



The Open Public Health Journal

Content list available at: <https://openpublichealthjournal.com>



RESEARCH ARTICLE

Association of Maternal Common Mental Disorder and Young Children Acute Malnutrition among Mekelle Public Health Facilities, Northern Ethiopia, 2019 - a Case-control Study

Firaol Mesfin Ayele^{1*}, Workua Mekonnen Metekya¹ and Kenfe Tesfay¹

¹Department of Psychiatry, Mekelle University-Collage of Health Science, Mekelle, Ethiopia.

Abstract:

Background:

The World Health Organization has claimed that morbidity and disability of the global population due to child malnutrition has internationally become the chief cause of disability. However, in our country, its association with a young child's nutritional outcomes is rarely studied.

Objectives:

To assess the effect of maternal common mental disorder and substance abuse on young child acute malnutrition.

Methods:

An institution's based case-control study was conducted among 192 women; 64 cases and 128 control in Mekelle public health facilities. Two hospitals and three health centers were included in this study. Self-Reporting Questionnaire 20-Item (SRQ-20) was used to assess the presence of maternal common mental disorder. Bivariate and multivariable logistic regression analysis was performed. The strength of association was measured through odds ratio at their 95% CI. The statistical significance was set at $p < 0.05$.

Results:

The result of this study revealed that young children who have a mother with a common mental disorder are 6.1 times [AOR= 6.11, 95%CI (1.18, 31.71)] more likely to develop acute malnutrition than children who have mothers with no common mental disorder. Mothers of acutely malnourished children should be evaluated early for the detection of maternal common mental disorder for appropriate referral and support.

Conclusion:

Maternal common mental disorder was an independent determinant of young children's acute malnutrition. Mothers of acutely malnourished children should be evaluated early for the detection of maternal common mental disorder for appropriate referral and support.

Keywords: Acute malnutrition, Maternal common mental disorder, Young children, Nourishment, Protein, Low and middle income countries.

Article History

Received: June 25, 2020

Revised: August 23, 2020

Accepted: September 12, 2020

1. INTRODUCTION

Malnutrition can be well-defined as a state of nourishment in which insufficiency or excess of energy, protein, and other nutrients causes measurable adverse effects. Malnutrition can be of the acute, chronic, or mixed type [1]. Malnutrition has been labeled as the disparity among intake and requirement which marks in altered metabolism, reduced function, and loss

of body mass or else as a state of nutrition in which a deficiency or imbalance of energy, protein, and other nutrients grounds measurable contrary effects on tissue and/or body form [2, 3].

Acute malnutrition is an extremely severe disorder. It is associated with high rates of morbidity and mortality. Approximately 1-2% of the under-five population in low-income countries are affected by severe acute malnutrition, which may be responsible for about 1 million child deaths every year. In sub-Saharan Africa, nearly 1 in 10 children under the age of five were wasted. More than 80 percent of the

* Address correspondence to this author at Department of Psychiatry, Mekelle University-Collage of Health Science, Mekelle, Ethiopia;
E-mails: firaol.mesfin@mu.edu.et or firaolmesfin8@gmail.com

2 million children treated for acute malnutrition were found in sub-Saharan Africa [4].

Acute malnutrition is a consequence of sudden decreases in food consumption or food quality and is often combined with pathological causes. Acute malnutrition has been defined in numerous names with somewhat overlapping definitions, including protein-energy malnutrition, wasting, kwashiorkor, and marasmus [5]. Common mental disorders include depression, anxiety, and somatic symptoms. These symptoms are reported to occur with more frequency among women than men, especially in low and low-middle income countries, and may compromise early child development [6, 7]. Poor maternal mental health has adverse social, economic, and psychological consequences for the individuals, their children, their families, and the community [8]. Maternal common mental disorder (CMD) is identified to be a significant health problem in low and middle-income countries. In a study from low-income and middle-income countries, maternal CMD affected 15.6% of women during the perinatal period and 19.8% during the postnatal period [8 - 11].

Maternal common mental disorder (CMD) is identified to be a significant health problem in low-and-middle-income countries. A study from low-income and middle-income countries reported that maternal CMD affected 15.6% of women during the perinatal period and 19.8% of women during the postnatal period. Evidence is mounting up from middle-income and low-income countries that the children of mothers with CMD have less optimal growth, cognitive, and language development, even when taking social adversity into account. This association is mediated through disruption of mother-child interactions as has been seen in high-income countries setting [9 - 13].

The mother's mental state as a risk factor for the infant's physical health in developing countries has received little attention. In Kingston, Jamaica found evidence of poor psychosocial functioning in mothers of hospital-referred malnourished children. These mothers had more chronically disrupted lives, unsupportive partners, and fewer social contacts [14].

International and regional estimates on child under-nourishment exposed that we are still distant from a world with no malnutrition. The shared estimates, available in May 2018, cover up an indicator of wasting among kids below the age of five and disclose inadequate steps forward to reach the World Health Assembly/ WHA targets set for 2025 and the nutritional outcome. Hence, it is mandatory to conduct a customized study to solve this issue. Besides, it creates a chance for more and more studies to be explored in this aspect.

This study was intended to investigate the association between young children's nutritional status and maternal CMD by conducting an unmatched case-control study to examine differences in maternal mental health issues in mothers with young children hospitalized for severe acute malnutrition and mothers with young children hospitalized for other health problems. According to the results, the investigator hypothesized that toddlers exposed to high symptoms of maternal CMD would have poorer nutritional status.

1.1. Significance of the Study

Acute malnutrition is the adverse outcome of young children in this research. These conditions contribute to a higher rate of mortality and morbidity in the children. The United Nations assembly had launched sustainable development goals with much emphasis to decrease infant's and young child's morbidity and mortality in 2015 due to such deadly outcomes. Hence, the importance of conducting a study to assess different factors that hide behind the scene is not a controversial issue.

Decrement of infant and young children's morbidity and mortality is one of the global agendas contained in SDG. This alarms researchers to investigate the factors that can contribute to such a condition whose overall result is highly significant for the policymakers and stakeholders to plan new approaches.

Different maternal physical health-related factors have been relatively investigated widely at the national level in a better manner as compared to maternal mental health; although it is highly important for the physical and psychological well-being of the mother as well as the infants.

It is important to carry out a study on different aspects of women's health to provide certain guidance to Midwives, Gynecologists, and other health care providers who care for pregnant women at the prenatal and postnatal unit to assure comprehensive physical and emotional support.

To provide psychological and social intervention to pregnant women and mothers, studies that assess the mental health well-being of the mother are important.

To clarify this issue, the objective of the present study is to examine whether maternal mental health is associated with a child's nutritional status in the sixth month of life.

2. MATERIALS AND METHODS

2.1. Study Design and Sample Size Determination

This study was conducted in public health facilities (2 hospitals and 3 health centers) of Mekelle Special zone, Tigray regional state, northern Ethiopia, in 2018/19. Mekelle is the capital city of Tigray Regional State located at about 783 km away north of Addis Ababa, Capital city of the Federal Democratic Republic of Ethiopia at geographical coordination of 39°28' East longitude and 13°32' North latitude. This study was conducted from March 10, 2019, to June 10, 2019.

An institution-based case-control study was employed in Mekelle public health facilities. Subjects were selected using a consecutive sampling technique. The source population was all mothers with young children visiting Mekelle public health institutions during the study period.

2.2. Study Population

Case: Young child's having acute malnutrition

Control: Young children having a normal nutritional status

2.3. Operational Definitions

Some words may be confusing, to avoid this, for this

research we have used the following definitions

(1) WHO - ASSIST V3.0- A probable case of substance use problem (abuse or dependence) in this study is defined as a score of 0-3, 4-26 and 27+ was low, moderate, and high consecutively for Tobacco, cannabis, and Amphetamine. But a score of 0-10, 11-26 and 27+ was low, moderate and high consecutively for Alcohol.

(2) Common mental disorders: A score of seven or more in SRQ-20 in the past 4 weeks was considered as having common mental disorders.

(3) Acute malnutrition (SAM): a Mid Upper Arm Circumference (MUAC) < 125 mm or presence of nutritional bilateral pitting edema.

(4) ARI - ARI was defined as the presence of cough/cold with fever and/or fast breathing.

(5) Diarrhea - Diarrhea was defined as three or more loose stools passed in a 24-h period.

(6) Food insecurity - The households were categorized into four groups: food secure, mildly food insecure, moderately food insecure, and severely food insecure. These categories were further categorized into two groups of households: food secure and food insecure (which included the mildly, moderately, and severely food-insecure groups).

2.4. Inclusion Criteria

Case: During the study, young children were considered for the study as if they are aged 12 to 23 months and their mothers were the primary caregiver of the child during the visit. Cases had acute malnutrition as defined in the World Health Organization (WHO) child growth standard measurements.

Control: Inclusion criteria for controls are having a visit to Mekelle public health facilities for other health problems but having normal nutritional status during the study period.

2.5. Exclusion Criteria

Case: The exclusion criterion for cases was if the child is aged below 12 and above 23 months, their mothers were not the primary caregiver of the child during the visit and if the mother experienced any loss (death, divorce, etc.) in the past two months.

Control: Young children with MUAC score of greater than 16.5.

2.6. Data Collection Instruments

In the socio-demographic section, we have collected information about family income, maternal age, education, and occupation including spouses' maternal control over finances. Children were considered to be malnourished if they had a

MUAC of less than 125 mm according to WHO growth standard measurements [1].

Maternal CMD was measured using the WHO recommended screening tool called the Self Reporting Questionnaire-20 (SRQ-20) that includes twenty questions with a recall period of 30 d before the administration of the questionnaire. The SRQ-20 measures several symptoms of depression, including headache, poor appetite, sleep disturbance, depressed mood, unhappiness, helplessness, and psychomotor retardation. Each question is given a score of 0 or 1 depending on the 'no' or 'yes' response, respectively. The scores are added to generate an overall SRQ-20 scale, where higher scores indicate higher levels of maternal CMD and vice versa. This tool is reliable, valid, and adaptable for screening mental disorders in the developing world [15] including Ethiopia. We used a cut-off of 7 to classify women with CMD, as suggested by several validation studies. In this study, the Cronbach's Alpha is 0.89.

Household food security was measured using the Household Food Insecurity Access Scale of the Food and Nutrition Technical Assistance Project/US Agency for International Development, which provides information on behavior and perceptions related to household food insecurity – anxiety and uncertainty, insufficient quality of intake, insufficient food intake and its consequences. All the questions were asked for a reference period of 30 days preceding the survey. The households were categorized into four groups: food secure, mildly food insecure, moderately food insecure, and severely food insecure. These categories were collapsed into two groups of households: food secure and food insecure (which included the mildly, moderately, and severely food-insecure groups) [16]. In this study, the Cronbach's Alpha is 0.92.

We have used the WHO - ASSIST V3.0 Alcohol smoking and substance involvement screening test scale to measure substance abuse.

The questionnaire was developed in English and translated into Tigrigna and then back to English to check for its consistency. The data collectors were senior Nurses, midwives, Public Health officers, and General Practitioners with a qualification of BSc degree and above.

2.7. Sample Size Determination and Sampling Procedure

The sample size is estimated using the double population proportion formula by considering: 95% confidence interval, 80% power, and a 1:2 ratio of case and control groups. By considering these assumptions, the final sample size is estimated based on the proportion of similar studies done in an urban slum area of Dhaka, Bangladesh [17]. The estimation is done by using Epi-info version-7 software. The largest sample size of the estimate was used for this study. Therefore, the final sample size to be used is 62 Cases and 127 Controls (Table 1).

Table 1. Sample size determination for the study.

	Kelsey	Fleiss	Fleiss with CC
Sample Size –Cases	58	57	64

(Table 1) contd....

	Kelsey	Fleiss	Fleiss with CC
Sample Size – Controls	116	114	127
Total sample size:	174	171	191

Therefore, a total of 191 mothers were selected from the public health facilities of the city. Two hospitals and three health centers were included in this study. Then, the sample was proportionally allocated to each health facility based on the number of young children visiting for acute malnutrition in hospitals in similar months of last year and the number of young children visiting the facilities in other cases except malnutrition in similar months of last year. Then, all eligible data entry was done by using EPI- Info version 4.4.2.1 and transfers to SPSS version 21.0 statistical software for cleaning, coding, and analysis. OR, adjusted OR by logistic regression method and Chi-square (χ^2) test was used to test the statistical significance and causal relationship at a 5% significance level. Finally, those variables significant at 5% with the outcome variable were selected for multivariate analysis. Graphs and

tables were used to represent the data.

3. RESULTS

3.1. Socio-Demographic and Psychosocial Factors of the Mothers and Young

3.1.1. Children

A total of 192 subjects (64 cases and 128 controls) were identified in the study. The response rate was 100%. The mean age of the child among cases (15.28 months, SD = 3.21) and controls (16.32 months, SD = 3.39) was different. The gender distribution was 51.56% males and 49.21% females consecutively among the cases and controls. (Table 2).

Table 2. Characteristics of participating mothers and their young child's attending the under-five OPD of Mekelle Public Health Facilities, Mekelle, North Ethiopia, June 2019 (N=192).

Variable	Nutritional Status	
	Controls N (%)	Cases N (%)
Marital Status		
Single	2 (1.6%)	1 (1.6%)
Married	122 (95.3%)	60 (93.8%)
Divorced	3 (2.3%)	2 (3.1%)
Widowed	1 (0.8%)	1 (1.6%)
Mother's Education		
No schooling	11 (8.6%)	10 (15.6%)
Primary school	52 (40.6%)	27 (42.2%)
High school	32 (25.0%)	18 (28.1%)
Collage or higher	33 (25.8%)	9 (14.1%)
Father's Education		
No schooling	8 (6.3%)	14 (21.9%)
Primary school	24 (18.8%)	19 (29.7%)
High school	55 (43%)	15 (23.4%)
Collage or higher	41 (32.0%)	16 (25.0%)
Age of Mother		
18-24 Years	57 (44.5%)	33 (51.6%)
25-29 Years	42 (32.8%)	14 (21.9%)
30-39 Years	28 (21.9%)	15 (23.4%)
40 Years and Over	1 (0.8%)	2 (3.1%)
Mothers Occupation		
Un Employed	72 (56.3%)	38 (59.4%)
Employed	56 (43.8%)	26 (40.6%)
Mothers Control Over Family Finance		
Total	59 (46.1%)	24 (37.5%)
Partial	38 (29.7%)	20 (31.3%)
None	31 (24.2%)	20 (31.3%)
Family Monthly Income in ETH Birr		
Below Poverty Line	43 (33.6%)	35 (54.7%)
Above Poverty Line	85 (66.4%)	29 (45.3%)
Birth Interval of the Last Child		
Para-1	39 (30.5%)	17 (26.6%)
14-18 Months	35 (27.3%)	18 (28.1%)

(Table 2) contd.....

Variable	Nutritional Status	
18-24 Months	20 (15.6%)	9 (14.1%)
24-60 Months	30 (23.4%)	15 (23.4%)
60 Months and Over	4 (3.1%)	5 (7.8%)
Regular Maternal Antenatal Care		
Yes	126 (98.4%)	52 (81.3%)
No	2 (1.6%)	12 (18.8%)
Child Sex		
Male	63 (49.2%)	33 (51.6%)
Female	65 (50.8%)	31 (48.4%)
Child Illness During The Past Two Weeks		
Diarrhea	46 (35.9%)	28 (43.8%)
Fever	36 (28.1%)	15 (23.4%)
Cough	26 (20.3%)	16 (25.0%)
Other*	20 (15.6%)	5 (7.8%)
Maternal Common Mental Disorder		
No CMD	93 (72.7%)	28 (43.7%)
CMD	35 (27.3%)	36 (56.3%)
Maternal Alcohol Use		
Low Risk	51 (54.3%)	19 (42.2%)
Moderate Risk	36 (38.3%)	23 (51.1%)
High Risk	7 (7.4%)	3 (6.7%)
Household Food Insecurity Access		
Food Secure	88 (68.8%)	25 (39.1%)
Mildly Food Access Insecure	35 (27.3%)	22 (34.4%)
Moderately Food Access Insecure	5 (3.9%)	12 (18.8%)
Severely Food Access Insecure	--	5 (7.8%)

3.2. Maternal Common Mental Disorder

Maternal common mental disorder among mothers having a child with acute malnutrition was 36(56.3%) while among mothers having children with normal nutritional status was 35(27.3%).

3.3. Household Food Insecurity Access

Mildly, moderately and severely food insecure access of household mothers of acutely malnourished children was 22(34.4%), 12(18.8%), and 5(7.8%) consecutively. On the other hand, mildly and moderately food insecure access of mothers of children with normal nutritional status was 35 (27.3%) and 5 (3.9%), respectively.

3.4. Maternal Substance Abuse

The majority of mothers among cases (45 (70.3%)) and

controls (94 (73.4%)) had ever used alcohol in their lifetime. Almost one out of two mothers (23 (51.1%)) of a child with acute malnutrition has a moderate risk for alcohol abuse, on the other hand, mothers among controls had 36 (38.3%) moderate risk for alcohol abuse. The risk level of maternal tobacco use among mothers in cases and controls showed 3 (4.7%) and 1 (0.8%) moderate risks, respectively (Table 2).

3.5. Associated Factors with Young Child Acute Malnutrition

In the crude analysis (Table 3), mothers educational background, fathers educational background, regular antenatal care, maternal common mental disorder, household food insecurity access, and family monthly income were significantly associated with young children's acute malnutrition and were the variables selected to be included in the multiple linear regression models.

Table 3. Multivariate analysis of young child acute malnutrition among the young child's attending the under-five OPD of Mekelle Public Health Facilities, Mekelle, North Ethiopia, May 2019 (N=192).

Variables	Control N(%)	Case N (%)	AOR (CI)	P-Value
Mothers Educational Background				
No Schooling	11 (8.6%)	10 (15.6%)	.666 (.124, 3.59)	.636
Primary School	52 (40.6%)	27 (42.2%)	.235 (.053,1.032)	.055
High School	32 (25.0%)	18 (28.1%)	1.475 (.529,4.108)	.457
Collage and Higher	33 (25.8%)	9 (14.1%)	--	1
Fathers of Educational Background				

(Table 3) contd....

Variables	Control N(%)	Case N (%)	AOR (CI)	P-Value
No Schooling	8 (6.3%)	14 (21.9%)	4.677 (.898,24.37)	.067
Primary School	24 (18.8%)	19 (29.7%)	1.847 (.533, 6.40)	.333
High School	55 (43%)	15 (23.4%)	.769 (.305,1.937)	.577
Collage and Higher	41 (32.0%)	16 (25.0%)	--	1
Regular Maternal Antenatal Care				
Yes	126 (98.4%)	52 (81.3%)	--	1
No	2 (1.6%)	12 (18.8%)	6.80 (1.26,36.72)	.026*
Maternal Common Mental Disorder				
No CMD	93 (72.7%)	28 (43.8%)	--	1
CMD	35 (27.3%)	36 (56.3%)	6.111 (1.18,31.71)	.031*
Food Insecurity Access Scale				
Food secure	88(68.8%)	25(39.1%)	--	1
Food insecure	40(31.3%)	39(60.9%)	1.542 (.36, 6.58)	.559
Family Monthly income in ETH Birr				
Below Poverty Line	43(33.6%)	35(54.7%)	.585 (.220,1.560)	.284
Above the Poverty line	85(66.4%)	29(45.3%)	--	1

3.6. Bivariate and Multivariate Logistic Regression

All variables that had $p < 0.25$ in the bivariate analysis were included in multivariate analysis for entering logistic regression. From the total variables included in the logistic regression models, two variables were found to be statistically significant at the level of $p < 0.05$. Accordingly, maternal common mental disorder and maternal regular antenatal care of study participants mothers have demonstrated a statistically significant association with young children's acute malnutrition

As of this result, young children who have a mother with a common mental disorder are 6.1 times [AOR= 6.11, 95%CI (1.18, 31.71)] more likely to develop acute malnutrition than children who have mothers with no common mental disorder. Regarding regular antenatal care, children of mothers who have no regular antenatal care times are more likely to develop acute malnutrition than mothers who have regular antenatal care [AOR=6.80, 95%CI (1.26, 36.72)]. The association between being acutely malnourished young children and the remaining variables was not significant (Table 3).

4. DISCUSSION

This study showed that 56.3% with 95% CI (46.9, 68.8) of mothers of acutely malnourished cases had a common mental disorder (SRQ=7 and above), compared to only 27.3% with 95% CI [1, 9, 18] of controls. This is in line with the study done in Pakistan [19].

Our study shows that the presence of the maternal common mental disorder is strongly associated with the risk of children's acute malnutrition (less than 12.5 cm on anthropometric MUAC score) in 12-23 months of children. As of this result, young children who have a mother with a common mental disorder are 6.1 times [AOR= 6.1, 95%CI (1.2, 31.7)] more likely to develop acute malnutrition than children's who have mothers with no common mental disorder. This study is in line with the studies conducted in Pakistan and Vietnam [10].

Several prior studies in low-income countries such as Ethiopia, India (Andhra Pradesh), Peru, and Vietnam have shown inconsistent findings with this study. According to this

researches, the simple regression found a child's acute malnutrition to be associated with a maternal common mental disorder. However, they did not find evidence on the association of Maternal common mental disorder and children's acute malnutrition as an independent predictor in their multivariate analysis. This difference might be because of a difference in sample size and longitudinal nature of the prior studies [21 - 22].

In this study, maternal substance use did not show a significant association with the young child's acute malnutrition. This study contradicts a study conducted in Indonesia and southern Brazil [13, 23]. The possible reasons might be a cultural difference, the tool used to assess the maternal abuse, and the study setting.

On the other hand, based on crude analysis, having no formal schooling of mothers (COR=3.33 (95% CI=1.077, 10.318)), having no formal Schooling of fathers COR=4.484 (95% CI=1.580-12.728)), Household Food Insecurity (COR=3.432 (95% CI=1.835-6.418)) and family monthly income of below the poverty line (COR=2.386 (95%CI=1.291-4.407)) were significantly associated with young children's acute malnutrition. However, in this study, by controlling confounders in multivariate analysis maternal education and father's education did not show a significant association. This agrees with a study conducted in Ethiopia, India (Andhra Pradesh), Peru, and Vietnam. Household food insecurity and family monthly income below the poverty line were also found insignificant in multivariate analysis. This is in line with the above study [21].

Mother's attendance of regular antenatal care (COR=14.538 (95% CI= 3.144-67.236)) showed a significant association on crude analysis and remained associated with young child's acute malnutrition on multivariate analysis after controlling confounders (AOR=6.801 (95% CI = 1.2636.72)). This variable needs a further and detailed investigation.

CONCLUSION

In this study, the maternal common mental disorder was an independent determinant of young children's acute

malnutrition. However, maternal substance use did not show a significant association with child acute malnutrition.

RECOMMENDATION

For Ministry of Health: Ministry of Health should develop guidelines to screen and treat maternal common mental disorders among mothers visiting for child acute malnutrition. The findings might imply that mothers of an acutely malnourished child should be evaluated early for the detection of maternal common mental disorder for appropriate referral and support.

For Public Health Facilities: Public health facilities should screen mothers for the presence of maternal common mental disorder on each antenatal and postnatal visit and should give priority for close monitoring of the growth of children of mothers having common mental disorders. They should work on the increment of regular antenatal care of mothers to 100% by providing health education at health centers and home to home health extension program.

For researchers: There is a need for further studies not only focusing on acute malnutrition, but also on severe acute malnutrition and moderate acute malnutrition. Besides, further population-based studies of a longitudinal nature are required to clarify the precise nature of a potentially important association.

LIMITATIONS OF THE STUDY

This study has some limitations. The data was collected through face to face interview. Therefore, this study may have biases since some respondents may not answer truthfully, may not recall, or may not be comfortable to disclose sensitive information (i.e. Income, maternal control over family monthly income, and household food insecurity access, and maternal substance use).

LIST OF ABBREVIATIONS

AOR	=	Adjusted Odds Ratio
(CMD)	=	Maternal Common Mental Disorder
CI	=	Confidence Interval
COR	=	Crud Odd Ratio
MUAC	=	Mid Upper Arm Circumference;
SPSS	=	Statistical Package for Social Sciences;
SRQ-20	=	Self Reporting Questionnaire;
WHO	=	World Health Organization;

AUTHOR CONTRIBUTIONS

Firaol M designed the study, collected data, analyzed the data, and reviewed the manuscript. WorkuaM and Kinfe T designed the study, supervised data collection, analyzed the data, drafted the manuscript, and critically reviewed the manuscript. All authors read and approved the final manuscript.

ETHICAL APPROVAL AND CONSENT TO PARTICIPATE

This research was conducted after gaining ethical approval

from the Institutional Review Board of the College of Health Sciences, Mekelle University.

HUMAN AND ANIMAL RIGHTS

Not applicable.

CONSENT FOR PUBLICATION

The study was conducted with a written consent that assures the willingness of each subject to participate in the study.

AVAILABILITY OF DATA AND MATERIALS

The datasets used and analyzed during the current study are available from the corresponding author [F.M.A.] on reasonable request.

FUNDING

The research was conducted by financial funding from Mekelle University with grant number 2325.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest in this work.

ACKNOWLEDGEMENTS

First and foremost, we would like to express our deepest gratitude to Mekelle University college of health science for giving us the chance to do this research including funding. Last but not the least; we would like to thank the mothers who participated in this study and to Health Management information system Offices of Mekelle city Health facilities which gave adequate data during the process of this work.

REFERENCES

- [1] Joosten KF, Hulst JM. Prevalence of malnutrition in pediatric hospital patients. *Curr Opin Pediatr* 2008; 20(5): 590-6. [<http://dx.doi.org/10.1097/MOP.0b013e32830c6ede>] [PMID: 18781124]
- [2] Kinoshian B, Jeejeebhoy KN. What is malnutrition? Does it matter? *Nutrition* 1995; 11(2)(Suppl.): 196-7. [PMID: 7626900]
- [3] Lochs H, Allison SP, Meier R, *et al.* Introductory to the ESPEN Guidelines on Enteral Nutrition: Terminology, definitions and general topics. *Clin Nutr* 2006; 25(2): 180-6. [<http://dx.doi.org/10.1016/j.clnu.2006.02.007>] [PMID: 16697086]
- [4] Seid A, Seyoum B, Mesfin F. Determinants of acute malnutrition among children aged 6–59 months in Public Health Facilities of Pastoralist Community, Afar Region, Northeast Ethiopia: a case-control study. *J Nutr Metab* 2017; 20177265972 [<http://dx.doi.org/10.1155/2017/7265972>] [PMID: 29057119]
- [5] Myatt M, Duffield A, Seal A, Pasteur F. The effect of body shape on weight-for-height and mid-upper arm circumference based case definitions of acute malnutrition in Ethiopian children. *Annals of Human Biology*. 2009 Jan 1;36(1):5-20. *Sirc G. Gender and. Freshm English News* 1989; 18(1): 4-11.
- [6] World Health Organization. Maternal mental health and child health and development in low and middle-income countries: report of the meeting, Geneva, Switzerland, 30 January 1 February 2008.
- [7] Fisher J, Cabral de Mello M, Patel V, *et al.* Prevalence and determinants of common perinatal mental disorders in women in low- and lower-middle-income countries: a systematic review. *Bull World Health Organ* 2012; 90(2): 139G-49G. [<http://dx.doi.org/10.2471/BLT.11.091850>] [PMID: 22423165]
- [8] Black MM, Baqui AH, Zaman K, El Arifeen S, Black RE. Maternal

- depressive symptoms and infant growth in rural Bangladesh. *Am J Clin Nutr* 2009; 89(3): 951S-7S.
[<http://dx.doi.org/10.3945/ajcn.2008.26692E>] [PMID: 19176729]
- [9] Cooper PJ, Tomlinson M, Swartz L, *et al.* Improving quality of mother-infant relationship and infant attachment in socioeconomically deprived community in South Africa: randomised controlled trial. *BMJ* 2009; 338: b974.
[<http://dx.doi.org/10.1136/bmj.b974>] [PMID: 19366752]
- [10] Servili C, Medhin G, Hanlon C, *et al.* Maternal common mental disorders and infant development in Ethiopia: the P-MaMiE Birth Cohort. *BMC Public Health* 2010; 10(1): 693.
[<http://dx.doi.org/10.1186/1471-2458-10-693>] [PMID: 21073710]
- [11] Ferri CP, Mitsuhiro SS, Barros MC, *et al.* The impact of maternal experience of violence and common mental disorders on neonatal outcomes: a survey of adolescent mothers in Sao Paulo, Brazil. *BMC Public Health* 2007; 7(1): 209.
[<http://dx.doi.org/10.1186/1471-2458-7-209>] [PMID: 17705835]
- [12] Murray L, Fiori-Cowley A, Hooper R, Cooper P. The impact of postnatal depression and associated adversity on early mother-infant interactions and later infant outcome. *Child Dev* 1996; 67(5): 2512-26.
[<http://dx.doi.org/10.2307/1131637>] [PMID: 9022253]
- [13] Best CM, Sun K, de Pee S, Sari M, Bloem MW, Semba RD. Paternal smoking and increased risk of child malnutrition among families in rural Indonesia. *Tob Control* 2008; 17(1): 38-45.
[<http://dx.doi.org/10.1136/tc.2007.020875>] [PMID: 18218806]
- [14] World Health Organization. WHO child growth standards: length/height-for-age, weight-for-age, weight-for-length, weight-for-height and body mass index-for-age: methods and development
- [15] Hanlon C, Medhin G, Alem A, *et al.* Detecting perinatal common mental disorders in Ethiopia: validation of the self-reporting questionnaire and Edinburgh Postnatal Depression Scale. *J Affect Disord* 2008; 108(3): 251-62.
[<http://dx.doi.org/10.1016/j.jad.2007.10.023>] [PMID: 18055019]
- [16] Coates J, Swindale A, Bilinsky P. Household Food Insecurity Access Scale (HFIAS) for measurement of food access: indicator guide: version 3
- [17] Khan AM, Flora MS. Maternal common mental disorders and associated factors: a cross-sectional study in an urban slum area of Dhaka, Bangladesh. *Int J Ment Health Syst* 2017; 11(1): 23.
[<http://dx.doi.org/10.1186/s13033-017-0129-3>] [PMID: 28293284]
- [18] Grace SL, Evindar A, Stewart DE. The effect of postpartum depression on child cognitive development and behavior: a review and critical analysis of the literature. *Arch Women Ment Health* 2003; 6(4): 263-74.
[<http://dx.doi.org/10.1007/s00737-003-0024-6>] [PMID: 14628179]
- [19] Rahman A, Lovel H, Bunn J, Iqbal Z, Harrington R. Mothers' mental health and infant growth: a case-control study from Rawalpindi, Pakistan. *Child Care Health Dev* 2004; 30(1): 21-7.
[<http://dx.doi.org/10.1111/j.1365-2214.2004.00382.x>] [PMID: 14678308]
- [20] Nguyen PH, Saha KK, Ali D, *et al.* Maternal mental health is associated with child undernutrition and illness in Bangladesh, Vietnam and Ethiopia. *Public Health Nutr* 2014; 17(6): 1318-27.
[<http://dx.doi.org/10.1017/S1368980013001043>] [PMID: 23642497]
- [21] Hazarika A. The Effect of Maternal Education and Maternal Mental Health on Child's Growth Education and Maternal Mental MSc in Global Health Science Department of Public Health and Primary Health Care 2010.
- [22] Santos DS, Santos DN, Silva RdeC, Hasselmann MH, Barreto ML. Maternal common mental disorders and malnutrition in children: a case-control study. *Soc Psychiatry Psychiatr Epidemiol* 2011; 46(7): 543-8.
[<http://dx.doi.org/10.1007/s00127-010-0220-4>] [PMID: 20401464]
- [23] Hassan BK, Werneck GL, Hasselmann MH. Maternal mental health and nutritional status of six-month-old infants. *Rev Saude Publica* 2016; 50: 7.
[<http://dx.doi.org/10.1590/S1518-8787.2016050006237>] [PMID: 27007683]