Prevalence of child underweight, maternal malnutrition and pregnancy weight gain of urban poor of Dhaka and Chittagong, Bangladesh: an analysis of growth monitoring and promotion cards

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Abstract

Child and maternal malnutrition is a major public health problem in Bangladesh. The study assessed children and pregnant women malnutrition, and pregnancy weight gain in urban poor areas of Dhaka and Chittagong City, Bangladesh. This longitudinal study analyzed data of children <2 years and pregnant women using growth monitoring and promotion (GMP) cards. A total of 4223 GMP cards of urban static and satellite clinics were included in this study. The study found that the prevalence of low birth weight (LBW) was about 15% and that underweight was about 25%; male children were significantly more underweight than the female children. Underweight was high among children aged 18-23 months followed by <6 months. More than one third of the pregnant women (36.4%) suffered from malnutrition (BMI<18.5) at their first trimester. Overall, 23% of the pregnant women were malnourished based on mid upper arm circumference (MUAC) <21.5 cm, irrespective of their pregnancy status. Median pregnancy weight gain was 7.0 kg. Almost two-third of the pregnant women (63.6%) failed to gain desired weight (>4 kg) during the third trimester. Overall, 35.4% of pregnant women conducted 3 or more antenatal care visits throughout her pregnancy period. Prevalence of child and maternal malnutrition was significantly high in urban poor areas of Dhaka than those in Chittagong areas. Lack of continued participation in GMP program is a great challenge. Nutrition intervention programs should be intensified in the urban poor areas to address maternal and child nutrition problems.

Key words: Urban poor, GMP, LBW, Underweight, Pregnancy weight gain

Introduction

The World Health Organization defines growth monitoring and promotion (GMP) as a nutritional intervention that measures and charts the weight of children and uses this information to counsel parents so that they can motivate actions to improve child physical growth[1]. GMP is used as a problem-solving tool for a child with malnutrition or a health problem. This tool warns the caregivers to take action before the child's nutritional status seriously puts it to risk. Potential benefits of GMP are improved nutritional status, increased utilization of health services and reduction in mortality[2]. Considering its benefit, majority of the countries use GMP as an essential component of primary health care[3-5].

In Bangladesh, GMP cards were widely used as nutritional tool kit in a large-scale nutrition program 'Bangladesh Integrated Nutrition Project (BINP)' which was established in1996, and later used in 'National Nutrition Program (NNP)' from 2000-2011. Those two national programs of Bangladesh used growth reference chart of the Center for Disease Control (CDC). However, in 2007, the World Health Organization modified this GMP card which is being used in all national health and nutrition programs in Bangladesh[6,7].

Although large scale studies in India (ICDS) and Bangladesh (BRAC and BINP) reported little improvement of nutritional status in children because of poor infrastructure, inconsistency of plotting and inappropriate monitoring[2], small-scale studies in Nigeria, Jamaica, India, and large program in Tanzania

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(Iringa), India (TINP), Madagascar and Senegal reported that children whose growth is monitored and whose mothers receive nutrition and health education have better nutritional status than the children who do not[2]. Therefore, standardized procedure, evidence-based health and nutrition counseling, and proper monitoring are fundamental for effectiveness of GMP[2,5].

Although some studies are conducted to assess nutrition and health status of women and children of the urban slum areas[8-10], studies using GMP data to report trend of women and children malnutrition of the urban poor are limited. Since GMP cards record longitudinal data, this study aimed to generate information from GMP cards on the nutritional status of pregnant women and children under 2 years of age as well as to calculate pregnancy weight gain and percent number of ANC visit by women of the urban poor areas of Dhaka and Chittagong City, Bangladesh. Additionally, this study aimed to identify problems associated with GMP cards within its scope.

Methods

Study design and subjects: This was a secondary analysis of longitudinal growth monitoring and promotion data from GMP cards. The study had been conducted in major metropolitan areas of Dhaka and Chittagong. The Integrated Urban Nutrition Project (IUNP) project of Concern Worldwide, an international non-government organization, distributed GMP cards to pregnant and lactating women with under 2-year old children when they registered at primary health care centers (PHCs). The IUNP project targets children under 2-year of age and pregnant and lactating women living in street and squatter dwellers households in selected wards of Dhaka and Chittagong City Corporation. They are the most vulnerable groups in terms of physiological status as well as living in an extremely poor condition. Many of them come to take primary health care services either to static and satellite clinics which are situated nearby slum areas. Each month doctors, paramedics or field staffs measured weight and height/length of the pregnant, lactating and under two years old children during their monthly visits at PHCs. Health staffs of the satellite and static clinics plotted weight on the GMP cards.

The information in 4223 GMP card had been collected for analysis. Of them, 2049 were children, including 1003 male and 1046 female, and 2209 were pregnant women (Table 1). Very few cards were found to have data on lactating mothers and thus excluded from our analysis. Among the total number of children cards, proportion of male and female were almost equal. Chittagong coverage area contained more GMP cards than Dhaka area.

Data extraction: The data extraction team consisted of 4 nutrition graduates who received a 2-day basic training before extraction of data from GMP cards. Data were extracted from November 6 to December 17, 2012. Following data extraction in the field, the raw data were sent back to Institute of Nutrition and Food Science (INFS), University of Dhaka in phases for data processing. About 5% of the GMP cards were randomly checked to assess the integrity of data extraction. Additionally, problems associated with GMP cards were noted during data extraction.

Data analysis:

Indicators derived from GMP cards are weight for age Z-score (WAZ), body mass index (BMI), and mid upper arm circumference (MUAC). Children with WAZ<-2 SD were identified as underweight using WHO growth reference 2006[11]. BMI was calculated as weight in kg over height in meter square (kg/m^2).

Table 1: Subjects recorded on GMP cards by divisions

Subjects	Dhaka	Chittagong	Total
No of GMP cards	1177	3046	4223
Children	491	1558	2049
Male	245	758	1003
Female	246	800	1046
Pregnant Women	716	1493	2209

Adults with a BMI<18.5 kg/m^2 were defined as having low BMI[12]. Women with a MUAC <21.5 cm was considered as malnourished[13]. Additionally, pregnancy weight gain and percent antenatal care visits were calculated. Pregnancy weight gain was defined as weight before or earliest first trimester measure. Since negligible weight gain is seen till the 3rd month of gestation, weight gain from the end of the first trimester to the 3rd trimester or delivery whichever is earlier taken for the calculation of weight gain during pregnancy[14]. Percent number of antenatal care (ANC) visit by women was reported[15].

Data were analyzed to produce descriptive statistics and inferential statistics (Shapiro-Wilk test, t-test, Mann-Whitney U test and chi-squared tests), using SPSS, version 16, expressed as means with standard deviations (SD), or percentages. Anthropometric data for children were converted to Z-scores based on WHO 2006 growth reference using the software package Anthro 3.2.2[16]. The Z-scores were then transferred to SPSS spread sheet for further analysis. Statistical significant was defined as p<0.05.

Results

Nutritional status of children

Of all the GMP cards of children, only 40% of the cards were found to have record of the birth weight. Overall, the prevalence of LBW babies in these urban poor was about 15% and it was significantly higher (p<0.05) in Dhaka (20.6%) than in Chittagong areas (13.6%) (Table 2)

Based on the last data points on GMP cards among children under 2 years, about 25% were underweight and about 8% of them were severely underweight (Table 3). Significantly more male children were underweight than the female children (27.4% vs. 22.6%, p=0.01).The proportion of underweight children was slightly higher in Dhaka than Chittagong.

Table 2: Prevalence of LBW babies by divisions

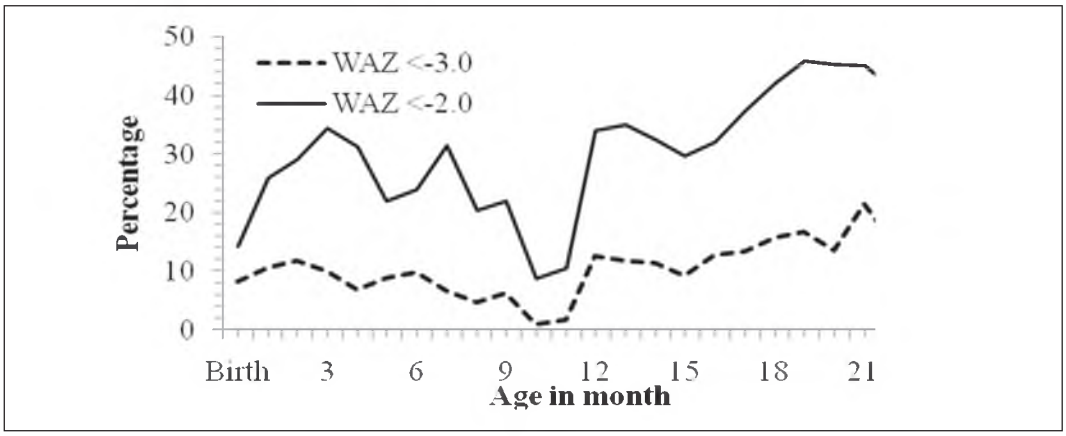
Division	Birth weight %(n)	
	<2.5 kg†	≥ 2.5 kg
Dhaka (n=189)	20.6 (39)*	79.4 (150)
Chittagong (n=639)	13.6 (87)	86.4 (552)
Total (N=828)	15.2 (126)	84.8 (702)

Note. LBW = Low Birth Weight
†*P* value is based on Chi-Squared tests for differences between Dhaka and Chittagong; **P*<0.05

Table 3: Prevalence of underweight among children under 2 years of age by divisions

Division	Weight for age (%)								
	Severe underweight (WAZ <-3 SD)			Underweight (WAZ<-2 SD)			Normal (WAZ ≥ -2 SD)		
	M	F	Both	M	F	Both	M	F	Both
Dhaka (n=491)	11.4	10.6	11.0	29.4	24.8	27.1	70.6	75.2	72.9
Chittagong (n=1558)	7.3	6.1	6.7	26.8	21.8	24.2	73.2	78.2	75.8
Total (N=2049)†	8.3	7.2	7.7	27.4*	22.5	24.9	72.6	77.5	75.1

Note. WAZ = Weight for Age Z-score; SD= Standard Deviation; M=Male; F=Female
†P value is based on Chi-Squared tests for differences between male and female children; **P*<0.05



Note. WAZ = Weight for Age Z-score

Figure 1: Trend in the prevalence of underweight in children aged 1-23 months.

Figure 1 shows the prevalence pattern of underweight at different months. Underweight pattern was not the same across different months; it increased sharply after birth and then followed a decreasing trend, although not consistent, up to the age of 10 months and then followed an upward trend for the 2nd year of children age.

Nutritional status of pregnant women

Of the total 2209 cards, we noticed that only 8% (226) of GMP cards had recording of both weight and height at 3rd month of pregnancy and thus included in our analyses to calculate BMI of women (Table 4). About 37% of the pregnant women were found malnourished at their first trimester. However, about 42% of the GMP cards of women (1782) contained information of MUAC. Twenty three percent of the pregnant women had MUAC less than 21.5 cm. Prevalence of malnutrition among pregnant women in Dhaka City was significantly higher than Chittagong City in both indicators (Table 4).

Pregnancy weight gain

Although we had many cards having women data, but cards having weight at 3rd and 9th month of pregnancy were few (n=37) (Table 5). About two-third of the pregnant women (63.6%) were not able to maintain the standard weight gain during third trimester (>4 kg), and the proportion was not significant (p=0.40) between Dhaka and Chittagong City. The overall median weight gain (kg) during pregnancy (3rd trimester minus 1st trimester) was 7.0 (5.0, 9.5) [median (25^{th}, 75^{th} percentile)] and the weight was significantly higher in Dhaka than Chittagong. Overall, 35.4% pregnant women conducted at least 3 or more antenatal care visits throughout the pregnancy period. The pregnant women in Dhaka urban poor areas conducted significantly ($p<0.001$) 4 or more visits (32%) than those of Chittagong (12%) (Table 5).

Problems associated with GMP cards

Problems that were associated with the record keeping on the GMP cards are: (1) identification problems– cards having no name or registration number, duplicate identification numbers, wrongly marked gender box ; (2) plotting problems– plotting weight without any notification of date, self-reported birth date, plotting more than one value at a single point of time, overwriting, recording the first measured weight of the pregnant women as pre-pregnancy weight, writing up the patient's weight, and height on the prescription that was not translated onto GMP cards, and was not plotted against weight gain measure; (3) inconsistency in measurement units– inconsistency in the use of units in recording (height expressed as centimeter, inches, and foot); (4) missing of information on GMP cards– weight, height and MUAC were not available at a time; sometimes the

Table 4: Nutritional status of pregnant women based on BMI and MUAC in Dhaka and Chittagong

Indicator	Total		Dhaka		Chittagong		P-value
	n	%	*n*	%	*n*	%	
BMI at first trimester†							
<18.5	82	36.4	43	53.8	39	26.9	<0.001*
≥18.5	143	63.6	37	46.2	106	73.1	
MUAC of the pregnant women†							
<21.5	412	23.1	160	32.5	252	19.6	<0.001*
≥21.5	1370	76.9	333	67.5	1037	80.4	

Note. BMI=Body Mass Index; MUAC= Mid Upper Arm Circumference

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

Table 5: Pregnancy weight gain and antenatal care visits of women in Dhaka and Chittagong

	Total		Dhaka		Chittagong		P-value
	n	%	*n*	%	*n*	%	
Pregnancy weight gain during the third trimester							
≥4 kg	133	63.6	71	66.4	62	60.8	0.40
<4 kg	76	36.4	36	33.6	40	39.2	
Net weight gain, n=37, median, (25^{th},75^{th} percentile)†	7.0 (5.0, 9.5)		9.0 (5.25, 10.37)		6.0 (4.0, 9.0)		0.048 0.049*
Number of ANC visit‡							
1	922	41.7	159	22.2	763	51.1	
2	505	22.9	160	22.3	345	23.1	
3	384	17.4	170	23.7	214	14.3	
≥4	398	18.0	227	31.7	171	11.5	<0 .001*

Note. ANC=Ante Natal Care

†*P* value is based on Mann-Whitney U test for differences; ‡*P* value is based on Chi-Squared tests for differences; **P*<0.05

Discussion

This study reports important prevalence rate and trend of malnutrition among urban poor children and women who need tailored nutrition intervention program. This study also identified problems or challenges associated with GM cards which might offer insights for future GMP programs.

Regarding LBW, the findings of this study confirms the trend in the literature. The global prevalence of LBW is about 15.5% with most cases occurring in developing countries[17]. This study found that the prevalence of LBW in urban slum was 15.2% which is almost equal to the global prevalence. However, this study does not support the findings reported by National Low Birth Weight Survey (NLBWS) of 2015 that the prevalence of LBW in urban slum of Dhaka is 31.4% and 20.8% in Chittagong[18]. In this study, Dhaka had significantly higher proportions of LBW babies than Chittagong. These are in agreement with

the findings NLBWS (2015)[18]. It is to be noted that about 27% of child birth weight was recorded as 2.5 kg. This might cause under and over reporting of LBW prevalence, and this could be due to the digit preference of the health workers or lack of having precise weight measuring instruments. Only 40% of all the GMP cards of children had recorded birth weight, so these were analyzed. Many of the missing birth weight from children of the slum areas whose birth weights were not recorded, or they were born at home[3].

One of the important findings of this study is that a quarter of the urban slum children under 2 years of age were underweight, and 8% of them were severely underweight. These measures are in agreement with the Bangladesh Demographic and Health Survey (BDHS) of 2014 that 26% of under 2 years children were underweight[19]. The present study notes that the age group of 18-23 months showed the highest prevalence of underweight children (about 36%). This finding concurs with the previous studies in Bangladesh by Rahman et al. which showed that malnutrition was highly prevalent amongst children from 12-21 months of age[20]. In this study, we found that male children were significantly more underweight than the female children. This finding does not support the findings of BDHS (2014)[19]. Poor urban male children may be more vulnerable than their female counterpart.

Maternal short stature and low BMI are linked with poor pregnancy outcomes[21]. In a recent study published in the Lancet that the prevalence of low BMI was reported around 40% in women, and this situation can be considered critical in India, Bangladesh, and Ethiopia[22]. In this study, we found a slightly low prevalence of the pregnant women (about 37%) having BMI<18.5 at the first trimester. Dhaka had significantly higher proportion of malnourished pregnant women than that of Chittagong. Of the total 2209 cards, we noticed that only 8% (226) of GMP cards had recording of both weight and height at 3rd month of pregnancy. These means that there were poor participation and recording of weight and height at the beginning of pregnancy. We did not consider the pre-pregnancy weight recorded on the GMP cards of the women because we found that the health workers had written the first recorded pregnancy weight as a pre-pregnancy weight of the women irrespective of their pregnancy stages.

On the other hand, 23% of the pregnant women were found malnourished in this study based on MUAC< 21.5 cm. Prevalence of malnutrition among pregnant women in Dhaka was significantly higher than Chittagong urban poor areas. Proportion of malnutrition based on MUAC cut off points was quite lower than malnutrition assessed on BMI cut off points. One explanation could be that MUAC cut off points vary from study to study[23-25]. The other explanation could be that only a small proportion of the GMP cards contained BMI data while a large number of GMP cards had available MUAC data irrespective of their pregnancy status. The actual pre-pregnancy weight was not available in the GMP cards. Nevertheless, we had calculated BMI at pre-pregnancy stage by taking the 3rd month weight of the pregnant women as pre-pregnancy weight assuming that there was a little weight gain at 3rd month of pregnancy after conception and the women may gain a total of 0.9 to 1.8 kg of weight at the end of first 3 month. So, the calculation of pre-pregnancy BMI could reduce the prevalence of malnourished mother.

In the context of Bangladesh, standard gestational weight gain for the 3rd trimester is >4 kg. We found that only around one third of pregnant women (36.4%) were able to gain the standard gestational weight during the 3rd trimester. This finding was slightly over the NNP baseline survey (2004) which reported that only 33.8% of the pregnant women were able to maintain the standard weight gain[26]. This increment of the proportion of pregnant women who had attained standard gestational weight gain during their 3rd trimester could have affected positively to reduce the incidence of LBW babies. In this study, median gestational weight gain was 7.0 kg which was slightly lower than that of national average weight gain reported by NLBWS (2015), 8.2 kg[18].

Antenatal visits are significantly associated with LBW[21]. Three or more ANC visits are linked with gestational weight gain at third trimester[22]. In this study, we found that more than one third of the

pregnant women had 3 or more antenatal care visits. However, about 65% of the pregnant women had less than 3 visits. Our findings are in agreement with the study conducted by Kabir et al. who found that 35.7% woman of urban slums received 3 or more ANC during pregnancy[23].

We observed that recording and plotting on the GMP cards perfectly were a challenging task for both the paramedic and the field workers. Major problems associated with record keeping on the GMP cards were identification problems, plotting problems, inconsistency in writing measurement units, and missing of information on GMP cards. These problems might result from several barriers such as heavy workload, collecting data in harsh condition (for satellite workers), irregularity in participation, and insufficient space for writing on GMP cards. The other reason could be insufficient training received by the health workers.

Conclusions

In summary, a quarter of the children and pregnant women of the urban poor areas were found malnourished, and the proportion of malnutrition was significantly higher among urban poor in Dhaka metropolitan areas than in Chittagong metropolitan areas. Majority of the pregnant women failed to achieve desired weight gain during the third trimester of pregnancy. Over all, participation in GMP program (3 or more) by women of urban poor areas was low. More nutrition intervention programs are required to tackle under nutrition problems of children and pregnant women in urban poor ares of Bangladesh.

Limitations

All the relevant information including the anthropometric data of the children and women were collected from GMP cards. An uneven distribution of the number of children in different age group was seen; about 60% of the children were below 6 months of age. Participation of mother with under 6-month infants in GMP programs was high but the rate of participation decreased with the increased age of the children. Therefore, irregularity in participation in the GMP program, to some extent, limited the analysis of trend of under nutrition of women and children of the urban poor areas from GMP data.

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