Maternal mental health and child nutritional status in an urban slum community in Bangladesh

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Research Article

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Abstract

Objective: Maternal poor mental health might diminish her capability of taking adequate care of her child, resulting in negative impact on child's nutrition. This study aims to determine the association between maternal mental health and child nutritional status.

Methods: It was a cross-sectional study carried out in 264 mother-child pairs in an urban slum area of Bangladesh. Self-Reporting Questionnaire-20 (SRQ-20) was used for assessing maternal mental health. SRQ-20 score ≥ 7 was considered as common mental disorders (CMD). Anthropometric measurements were done for assessing child nutritional status.

Results: The prevalence of maternal CMD was 46.2%. Maternal CMD was associated with poorer child feeding practice ($p < 0.001$), poorer hygiene practice ($p < 0.001$), poorer preventive care service use ($p = 0.016$) and suffering from diarrheal disease ($p = 0.049$). The prevalence of stunting, wasting and underweight were 44.3%, 18.2% and 33.7%, respectively. Poorer child feeding practice was associated with wasting ($p = 0.004$) and underweight ($p < 0.001$) but not with stunting. Poorer hygiene practice and suffering from diarrheal disease were associated with stunting and underweight but not with wasting. In multivariate analysis, maternal CMD was associated with child underweight (adjusted OR=2.25, 95% CI=1.15-4.43). Association between maternal CMD and wasting found in bivariate analysis that disappeared after multivariate analysis. No association was observed between maternal CMD and stunting in this study.

Conclusions: Maternal mental health affects child nutritional status through child feeding practice, hygiene practice and preventive care use. Interventions to address mental health of mothers in child nutrition programmes might contribute to improve child nutritional status.

Introduction

Malnutrition is a leading cause of child mortality, morbidity and lifelong developmental impairment (Smith & Haddad, 2000). Globally, 162 million under-five children are stunted; 99 million are underweight and one million are wasted; A major portion of these children reside in Asia (World Health Organization, 2012). Although the trends in malnutrition prevalence continues to reduce in recent years in Bangladesh, it is still very high (UNICEF, 2009). According to the Bangladesh Demographic and Health Survey (BDHS) 2011, the prevalence of stunting, wasting and underweight were 41%, 16% and 36%, respectively (NIPORT, Mitra and Associates, & ICF International, 2012). The contributing factors of child malnutrition include child age, sex, birth weight, previous birth interval, parents' education, maternal nutrition, low socioeconomic status, child feeding practice, hygiene, child illness, health seeking behavior etc. (Black et al., 2013; Pongou, Ezzati, & Salomon, 2006; Rayhan & Khan, 2006).

Maternal mental health plays a major contributing role in child nutritional status (Ashaba, Rukundo, Beinempaka, Ntaro, & LeBlanc, 2015; Cavalcante-Neto, Paula, Florencio, & Miranda, 2016; Harpham, Huttly, De Silva, & Abramsky, 2005; Nguyen et al., 2014; Santos, Santos, Silva Rde, Hasselmann, & Barreto,

2011). Common mental disorders (CMD) such as anxiety, depression, somatic symptoms (Prince et al., 2007) are more frequent to occur among women than men (Steel et al., 2014). The prevalence of CMD among mothers is fairly typical for women in developing countries (Harpham et al., 2005; Nguyen et al., 2014). In Bangladesh, the prevalence has been reported to be 49% (Nguyen et al., 2014).

When mother's mental health is compromised, it adversely affects child nutrition (Ashaba et al., 2015; Cavalcante-Neto et al., 2016; Harpham et al., 2005; Nguyen et al., 2014; Santos et al., 2011), interfering with mother's responsibility to child care (Surkan, Kennedy, Hurley, & Black, 2011). Maternal CMD affects mother's caregiving practices leading to improper feeding and inadequate health care for children especially immunization (Harpham et al., 2005; R. C. Stewart, 2007). Because of maternal CMD, hygiene practice is not properly maintained resulting in child illness especially diarrhea (Nguyen et al., 2014). There is a bidirectional relationship between infection and malnutrition. Infection causes malnutrition through reducing dietary intake and intestinal absorption, whereas malnutrition increases risk of diarrhea as it can predispose to infection due to weak immune system (Brown, 2003). Insufficient childcare doubles the probability of child malnutrition (Carvalhaes & Benicio, 2006).

Several studies have been published on the association between maternal CMD and child nutritional status. However, limited literature is available focusing on urban community whether prevalence of maternal CMD is relatively higher. Therefore, this study was designed to assess the relationship between maternal mental health and child nutritional status in the urban population of Bangladesh. This result would help to understand the complexities of relationship between maternal mental health and child nutrition and strengthen the knowledge base of policy makers in decision making to combat child malnutrition.

Methods

Study design and setting

The present study was a community based cross-sectional study carried out from September to November 2013. It was conducted in an urban slum area at Kamrangichar of Dhaka district in Bangladesh. An estimated 400,000 population lived in its surface area of 3.68 km². The study area is divided into 12 administrative areas or '*mohallas*'.

Study population and sample size

The study population were the mothers and their under-five children. Currently pregnant mothers were excluded as pregnancy has a potential effect on mother's mental health (Parcells, 2010) as well as her body mass index (BMI) (Olson, Strawderman, & Dennison, 2009). Data collection was done from a sample of 264 mother-child pairs. The sample size was estimated considering the prevalence of child stunting (41%) in Bangladesh (NIPORT et al., 2012) with allowable error of 6% and confidence interval of 95%. An equal number of participants were recruited from each '*mohalla*' of the study area to achieve the sample size. Starting from the center of the '*mohalla*', the data collectors approached towards a randomly

selected direction. They knocked on doors of consecutive households, and if both mother and child were present at that period, they were recruited. In case of multiple under-five children of a mother, the youngest one was enrolled.

Measurements

A structured questionnaire was used which included questions on socio-demographic information, childcare practices and child illness. There were also questions from Self-Reporting Questionnaire-20 (SRQ-20) ([World Health Organization, 1994](#)), Household Food Insecurity Access Scale (HFIAS) ([Coates, Swindale, & Bilinsky, 2007](#)), and Kuppuswamy's socioeconomic status scale ([Kumar, Gupta, & Kishore, 2012](#)). Checklist for height, weight and hygiene was used. All the questionnaires were translated into local language (Bangla) and adapted for local context. After pretesting and necessary modifications, the questionnaire was finalized.

Self-Reporting Questionnaire-20

The SRQ-20 developed by World Health Organization (WHO) was used to measure maternal mental health. It is a 20-item tool that includes questions about depressive, anxiety, panic and somatic symptoms in the preceding four weeks. Each of the 20 items is scored 1 or 0 which indicates the presence or absence of symptom, respectively. The sum of scores generates an overall SRQ-20 scale ranging from 0 to 20, where higher scores indicate poor mental health states and vice versa ([World Health Organization, 1994](#)). A cut-off of 7 was set to categorize women with 'CMD' or 'no CMD', as suggested by several studies ([Harpham et al., 2005](#); [Medhin et al., 2010](#); [Nguyen et al., 2014](#); [Robert C Stewart et al., 2008](#)). The reliability and validity of this instrument are well established ([World Health Organization, 1994](#)) and it has been used in several studies including Bangladesh ([Harpham et al., 2005](#); [Medhin et al., 2010](#); [Nguyen et al., 2014](#); [Robert C Stewart et al., 2008](#)).

Household Food Insecurity Access Scale

The HFIAS 9-item questionnaire was used to measure household food security which is appropriate for urban population. The questionnaire asks a specific condition related to the experience of food insecurity for a period of four weeks preceding the survey. According to their HFIAS questionnaire scores, households were categorized into four groups: food secure, mildly, moderately and severely food insecure ([Coates et al., 2007](#)). It has been used in different surveys including Bangladesh, and the reliability and validity are well established ([Coates et al., 2007](#); [Nguyen et al., 2014](#)).

Kuppuswamy's socioeconomic status scale

The original version Kuppuswamy's socioeconomic scale (SES) developed in 1976 in India ([Kuppuswamy, 1981](#)) which was revised by Kumar et al in 2012. It is an important tool to measure SES in urban communities. ([Kumar et al., 2012](#)). It consists of three variables - family head's education, occupation and monthly family income. Based on the overall score, SES was classified into following upper, upper middle, lower middle, upper lower and lower ([Kumar et al., 2012](#)).

Family size and family type

Family members were the persons living in the same household and shared the same kitchen. The family size was categorized into small (≤ 4 members), medium (5-6 members) and large (≥ 7 members) depending on the family members. The families were of two types: (i) nuclear family consisting of husband, wife and their children; and (ii) extended family - where more than one nuclear families living together and sharing the household functions and income (Georgas et al., 2001).

Maternal occupation

Maternal occupation was categorized as housewives and working mothers. The women were considered as working mothers if they worked outside the home for income in addition to the work they performed at home. The mothers were considered as housewives if they were not involved any income generating activity outside of the home.

Child feeding index

Child feeding practice was measured using age specific child feeding index for 0-6, 6-9, 9-12, 12-36 and 36-60 months age groups. The variables used in the index creation were breastfeeding, use of baby feeding in the previous 24 hours, dietary diversity, food group frequency and meal frequency. The general scoring system was to assign a score of -1 for a potentially harmful practice, a score of 0 for medium practice and a score of 1 for a positive practice. The final child feeding index was the sum of the scores obtained for each variable. (Arimond & Ruel, 2001). Feeding terciles were derived to categorize feeding practices into poor, average, and good to make it comparable across the age groups.

Hygiene spot check observation

Child's and mother's hygiene was assessed based on a hygiene spot check of the general appearance of hands, clothes, face and hair (Ruel & Arimond, 2002). Each observation was scored 0 or 1 which indicates dirty and clean, respectively. The sum of scores generates an overall hygiene scale (range: 0-4) where higher scores indicated higher level of cleanliness and vice versa (Nguyen et al., 2014). Hygiene spot check observation was done from all the participants by a single team of data collectors to minimize subjectivity.

Preventive health seeking index

Preventive health care service use was assessed by preventive health seeking index. This index included three variables, i.e., whether the child had been taken to growth monitoring in the previous month, and whether the child had received pentavalent and measles immunizations. A score of -1 was given for children who had not received the immunization or had not attended growth monitoring in the previous month, and 0 for those who had done so. The index scores ranged from -2 to 0 (Armar-Klemesu, Ruel, Maxwell, Levin, & Morris, 2000). As immunizations are expected up to a certain age, age-specific immunization status was considered in the index for the relevant age groups.

Child illness

Child was considered ill if s/he had symptoms of either diarrhea or acute respiratory infection (ARI) within 30 days as per maternal recall.

Maternal nutritional status

According to BMI maternal nutritional status was measured. Undernutrition was considered if her BMI $<18.5 \text{ kg/m}^2$ (Barba, Cavalli-Sforza, Cutter, & Darnton-Hill, 2004).

Child nutritional status

Child nutritional status was assessed as per WHO recommended length/height-for age Z-score (HAZ), weight-for-height Z-score (WHZ) and weight-for-age Z-score (WAZ). The child was defined as stunted, wasted or underweight if his or her HAZ, WHZ or WAZ, respectively, was less than -2 standard deviations (SD) (De Onis, 2006).

Conceptual framework

The conceptual framework of this study is shown in Figure 1.

Data collection technique

Data were collected by face-to-face interview, measurement of the height and weight and observation of cleanliness of child and mother. Interview was conducted at the participant's home ensuring the privacy and confidentiality. Informed written consent was obtained before the interview. Anthropometric measurements were done following standard procedure (Cogill, 2003). Child weight was measured using electronic scales accurate to 100 g. Supine length was taken up to age of 24 months and standing height was taken after 24 months using locally manufactured length/height boards which were precise to 1 mm. Height and weight of the mothers were also measured. Their hands, clothes, face and hair were observed for cleanliness. Data were collected from all the participants by a single team of data collectors.

Data analysis

Data analysis began with descriptive analysis. Means and SD were calculated for continuous variables while frequencies and percentages were calculated for categorical variables. HAZ, WHZ and WAZ were calculated from child's age, height and weight using the software 'WHO Anthro' (World Health Organization, 2011). Bivariate analysis was done to find out the factors associated with under nutrition. The variables of interest of bivariate analysis were child's age and sex, maternal age, education occupation and nutritional status, SES, household food security, monthly family income, family type, family size, number of under-five children in the household and maternal mental health. Bivariate analysis was also done to determine the association between maternal mental health and childcare practices and between childcare practices and child nutritional status. χ^2 -test, Fisher's Exact test, Mann-Whitney U test and Spearman correlation were carried out which one was appropriate. To determine the association

between maternal mental health and child nutritional status χ^2 test was done and multivariate logistic regression was conducted to adjust the effects of other variables. Statistical significance was defined as $p < 0.05$. Data analysis was done using IBM SPSS version 21.0.

Ethical approval

Ethical approval was obtained from the ethical committee of National Institute of Preventive and Social Medicine (NIPSOM), Bangladesh.

Results

Socio-demographic characteristics

Socio-demographic characteristics of the respondents are described in Table 1.

Prevalence of poor maternal mental health

The prevalence of maternal CMD was 46.2%. Household food insecurity and maternal undernutrition were the factors of maternal CMD. The details findings have been published elsewhere ([Khan & Flora, 2017](#)).

Prevalence of child stunting, wasting and underweight

Out of 264 children, 117 (44.3%) were stunted, 48 (18.2%) were wasted and 89 (33.7%) were underweight.

Maternal mental health, childcare practice and child illness

Association of maternal mental health with child feeding practice, hygiene practice, preventive care service use and child illness are shown in Table 2.

Childcare practice and nutritional status

Association of child feeding practices and child illness with child nutritional status are illustrated in Table 3.

Socio-demographic characteristics and child nutritional status

Association of child characteristics, maternal characteristics and household characteristics with HAZ, WHZ and WAZ are shown in Table 4. Child age ($p = 0.002$) and sex ($p < 0.001$) was associated with child stunting. The factors associated wasting were child sex ($p = 0.001$) and number of under-five children in the household ($p = 0.001$). The factors contributing to child underweight were child sex ($p < 0.001$), maternal nutrition ($p = 0.001$) and household food insecurity ($p = 0.001$).

Maternal mental health and child nutritional status

Maternal mental health and child stunting

Child stunting was more common in the mothers with CMD (50.0%) than the mothers with no CMD (39.4%). This difference was not statistically significant ($p=0.085$, Table 5)

Maternal mental health and child wasting

About one-fourth mothers (25.4%) with CMD had wasted children whereas only 12% mothers with no CMD had wasted children which was statistically significant ($p=0.005$). Logistic regression was performed to determine the association of maternal CMD with wasting, after controlling for the other factors which showed significant association in bivariate analyses. The model contained three independent variables (maternal mental health, child sex and number of under-five children in the household). The final model was statistically significant ($p<0.001$). Mothers with CMD were about two times more likely to have wasted children than the mothers with no CMD after adjusting the effect of child sex and number of under-five children in the households (adjusted OR=2.25, 95% CI=1.15-4.43, Table 5)

Maternal mental health and child underweight

The underweight children were more common in mothers with CMD (45.1%) than in mothers with no CMD (23.9%). This difference was statistically significant ($p < 0.001$). Mothers with CMD had two and half times more chance to have underweight children than mothers with no CMD. (OR=2.61, 95% CI=1.54-4.41). Logistic regression was done to determine the independent association of maternal CMD with child underweight. The model contained four independent variables (maternal mental health, maternal nutritional status, child sex and household food security). The final model was statistically significant ($p<0.001$). Association between maternal CMD and child underweight disappeared after controlling for the effect of maternal nutrition, child sex and household food security (adjusted OR=1.77, 95% CI=0.94-3.33, Table 5).

Discussion

This study revealed maternal CMD as a considerable public health problem which was associated with child undernutrition. About half of the mothers (46.2%) were identified as suffering from CMD in this study. This result is almost similar (49%) to a previous study carried out in Bangladesh ([Nguyen et al., 2014](#)). Although maternal CMD is very common in developing countries, its prevalence differs from country to country- Vietnam 31.2%; Ethiopia 39.4% ([Nguyen et al., 2014](#)); Peru 30% and India 30.0% ([Harpham et al., 2005](#)). The high prevalence of maternal CMD in developing countries might be due to lower socioeconomic condition, food insecurity, being younger, being illiterate, undernutrition, unsupportive partner and experiencing physical violence ([Fisher et al., 2012](#); [Nguyen et al., 2014](#)).

Childcare practices are identified as key underlying cause for child malnutrition. Mental health of caregiver is one of the components which affects child care practice, stated in UNICEF care model ([World Health Organization, 2004](#)). Several studies have revealed that maternal mental health adversely affects child feeding practices resulting in malnutrition ([Harpham et al., 2005](#); [Nguyen et al., 2014](#)). In the present

study, childcare practices were measured in three domains – feeding practice, hygiene practice and preventive care service use. Maternal mental health was found associated with all three domains. Maternal CMD could prevent them from taking proper care of their children especially infant feeding, improper food preparation and child care regarding immunization, and therefore it constitutes a risk factor for impairment of the nutritional status of the children ([Rahman, Iqbal, Bunn, Lovel, & Harrington, 2004](#); [R. C. Stewart, 2007](#)).

This study found association of child feeding practice with wasting and underweight. A study conducted in Latin America has also found association between child feeding practice and nutritional status ([Ruel & Menon, 2002](#)). The important factors of hygiene practice are social, lifestyle, and environmental factors which are indirectly associated with mental health of family members ([Sherriff & Golding, 2002](#)). A significant relationship was observed between hygiene practice and child stunting and wasting. A similar finding was observed in our analysis of the relationship between individual hygiene and child nutrition ([Ruel & Menon, 2002](#)). It might be because of inadequate hygiene practices increase the risk of infection among the children especially diarrhea, helminth infection and other gastrointestinal symptoms ([Aiello & Larson, 2002](#)). Harpham et al. have also described a pathway showing how maternal common mental disorder affects child nutrition through breast feeding, child immunization and child physical health ([Harpham et al., 2005](#)).

Association between maternal CMD and child illness was examined in this study. Diarrheal disease was significantly associated with maternal CMD. To our knowledge, few studies examined the association between maternal mental health and child illness ([Humphreys, Araya, Cruchet, Espinoza, & Brunser, 1996](#); [Nguyen et al., 2014](#); [Rahman, Bunn, Lovel, & Creed, 2007](#)). Association between maternal CMD and diarrhea can be explained by maternal poor mental health affects the ability of the mothers to take of their personal hygiene which translates into diarrheal diseases among children. These findings suggest that a potential pathway for the relationship between maternal poor mental health and child undernutrition could be through child illness. Poor mental health may hinder the mother's ability to take adequate care of her child, prevent illness and seek health care when the child is ill.

Out of 264 children, 44.3% were stunted, 18.2% were wasted and 33.7% were underweight. These findings are consistent with the national data where prevalence of stunting, wasting and underweight are 41%, 16% and 36%, respectively ([NIPORT et al., 2012](#)). Evidence of association between maternal CMD and poor nutritional status in urban population of Bangladesh in this study, confirmed previous evidence from some other countries ([Harpham et al., 2005](#); [Medhin et al., 2010](#); [Nguyen et al., 2014](#); [Robert C Stewart et al., 2008](#)). After controlling for the effects of the confounders, significant association was found between maternal CMD and child wasting. Association was found with underweight in bivariate analysis, but it disappeared in multivariate analysis suggesting that other factors might be more important, or so tightly correlated with maternal mental health that the independent effects cannot be disentangled in this model. Surprisingly, there was no association between maternal CMD and stunting which is hard to explain. Stunting is a condition which reflects the cumulative effects of chronic malnutrition while wasting is a condition which reflect acute or recent nutritional deficit. Underweight reflects the combination of acute

and chronic malnutrition. SRQ-20, used to assess maternal mental health is based on some symptoms in previous 30 days. Therefore, association of maternal CMD with wasting which was found in this study is justifiable. But this result is inconsistent with the result of Harpham et al. and Nguyen et al. Maternal CMD is associated with child stunting in India and with child underweight in Vietnam (Harpham et al., 2005). A study conducted in Bangladesh found maternal CMD was associated with stunting, but no association with wasting and underweight (Nguyen et al., 2014). The variability of findings may be explained by sociocultural differences in care and feeding practices, difference in maternal education, socioeconomic status, household food security and other factors. This heterogeneity in the results is particularly interesting and needs to be further analyzed to fully understand this relationship.

Despite all effort there were some limitations in this study. First, the study was conducted in a selected urban area. Therefore, the study result might not necessarily have external validity. Second, SRQ-20 is a screening tool to assess mental health, not a diagnostic one. Therefore, the number of mothers, identified as CMD, might differ from the actual number. Third, data were collected based on maternal recall of their mental distress in the past four weeks prior to the interview. Maternal recall can result in either under- or over-reporting. Forth, the association of childcare practice with maternal mental health and child nutritional status was investigated by bivariate analysis. The logistic regression model was not used to address this. Last, as it was a cross sectional study, causal relationship between maternal mental health and child nutrition was not established. The potential reverse causality cannot be ruled out as poor child health is a contributor to maternal CMD, and this may be especially true when children are acutely undernourished rather than chronically moderately undernourished. This in turn may impede the ability of mother to take adequate care of the child.

The study result may contribute to understand the importance of maternal mental health as a public health problem and its potential pathways to cause child malnutrition. It is the time to invest to fully understanding risk factors for CMD and developing evidence-based mental health interventions to improve maternal mental health. Maternal mental health components need to be incorporated in child nutrition program to improve child nutritional status.

Declarations

Ethical approval

Ethical approval was obtained from the ethical committee of National Institute of Preventive and Social Medicine (NIPSOM), Bangladesh.

Conflicts of interest The authors declare that they have no competing interests.

Consent to participate Informed written consent was taken from each participant.

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Tables

Table 1 Socio-demographic characteristic of the respondents

Socio-demographic characteristics	N (%)
Age of the children in months	
<6	25 (9.5)
6-11	12 (4.5)
12-23	68 (25.8)
24-35	83 (31.4)
36 and above	76 (28.8)
Sex of the children	
Male	122 (46.2)
Female	142 (53.8)
Age of the mothers in years	
<20	30 (11.4)
20-24	101 (38.3)
25-29	66 (25.0)
30-34	39 (14.8)
≥35	28 (10.5)
Mean ± SD	25.30 ± 5.65
Educational status of the mothers	
Illiterate	72 (27.3)
Primary	108 (40.9)
Class 6-8	56 (21.2)
Class 9-10	26 (9.8)
Class 11-12	2 (0.8)
Occupation of the mothers	
Housewife	237 (89.8)
Working	27 (10.2)
Socioeconomic class	
Lower	170 (64.4)
Lower middle	75 (28.4)
Upper middle	19 (7.2)
Household food security	
Food secure	34 (12.9)
Mildly food insecure access	63 (23.9)
Moderately food insecure access	139 (52.7)
Severely food insecure access	28 (10.6)
Monthly family income in BDT	
Up to 6500	51 (19.3)
6501 - 13000	157 (59.5)
13000 and above	56 (21.2)
Mean ± SD	10595 ± 5234
Family type	
Single	219 (83.0)
Extended	45 (17.0)
Family size	
Small	157 (59.5)
Medium	78 (29.5)
Large	29 (11.0)
Number of under five children	
One child	230 (87.1)
More than one	34 (12.9)

Table 2 Maternal mental health, childcare practices and child illness

Childcare practices	Statistics	<i>p</i>
Child feeding practice		
Good: No maternal CMD vs maternal CMD, N (%)	59 (41.5) vs 9 (7.4)	<0.001 ^a
Average: No maternal CMD vs maternal CMD, N (%)	66 (46.5) vs 62 (50.8)	
Poor: No maternal CMD vs maternal CMD, N (%)	17 (12.0) vs 51 (41.8)	
Hygiene practice		
Child hygiene: No maternal CMD vs Maternal CMD, Mean±SD	3.42 ± 0.85 vs 2.57 ± 1.02	<0.001 ^b
Mother's hygiene: No maternal CMD vs maternal CMD, Mean±SD	3.77 ± 0.55 vs 3.30 ± 0.79	<0.001 ^b
Preventive care service use		
No maternal CMD vs maternal CMD, Mean±SD	-1.08 ± 0.50 vs -1.24 ± 0.53	0.016 ^b
Child illness		
Diarrhea: No maternal CMD vs maternal CMD, N (%)	22 (38.6) vs 43 (54.4)	0.049 ^a
ARI: No maternal CMD vs maternal CMD, N (%)	4 (7.1) vs 9 (11.4)	0.410 ^a

^a χ^2 test; ^b Mann-Whitney U Test

Table 3 Childcare practice, child illness and nutritional status

Childcare practice	HAZ			WHZ			WAZ		
	Normal (147)	Stunting (117)	<i>p</i>	Normal (216)	Wasting (48)	<i>p</i>	Normal (175)	Underweight (89)	<i>p</i>
	N (%)	N (%)		N (%)	N (%)		N (%)	N (%)	
Child feeding practice									
Good	44 (64.7)	24 (35.3)	0.079 ^a	63 (92.6)	5 (7.4)	0.004 ^a	61 (89.7)	7 (10.3)	<0.001 ^a
Average	72 (56.2)	56 (43.8)		105 (82.0)	23 (18.0)		82 (64.1)	46 (35.9)	
Poor	31 (45.6)	37 (54.4)		48 (70.6)	20 (29.2)		32 (47.1)	36 (52.9)	
Child's hygiene practice	rho = 0.158		0.010 ^b	rho = 0.102		0.098 ^b	rho = 0.167		0.006 ^b
Mother's hygiene practice	rho = 0.132		0.032 ^b	rho = 0.097		0.117 ^b	rho = 0.124		0.045 ^b
Preventive care service use	rho = -0.026		0.673 ^b	rho = -0.017		0.781 ^b	rho = -0.042		0.496 ^b
Diarrhoea									
No	48 (67.6)	23 (32.4)	0.019 ^a	59 (83.1)	12 (16.9)	0.266 ^a	51 (71.8)	20 (28.8)	0.046 ^a
Yes	31 (47.7)	34 (52.3)		49 (75.4)	16 (24.6)		36 (55.5)	29 (44.6)	
ARI									
No	72 (59.0)	50 (41.0)	0.797 ^a	99 (81.1)	23 (18.9)	0.097 ^c	79 (64.8)	43 (35.2)	0.437 ^a
Yes	6 (46.2)	7 (53.8)		8 (61.5)	5 (38.5)		7 (53.8)	6 (46.2)	

^a χ^2 test; ^b Spearman correlation; ^c Fisher's Exact Test

Table 4 Socio-demographic characteristics and child nutrition

Characteristics	HAZ			WHZ			WAZ		
	Normal (147)	Stunting (117)	p^a	Normal (216)	Wasting (48)	p^a	Normal (175)	Under weight (89)	p^a
	N (%)	N (%)		N (%)	N (%)		N (%)	N (%)	
Age of the mother in years									
<20	16 (53.3)	14 (46.7)	0.490	24 (80.0)	6 (20.0)	0.284	19 (63.3)	11 (36.7)	0.369
20-24	50 (49.5)	51 (50.5)		82 (82.2)	19 (18.8)		62 (61.4)	39 (38.6)	
25-29	40 (60.6)	26 (39.4)		51 (77.3)	15 (22.7)		47 (71.2)	19 (28.8)	
30-34	25 (64.1)	14 (35.9)		32 (82.1)	7 (17.9)		30 (76.9)	9 (23.1)	
≥35	16 (57.1)	12 (42.9)		27 (96.4)	1 (3.6)		17 (60.7)	11 (39.3)	
Educational status of mother									
Illiterate	42 (58.3)	30 (41.7)	0.890	61 (84.7)	11 (15.3)	0.111	49 (68.1)	23 (31.9)	0.970
Primary	61 (56.5)	47 (43.5)		84 (77.8)	24 (22.2)		71 (65.7)	37 (34.3)	
Class 6-8	29 (51.8)	27 (48.2)		44 (78.6)	12 (21.4)		36 (64.3)	20 (35.7)	
≥Class 9	15 (53.6)	13 (46.4)		27 (96.4)	1 (3.6)		19 (67.9)	9 (32.1)	
Occupation of mother									
Housewife	134 (56.5)	103 (43.5)	0.406	191 (80.6)	46 (19.4)	0.126	159 (67.1)	78 (32.9)	0.415
Working	13 (48.1)	14 (51.9)		25 (92.6)	2 (7.4)		16 (59.3)	11 (40.7)	
Nutritional status of mother									
Normal	121 (58.5)	86 (41.5)	0.084	174 (84.1)	33 (15.9)	0.072	148 (71.5)	59 (28.5)	0.001
Underweight	26 (45.6)	31 (54.4)		42 (73.7)	15 (26.3)		27 (47.4)	30 (52.6)	
Child sex									
Male	90 (73.8)	32 (26.2)	<0.001	110 (90.2)	12 (9.8)	0.001	105 (86.1)	17 (13.9)	<0.001
Female	57 (40.1)	85 (59.9)		106 (74.6)	36 (25.4)		70 (49.3)	72 (50.7)	
Age of the children in months									
<6	22 (88.0)	3 (12.0)	0.002	18 (72.0)	7 (28.0)	0.173 ^b	21 (84.0)	4 (16.0)	0.290
6-11	8 (66.7)	4 (33.3)		8 (66.7)	4 (33.3)		8 (66.7)	4 (33.3)	
12-23	31 (45.6)	37 (54.4)		54 (79.4)	14 (20.6)		41 (60.3)	27 (39.7)	
24-35	40 (48.2)	43 (51.8)		73 (88.0)	10 (12.0)		53 (63.9)	30 (36.1)	
≥36	46 (60.5)	30 (39.5)		63 (82.9)	13 (17.1)		52 (68.4)	24 (31.6)	
Socioeconomic status									
Lower	92 (54.1)	78 (45.9)	0.711	140 (82.4)	30 (17.6)	0.527	109 (64.1)	61 (35.9)	0.403
Lower middle	43 (57.3)	32 (42.7)		59 (78.7)	16 (21.3)		51 (68.0)	24 (32.0)	
Upper middle	12 (63.2)	7 (36.8)		17 (89.5)	2 (10.5)		15 (78.9)	4 (21.1)	

Household food security									
Food secure	22 (64.7)	12 (35.3)	0.635	31 (91.2)	3 (8.8)	0.113	29 (85.3)	5 (14.7)	0.001
Mildly food insecure	36 (57.1)	27 (42.9)		55 (87.3)	8 (12.7)		50 (79.4)	13 (20.6)	
Moderately food insecure	75 (54.0)	64 (46.0)		110 (79.1)	29 (20.9)		82 (59.0)	57 (41.0)	
Severely food insecure	14 (50.0)	14 (50.0)		20 (71.4)	8 (28.6)		14 (50.0)	14 (50.0)	
Family type									
Nuclear family	122 (55.7)	97 (44.3)	0.985	181 (82.6)	38 (17.4)	0.595	146 (66.7)	73 (33.3)	0.774
Joint family	25 (55.6)	20 (44.4)		35 (77.8)	10 (22.2)		29 (64.4)	16 (35.6)	
Family size									
Small	85 (54.1)	72 (45.9)	0.827	133 (84.7)	24 (15.3)	0.323	103 (65.6)	54 (34.4)	0.754
Medium	45 (57.7)	33 (42.3)		61 (78.2)	17 (21.8)		54 (69.2)	24 (30.8)	
Large	17 (58.6)	12 (41.4)		22 (75.9)	7 (24.1)		18 (62.1)	11 (37.9)	
No. of under five children									
One child	133 (57.8)	97 (42.2)	0.068	195 (84.8)	35 (15.2)	0.001	157 (68.3)	73 (31.7)	0.078
More than one	14 (42.2)	20 (58.8)		21 (61.8)	13 (38.2)		18 (52.9)	16 (47.1)	

^a χ^2 test

^b Fisher's Exact Test

Table 5 Maternal mental health and child nutritional status

Maternal mental health	HAZ		WHZ		WAZ	
	Normal (147)	Stunting (117)	Normal (216)	Wasting (48)	Normal (175)	Underweight (89)
	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
No CMD ^a	86 (60.6)	56 (39.4)	125 (88.0)	17 (12.0)	108 (76.1)	34 (23.9)
CMD	61 (50.0)	61 (50.0)	91 (74.6)	31 (25.4)	67 (54.9)	55 (45.1)
Crude OR (95% CI)	1.54 (0.94-2.51)		2.51 (1.31-4.80)		2.61 (1.54-4.41)	
p-value	0.085		0.005		<0.001	
Adjusted OR (95% CI)	1.46 (0.84-2.54) ^b		2.25 (1.15-4.43) ^c		1.77 (0.94-3.33) ^d	

^a Reference

^b Adjusted for maternal age, child age and sex

^c Adjusted for child sex and number of under-5 children in household

^d Adjusted for maternal nutrition, child sex and household food security

Figures

Figure 1

Conceptual framework