Skilled manual	0.45	0.36,0.94				
		Unskilled labour	0.43	0.31,0.95				
		Agricultural work	0.38	0.42,0.94				
		Unemployed	1	Ref				
Overweight mother with anaemic child	Region	Barisal	3.13	2.32,3.94	55.1	0.003	0.4	Small
		Chittagong	0.92	0.86,0.98				
		Dhaka	1.29	1.11,1.47				
		Khulna	2.89	2.11,3.63				
		Rajshahi	2.68	1.97,3.39				
		Rangpur	1.26	1.09,1.43				
		Sylhet	1	Ref				
	Drinking water	Pipe	0.73	0.50,0.96	26.9	0.003	0.4	Small
		Tube well	0.65	0.34,0.95				
		Rest	1	Ref				

Ref., Reference category. *In multinominal logistic regression analysis the baseline category is normal.

Khulna had almost 20% overweight mothers with anaemic children, which was highest among seven other regions. Rural households had high number of overweight mothers with anaemic children. Fathers working in services had high number of overweight mothers with anaemic children. More than 80% unemployed mothers were overweight with anaemic children.

The number of overweight mothers with anaemic children increased with improvements of father's education, wealth index, toilet facilities and vice-versa (Table 1). The results showed similar pattern while using Asian cut-off for BMI to define maternal overweight (Supplemental Table S1). In a multinomial regression analysis, region and drinking water were significantly associated with double burden of malnutrition in mother-child pairs. Households having pipes drinking water source were 70% less likely to have underweight mothers with anaemic children (Table 2).

Discussion:

The present paper observed the existence of a double burden of malnutrition in the same household. Overweight mothers with undernourished (stunted/underweight/wasted) children were found under the same roof. When the effect of all other variables were removed, the double burden of malnutrition was significantly associated with region, wealth index and father's/husband's occupation. Overweight mothers and undernourished children were more evident in the richest households (Fig 3). The prevalence of malnourished mother and anaemic children improved with an improvement of drinking water quality. Overweight mothers with anaemic children were 27% more likely to use pipe water as the source of their drinking water.

Oddo *et al.* [19] observed the existence of stunted child and overweight mother within the same household in Bangladesh. They used data from the Bangladesh Nutritional Surveillance Project (BNSP) (2003-2006) and reported that double-burden households were more likely to be among the wealthier quintiles, which is consistent with the current study result. Other researchers also found similar results [14,29,30]. Although research is limited, an increased prevalence of Maternal and Child Double Burden (MCDB) has been observed in countries that are in the midst of their nutrition transition [30,31].

In a regional context, Shukla *et al*. [31] have confirmed the co-existence of under-and overnutrition in South Asian countries. Demographic and socioeconomic transitions have been occurring for the last few decades in this region [32]. Using data collected by HKI, Shafique *et al.* [33] observed an increasing trend of overweight in urban poor women. But it was not widely evident in rural poor women. 54% urban and 46.2% women were overweight in the present study. There are extensive differentials hidden behind these simple urban/rural comparisons. Different socioeconomic groups living in slums within the same urban areas are also exposed to the greatest health risks. The stunting rates among urban poor children are as high as poor rural children.

In the present paper, three major big cities (Dhaka, Chittagong and Khulna) had the highest percentages of overweight mothers with undernourished children (Fig 2). More

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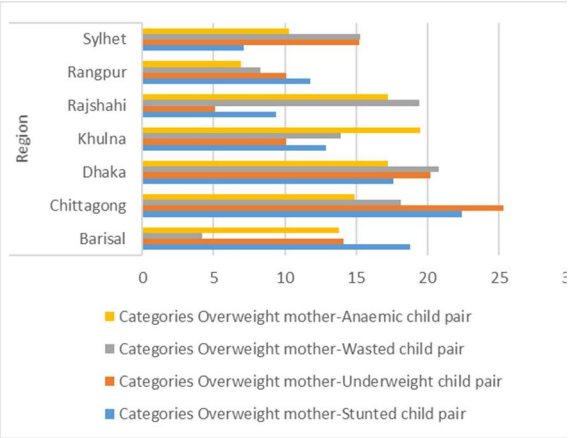

Fig 2: Regional distribution of DBM.

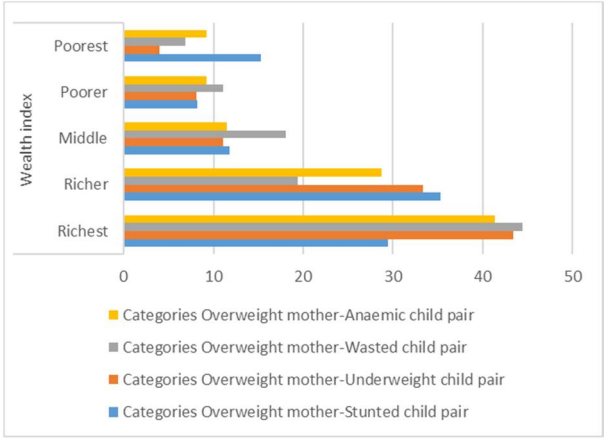

Fig 3: Distribution of DBM across the wealth index.

than 20% of mothers who were overweight had children suffering from either stunting, underweight or wasting. More than half of the urban households had Stunted Children with Overweight Mothers (SCOWT). SCOWT is not entirely an urban phenomenon because the prevalence of SCOWT is affected both by the rates of childhood stunting (high in rural areas) and maternal overweight (high in urban areas) [12].

With increased female employment and related time constraints, urban dwellers also increase their consumption of street foods or processed, ready-to-eat foods. Street foods often contain unhealthy levels of energy, saturated fats, salt, and refined sugars. It is also a good source of microbes responsible for food-borne illnesses due to poor hygiene status [34,35,36]. As a consequence, urban mother-child pairs are prone to both overweight and underweight.

There is a general perception that women living in urban areas are more likely to engage in income-generating activities outside the home than rural women. previous analysis of the Demographic and Health Surveys in developing countries showed that the main difference between urban and rural areas was not the rate of women's employment (which was roughly 50% in both areas) but rather the fact that urban mothers were much less likely to take their child to their place of work than rural women [37]. This is likely due to the types of work women engage in: agriculture in rural areas and factory, market, or street work in urban areas, which may be either unsafe or unsuitable for bringing the child along. Given these circumstances, the net impact of urban women's engagement in paid work on child well-being will depend on the quality of the substitute child care they are able to secure. Little information is available on the type and quality of childcare used by working women and this issue thus remains poorly understood. Evidence suggests, however, that women's employment and child care decisions are highly influenced by the age of their youngest child [38].

Mothers educated up to primary level education from poor households with unimproved toilet facility were underweight with anaemic children. Lower rates of extra-household employment and reduced economic

power within the household [39,40], higher rates of infection related to poor sanitation or high rates of reproductive tract infections, gynaecological morbidity, or sexually transmitted diseases [41,42] could be the possible causes of mother-child undernutrition. Overweight mothers with anaemic children tended to be from households having at least a possession score of 3 with improved toilet facility (Table 1). In the South Asian, cultural context the 'Dimensions of autonomy' such as freedom of movement, decision-making power and control over finances can also influence service use and service choice. This may lead to inappropriate treatment of illnesses.

Nutrition transition is caused by globalisation, rapid urbanisation, and economic development. A major shift in food consumption and physical activity patterns are evident in nutrition transition [43]. Urban populations are gradually shifting towards diets containing excessive amounts of energy, saturated fats, refined sugars, and salt replacing staple cereal-based diet [43]. Besides that, a sedentary lifestyle in urban population is increasing the risk of obesity and chronic non-communicable diseases such as coronary heart diseases, diabetes, and cancer.

So, the increasing number of overweight mothers is becoming a new health concern for Bangladesh. The results of this recent study clearly show that double burden exists in Bangladesh and in the same household. Apart from that, the co-existence of overweight mother and undernourished children in the same household portrays complex dynamics of possible causes.

Conclusion:

In recent years, adult overnutrition exists with child undernutrition in Bangladesh, which is well known as the 'double burden of malnutrition'. UNDP have confirmed the double burden of malnutrition, i.e. the co-existence of under-and overnutrition, in South Asia. For the last few decades, this region has been undergoing demographic and socioeconomic transitions [35]. These transitions include a shift in nutrition and morbidity patterns and Bangladesh is gradually paving its way to the double burden of malnutrition. Hence, along with measuring the prevalence of undernutrition, it is obviously important to determine the national prevalence of overweight as well as its determining factors [44].

According to the 'foetal origin of disease', early (intrauterine or early post-natal) undernutrition causes an irreversible differentiation of metabolic systems. For example, a foetus of an undernourished mother will respond to a reduced energy supply by switching on genes that optimize energy conservation. This survival strategy causes a permanent differentiation of regulatory systems that result in an excess accumulation of energy (and consequently of body fat) when the adult is exposed to an unrestricted dietary energy supply). Consequently, an undernourished child grows into an obese adult given the proper environment.

Increasing economic status and GDP decrease undernutrition but the relationship between GDP and nutrition is complex. Being poor in a middle-income country increase the risk of obesity than being rich in the same country [45]. In urbanised developing

countries, the availability of cheap, energy-dense foods could be the hidden cause of obesity. Besides that, undernutrition in the children (aged under five years) tends to increase in urban areas of countries in socio-economic transition [37]. Caballero [46] defined this phenomenon as 'underweight-overweight paradox. Effective, the underweight-overweight paradox poses a challenge to public health programs, since most programmes are designed to reduce undernutrition. large-scale nutrition-sensitive programmes, which address the key underlying determinants of nutrition, are necessary to enhance the coverage and effectiveness of nutrition-specific interventions [47].

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Supplemental Materials:

Table S1: Multinominal logistic regression analysis* of DBM in mother-child pairs by socio-demographic variables for Asian cut-off point (maternal BMI).

DBM	Variables	Categories	OR	CI	χ^2	p	R^2	Effect size
Overweight mother with stunted child	Region	Barisal	1.6	1.25,1.95	54.5	0.004	0.3	Small
		Chittagong	1.15	1.05,1.25				
		Dhaka	1.19	1.06,1.31				
		Khulna	0.87	0.77,0.97				
		Rajshahi	0.68	0.40,0.97				
		Rangpur	1.39	1.15,1.63				
		Sylhet	1	Ref.				
	Father's occupation	Service	1.01	1.00,1.02	41.1	0.004	0.3	Small
		Skilled manual	0.7	0.57,0.83				
		Unskilled labour	0.61	0.24,0.97				
		Agricultural work	0.7	0.44,0.96				
		Unemployed	1	Ref.				
	Wealth index	Richest	0.67	0.46,0.88	54.1	<0.001	0.3	Small
		Richer	1.13	1.11,1.19				
		Middle	0.64	0.41,0.87				
		Poorer	1.05	1.02,1.08				
		Poorest	1	Ref.				
Overweight mother with underweight child	Region	Barisal	0.92	0.88,0.96	64.2	<0.001	0.3	Small
		Chittagong	0.87	0.86,0.88				
		Dhaka	0.73	0.56,0.90				
		Khulna	0.45	0.03,0.87				
		Rajshahi	0.61	0.35,0.87				
		Rangpur	0.56	0.25,0.86				
		Sylhet	1	Ref.				
	Father's occupation	Service	1.33	1.14,1.52	42.8	0.002	0.3	Small
		Skilled manual	0.86	0.76,0.86				
		Unskilled labour	1.04	1.01,1.17				
		Agricultural work	1.05	1.02,1.08				
		Unemployed	1	Ref.				
	Wealth index	Richest	1.04	1.02,1.06	60.2	<0.001	0.3	Small
		Richer	0.93	0.89,0.97				
		Middle	0.82	0.72,0.92				
		Poorer	1.18	1.09,1.27				
		Poorest	1	Ref.				
Overweight mother with wasted child	Father's occupation	Service	1.06	1.02,1.10	42.7	0.002	0.3	Small
		Skilled manual	0.96	0.93,0.99				
		Unskilled labour	1.28	1.11,1.45				
		Agricultural work	1.43	1.19,1.67				
		Unemployed	1	Ref				
	Wealth index	Richest	0.57	0.28,0.86	53.1	<0.001	0.3	Small
		Richer	1.01	1.00,1.02				
		Middle	1.68	0.75,1.95				
		Poorer	1.54	1.31,1.77				
		Poorest	1	Ref				
Overweight mother with anaemic child	Region	Barisal	3.13	2.32,3.94	55.1	0.003	0.4	Small
		Chittagong	0.92	0.86,0.98				
		Dhaka	1.29	1.11,1.47				
		Khulna	2.89	2.11,3.63				
		Rajshahi	2.68	1.97,3.39				
		Rangpur	1.26	1.09,1.43				
		Sylhet	1	Ref				
	Drinking water	Pipe	0.73	0.50,0.96	26.9	0.003	0.4	Small
		Tube well	0.65	0.34,0.95				
		Rest	1	Ref				

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Author Contributions

Sumaiya Mamun reviewed the literature, prepared the data, performed the statistical analysis and wrote the first manuscript draft and C.G.N Mascie-Tayler. contributed to the study design, data analysis, interpretation and manuscript preparation. All authors read and approved the final manuscript.

Ethics of human subject participation: Ethical permission was obtained when the Demographic and Health Surveys were carried out. All data in the present study were anonymous and no additional ethical permission was required.

Conflicts of Interest

The authors declare no conflicts of interest.

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