Impact of maternal depression and social factors on child's nutritional status: a case–control study in Egypt

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Background
Malnutrition is a primary cause of child morbidity. Maternal depression affects children's health, especially nutrition.
Aim
This study aimed to explore the effects of maternal depression and social factors on children's nutrition.
Patients and methods
A case–control study was carried out on 100 children and their mothers: 50 malnourished children and 50 age-matched and sex-matched healthy-control children. Anthropometric measurements of children were done and transformed into weight-for-age and weight-for-height *Z*-scores. Screening of depression in mothers was done using Symptom's Checklist 90-Revised (SCL90-R) Depression dimension. Mini-Mental State Examination (MMSE) was used to assess maternal cognitive functions.
Results
Thirty-eight percent mothers of malnourished children were depressed compared with 12% mothers of healthy children. The difference was statistically significant ($P<0.05$). Statistically significant differences were found regarding maternal age at marriage, education, working status, crowding index, and family income between groups ($P<0.01$). Mothers of malnourished children had cognitive impairment than controls ($P<0.001$). The *Z*-score of malnourished children was positively correlated with breastfeeding duration, maternal age at marriage, education, working status, family income, and other social parameters; and negatively correlated with crowding index and gastrointestinal tract (GIT) morbidity, indicating that malnutrition increases with short duration of breastfeeding, younger maternal age at marriage, low education, bad working status, low income, and high crowding index.
Conclusions
Mothers of malnourished children have more depressive symptoms and impaired cognitive functions than the controls. Maternal age at marriage, education, family income, and crowding index are predictive variables affecting children nutrition.

Keywords:
depression, malnutrition, SCL-90 R

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Introduction

The health and well-being of children is inevitably related to their early social and emotional experiences. Feeding and caring for the young is primarily the mother's responsibility, therefore, poor maternal physical or mental health can negatively affect nutrition, physical, and psychological health of children (Cummings and Kouros, 2007).

Previous reports have demonstrated that the absence of natural motivation, enthusiastic, and emotional support has a similar significance like supplements' inadequacy on the developing cerebrum. When both the unfriendly elements are consolidated, the effect on youngsters is serious (Musaiger *et al.*, 2011).

The role of maternal depression in the development of the child has been questioned in research (Surkan *et al.*, 2014).

Maternal mental health has been disregarded in both youngster nourishment and advancement projects and it might be the missing connection in maternal and child-health programs.

We aimed to study the relationship between psychological and social aspects of mothers and their children nutritional status.

Patients and methods

This study is a case–control study, carried out from March 2018 to March 2019 at Children & Maternity University Hospital after study approval from the

ethical committee of the Minia Faculty of Medicine. The sample was designed to include two groups of children and their mothers that enrolled from nutrition-rehabilitation unit and from the general clinic of the same hospital after informed oral consents from their caregivers.

The first group included 50 children diagnosed as PEM (protein energy malnutrition) with *Z*-score weight for height less than−2 SD (as moderate PEM) and less than −3 SD (severe PEM). They were recruited from nutrition-rehabilitation unit of the hospital during admission with their mothers. The second group included children who were in a good nutritional state, and were recruited from the general clinic during medical consultation about acute illness (e.g. otitis media, common cold, etc.) in the same hospital. Children who were deaf, mute, or blind, also children suffering from chronic illness, motor, or mental disability were excluded from the study. Mothers who were deaf, mute, blind, or having chronic medical illness, physical, or intellectual disability were also excluded.

The children and their mothers were subjected to detailed nutritional, developmental, and family history followed by physical examination of children. Mothers of both groups were screened using.

A – Symptom Checklist 90–Revised (SCL-90 R) is a rapid self-report questionnaire that consists of 90 items, and requires 10–15 min to be completed. It is used to assess the psychopathological burden as well as monitor the treatment efficacy. It covers nine symptomatic dimensions. Each item of the questionnaire is rated by the patient on a five-point scale of distress from 0 (none) to 4 (extreme) (Derogatis and Savitz, 2000). Depression dimension of the SCL-90 R that included 13 items, was applied to screen mothers for depressive symptoms. Most of the typical symptoms of depressive syndromes according to current diagnostic criteria are included. Symptoms of dysphoric mood and affect, as well as signs of withdrawal of life interest, lack of motivation, and loss of vital energy are represented. Feelings of hopelessness, thoughts of suicide, and cognitive and somatic correlates of depression are included. The current study utilized the Arabic version, which was translated by Dr. Abd El Rakib Ahmed El Behery (El Behery, 1984).

B – Mini Mental State Examination (MMSE) is a nontimed, 11-question measure that tests five areas of cognitive functioning: orientation, memory, attention, calculation, recall, and language. It takes only 5–10 min to administer (this makes it practical to use repeatedly and routinely). MMSE is divided into two parts. The first part requires vocal responses only and covers orientation, memory, and attention. The second part tests the ability to name, follow verbal and written commands, write a sentence spontaneously, and copy a complex polygon. The maximum score is 30. The total score of 23 or lower indicates cognitive impairment, and if the patient is physically unable to complete a task (e.g. draw a shape), that task is skipped and the total score is reduced by that. MMSE is effective as a screening tool for patients with cognitive impairment. When used repeatedly, it can measure changes in cognitive status (Folstein *et al.*, 1975). It was translated from English to Arabic language (Rajeh *et al.*, 1999). An oral and written consent was approved from all participants in this research.

Study approval was obtained from the ethical committee of the Faculty of Medicine, Minia University.

Statistical analysis

Data were entered and analyzed by SPSS version 19 (Statistical Package for the Social Sciences, IBM Inc., Chicago, Illinois, USA). Quantitative data were presented as mean and standard deviation, while qualitative data presented as frequency distribution. Comparison between groups was done by Mann–Whitney test and χ^2 test. Spearman correlation was used. Probability of less than 0.05 was used as the cutoff for significance.

Results

The age of studied malnourished children ranged from 2 to 36 months, mean±SD was 15.26±4.15, 48% were males, and 52% were females. The healthy-children group had ages that ranged from 6 to 48 months, mean ±SD was 16.02±3.85, 60% (30) were males, and 40% (20) were females. No significant difference was found in birth order between both groups.

The well-nourished studied children (100%) were breastfed, but only 26 (52%) of malnourished children received breastfeeding (BF). Also, they have a shorter duration of BF than the controls ($P<0.001$). Malnourished children had significant recurrent attacks of gastroenteritis ($P<0.004$) and −72 (72%) have a significantly delayed motor development than well-nourished studied children ($P<0.004$) (Table 1). Forty four of the malnourished children were categorized as severe form according to WHO

criteria, and 16 of them have edema in the dorsum of their feet.

Mothers of malnourished-children ages ranged from 14 to 28 years, while mothers of the control ages ranged from 20 to 34 years old. The mothers of malnourished children were significantly of younger age ($P<0.00$). Eighty-four percent of mothers of malnourished children were illiterate and the rest can only read and write. On the other hand, 4% of mothers of the control group of children were illiterate ($P<0.001$) and the majority (40%) attained secondary-school education. Seventy-six percent of mothers of malnourished children were not working, even those who work (24%) were manual workers, while 32% of the controls were not working at all and 20% have professional work ($P<0.001$). Fathers of malnourished children also were illiterate (44%) and 96% had manual work ($P<0.001$) in comparison with the well-nourished group where 40% graduated from universities and have professional work. The family income did not meet the expenses in 40% of families of malnourished in comparison with 4% only of healthy-children families. The social parameters, including sewage disposal, refuse disposal, crowding index, and source of water, were significantly poor in the malnourished group ($P<0.001$) (Table 2).

Thirty-eight percent ($N=19$) of the mothers of malnourished children were depressed compared with 12% ($N=6$) of mothers of the controls screened by Depression Dimension of SCL-90 R and the difference was statistically significant ($P<0.05$). Moreover, Depression Dimension of SCL-90 R showed significant affection in mothers of malnourished children ($P<0.002$). The Mini Mental state testing the cognition in mothers showed 48% with mild and 44% with moderate cognitive impairment in mothers of malnourished. Only 8% in the other group have mild cognitive impairment and the rest of them (92%) have normal cognition. The difference was statistically significant ($P<0.001$) (Table 3).

The nutritional status of studied children was positively correlated with breastfeeding duration, maternal age at marriage, maternal and paternal education, working

Table 1 Criteria of studied children (malnourished children and normal-control children)

	Group I (malnutrition) $N=50$, N (%)	Group II (control) $N=50$, N (%)	P value
Age of the child (months)			
Mean±SD	15.26±4.15	16.02±3.85	0.505
Sex of the child			
Male	24 (48)	30 (60)	0.395
Female	26 (52)	20 (40)	
Birth order			
Range	(1–9)	(1–5)	0.110
Mean±SD	3.24±2.14	2.28±1.17	
Mental development			
Delayed	6 (12)	0	0.074
Normal	44 (88)	50 (100)	
Motor development			
Delayed	14 (28)	0	0.004*
Normal	36 (72)	50 (100)	
GIT morbidity			
Yes	30 (60)	10 (20)	0.004*
No	20 (40)	40 (80)	
Respiratory morbidity			
Yes	8 (16)	10 (20)	0.713
No	42 (84)	40 (80)	
Breastfeeding			
Yes	26 (52)	50 (100)	<0.001*
No	24 (48)	0	
Duration of breastfeeding (months)			
Range	(0–30)	(6–24)	<0.001*
Mean±SD	6.04±7.41	14.96±5.7	
Weight			
Range	(1.3–8.25)	(7.25–25)	<0.001*
Mean±SD	4.18±1.95	12.55±3.67	

*$P<0.05$ statistically significant. GIT: Gastrointestinal tract.

Table 2 Description of socioeconomic and demographic characteristics of the studied mothers

	Group I (malnutrition) *N*=50, *N* (%)	Group II (control) *N*=50, *N* (%)	*P* value
Maternal age at marriage (years)			
Range	(14–28)	(20–34)	<**0.001**
Mean±SD	19.56±3.97	24.04±3.34	
Maternal age now (years)			
Range	(17–42)	(24–45)	0.088
Mean±SD	28.36±7.31	31.36±4.53	
Maternal education			
Illiterate	42 (84)	2 (4)	
Read and write	8 (16)	16 (32)	<**0.001**
Secondary	0	20 (40)	
University	0	12 (24)	
Maternal working status			
Not working	38 (76)	16 (32)	
Manual	12 (24)	12 (24)	<**0.001**
Clerical	0	12 (24)	
Professional	0	10 (20)	
Paternal age at marriage (years)			
Range	(18–39)	(22–39)	0.977
Mean±SD	27.6±5.73	27.56±4.01	
Paternal age now (years)			
Range	(23–58)	(28–50)	0.370
Mean±SD	36.8±10.04	34.72±5.59	
Paternal education			
Illiterate	22 (44)	2 (4)	
Read and write	22 (44)	12 (24)	<**0.001**
Secondary	6 (12)	16 (32)	
University	0	20 (40)	
Paternal working status			
Not working	2 (4)	0	
Manual	48 (96)	6 (12)	<**0.001**
Clerical	0	24 (48)	
Professional	0	20 (40)	
Family income meets expenses*			
Yes and save	12 (24)	32 (64)	
Yes	10 (20)	8 (16)	**0.007***
Sometimes	8 (16)	8 (16)	
No	20 (40)	2 (4)	
Crowding index			
Range	(2–6)	(1–2)	<**0.001**
Mean±SD	3.72±1.22	1.1±0.28	
Source of water			
Piped in-house	20 (40)	50 (100)	
Piped outside	28 (56)	0	<**0.001**
Surface underground	2 (4)	0	
Sewage disposal			
Sewage system	16 (32)	50 (100)	<**0.001**
Pet latrine	34 (68)	0	
Refuse disposal			
Put in a container	4 (8)	48 (96)	<**0.001**
Discard in front of the house	46 (92)	1 (4)	

*$P<0.05$ statistically significant. $P<$ 0.001 means high statistical significance.

status, family income, sewage disposal, refuse disposal, and source of water. This means that the severity of malnutrition increases with decrease of maternal age at marriage, low education, bad working status, low family income, other social parameters, and decrease in the duration of BF. Moreover, the nutritional status was negatively correlated with crowding index and GIT morbidity (Tables 4 and 5).

Table 3 Comparison between mothers of malnourished and control children in depressive symptoms measured by SCL-90 R and cognitive functions measured by MMSE

	Group I (malnutrition) *N*=50, *N* (%)	Group II (control) *N*=50, *N* (%)	*P* value
Depressed	**19 (38)**	**6 (12)**	
Not depressed	**31 (62)**	**44 (88)**	0.05*
Depression item scores			
Mean±SD	**46.6±6.63**	**40.48±6.91**	0.002*
MMSE			
Range	(12–28)	(21–30)	0.001*
Mean±SD	19.56±4.26	28.96±2.07	
MMSE			
Normal	4 (8)	46 (92)	
Mild cognitive impairment	24 (48)	4 (8)	
Moderate cognitive impairment	22 (44)	0	0.001*
Severe cognitive impairment	0	0	

MMSE, Mini Mental State Examination; SCL-90 R, Symptom Checklist 90-Revised. *$P<0.05$ statistically significant. $P<0.001$ means high statistical significance.

Discussion

Child-care practices are essential for appropriate development of youngsters. It has been proposed that poor maternal psychological well-being may unfavorably influence the child-care practice, debilitate development and advancement of the children (Faruque *et al*., 2008).

In the present study, children from both malnourished and the control groups are between 2 and 48 months of age, with slightly higher frequency of females among the malnourished group compared with that of the other group, but this difference did not reach any statistical significance. Some studies such as Santos *et al*. (2010) have demonstrated a higher occurrence of malnutrition in females and suggested social risk of gender bias in child care (Santos *et al*., 2010).

Our study revealed better practice and longer duration of BF among mothers of healthy children than malnourished children, with a significant positive correlation with good nutritional status. Our finding is similar to a study done in Bangladesh among malnourished children, 6–60 months old, 48.3% of infants got artificial feeding and just 7% were breastfed Iqbal Hossain and Kabir (1999). However, Martin (2001) in his commentary, showed inconsistent associations about longer duration of BF. Some ideas showed good benefits and few described drawbacks if BF was alone. He concluded that further studies are needed to clarify whether prolonged BF is a response to poor growth and ill health, or is a precursor of inadequate energy intake, malnutrition, and/or diarrheal diseases (Martin, 2001).

Table 4 Correlation between *Z*-score of studied malnourished children and socioeconomic status of their families

	Z-score	
	R	*P* value
Maternal age at marriage (years)[a]	0.421	0.002*
Maternal education[b]	0.773	<0.001*
Maternal working status[b]	0.521	<0.001*
Paternal education[b]	0.600	<0.001*
Family income/month[b]	0.581	<0.001*
Crowding index[a]	–0.780	<0.001*
Source of water[b]	0.570	<0.001*
Sewage disposal[b]	0.685	<0.001*
Refuse disposal[b]	0.839	<0.001*
Duration of breastfeeding[a]	0.528	<0.001*
GIT morbidity[b]	–0.353	<0.012*
Respiratory morbidity[b]	–0.224	0.118

[a]Pearson's correlation. [b]Nonparametric Spearman's ρ correlation. *$P<0.05$ statistically significant. GIT: Gastrointestinal tract. $P<0.001$ means high statistical significance.

Table 5 Correlation study between *Z*-score of the studied malnourished children and the depressive symptoms and cognitive functioning of their mothers

	Z-score	
	R	*P* value
Depression item scores (SCL-90 R)	–0.357	0.079
Mini Mental State (MMSE)	0.005	0.980

Pearson's correlation. *$P<0.05$ statistically significant.

A significant motor delay in 28%, with 12% suffering delayed mental development, was encountered among studied malnourished children. This result is in line with (Grantham-McGregor, 1984) who demonstrated that longitudinal studies have additionally demonstrated that kids who had been stunted (height for age less than –2 SD below normal

values) in the initial 2 years of life kept on indicating shortages in perception and school accomplishment from age 5 years to adolescence. In this manner, interminable undernutrition in early life appears to have durable results for mental health.

In the present study, there were significant differences between the two groups regarding maternal age at marriage, maternal education, and maternal working status, with no differences between the two groups regarding maternal age. Also, there were significant differences between the two groups regarding paternal education and working status, but there was no significant difference in paternal age at marriage or paternal age now, with significant positive correlations between these parameters and the better nutritional status in our studied children. These discoveries concur with the study done in Kampala, Uganda and the Moi Teaching and Referral Hospital in Eldoret, Kenya, looked at kids from zero to 60 months and three to 35 months separately and found a relationship among PEM and youthful (15–25 years), and single mothers (Ayaya *et al.*, 2004). Likewise, Edward *et al.* (2013) reported that higher levels of unhealthy nutrition are related to a range of potential prenatal and postnatal confounds (i.e. poverty, teenage mother, low maternal education, parity, birth complications, substance use, criminal lifestyle, and partner cruelty toward mother) (Edward *et al.*, 2013).

Maternal education is still an important issue to address. Illiterate mothers in our study were 84% among the malnourished group compared with 4% in the group of healthy children. Likewise, Christiaensen and Alderman (2001) found that female education had a positive and factually critical impact on nutritional status of their children (Christiaensen and Alderman, 2001). This can be explained by having better knowledge about better nutrition for their kids and nourishing practices (National Food Consumption Survey NFCS, 1999). However, Zottarelli *et al.* (2007) found that moms with high educational level had brought down danger of stunting than those with lower educational level (Zottarelli *et al.*, 2007). It has been contended that education impacts the ability of mothers to decide concerning youngsters' nutrition (Kandala *et al.*, 2001). Then again, other studies did not discover a relationship among PEM and maternal level of education (Ayaya *et al.*, 2004; Ashaba *et al.*, 2015).

Social parameters such as family income, source of water, sewage disposal, and refuse disposal revealed significant differences between the two groups ($P<0.001$) with a significant positive correlation with the nutritional status. Our result is in line with a previous study that proved that some socioeconomic issues are linked to stunting such as the type of house (especially in urban areas): type of toilet in the home, fuel used in cooking, presence of refrigerator or stove, and television (Kleynhans *et al.*, 2006). Also, Christiaensen and Alderman (2001) expressed that the ownership of a flush latrine in the house positively affects height (Christiaensen and Alderman, 2001).

Our study shows a significant difference and a negative correlation with the severity of malnutrition between the two groups and the crowding index that is matching with Kleynhans *et al.* (2006) and Mamabolo *et al.* (2005).

However, our study shows that 38% ($N=19$) of the mothers of the malnourished children were depressed as opposed to 12% ($N=6$) of mothers of the healthy children ($P<0.05$). Ashaba *et al.* (2015) reported results similar to our study, as 42% of mothers of malnourished children of their sample in southwest Uganda were depressed, compared with 12% of mothers of normal-weight children admitted to hospital for chronic illness (Ashaba *et al.*, 2015). However, Haithar *et al.* (2018) reported higher prevalence of moderate-to-severe depression among mothers of malnourished children (64.1% compared with mothers of normal-weight children 5.1%) (Haithar *et al.*, 2018).

The present study also shows significant affection in mothers of malnourished children in Depression Dimension measured by SCL-90-R compared with mothers of the healthy children ($P=0.002$). In spite of contrasts in the methodological approach, the present study confirms with past reports of a positive relationship between maternal psychological well-being and nutritional status of their children. Many studies revealed that children of depressed mothers are probably going to be underweight and stunted contrasted to offspring of moms without depression in both low- and high-income countries (Duarte *et al.*, 2012; Husain *et al.*, 2012; Edward *et al.*, 2013; Surkan *et al.*, 2014; Qamar *et al.*, 2017; Haithar *et al.*, 2018; Joshi and Raut, 2019). However, Lima *et al.* (2017) did not find associations between maternal depressive symptoms with child malnutrition or child excess weight. In their study, the prevalence of maternal depressive symptoms was 27.6% during gestation and 19.8% in the second or third year of the child's

life. The malnutrition rate was 6% and the excess-weight rate was 10.9% (Lima *et al*., 2017).

When studying the differences in cognitive function between mothers in the two groups, we found that 22 out of 50 (44%) mothers of malnourished children had moderate cognitive impairment in comparison with 46 out of 50 (92%) mothers of healthy children who had normal cognition ($P<0.001$), with no significant correlation with *Z*-score of studied malnourished children. Anoop *et al*. (2004), in agreement with our study, show that lower maternal intelligence can likewise influence the child's nutrition (Lima *et al*., 2017). The explanations could be that lower ability to grasp the need to supplement nutritious food during the weaning period can result in malnutrition. Moreover, moms with lower intelligence will require basic guidelines and more prominent supervision (from relatives and group well-being specialists) to avoid malnutrition in their children. The study showed that the mental status of the studied mothers inversely affects child nutrition, as mothers whose mental health is poor are less able to care for themselves and their infants, whose survival, health, and development could be then compromised (Pangman *et al*., 2000). Few studies in the literature examined the relation between maternal cognitive functioning and children nutrition status.

Our study has some limitations. The sample size should be larger in order to generalize the results, especially the prevalence of maternal depression. Indeed, more extensive research to explore this issue is further needed.

Conclusions

Several socioeconomic factors such as maternal age at marriage, maternal education, family income, and crowding index may attribute to malnutrition of children. Also, mothers of malnourished children were found to have more psychological (i.e. depression) and mental problems than those of the control group.

Management of maternal mental health may have a positive impact on children nutritional status. Maternal psychiatric health assessment by simple tools should be carried out at medical universities and local health facilities for early detection and treatment of disorders that negatively impact children's health and well-being. Maternal education sessions focus on enhancing mother–child interaction and child-rearing practices should be applied at community clinics.

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Conflicts of interest

There are no conflicts of interest.

References

Anoop S, Saravan B, Joseph A, Cherian A, Jacob KS (2004). Maternal depression and low maternal intelligence as risk factors for malnutrition in children: a community case-control study from South India. Arch Dis Child 89:325–329.

Ashaba S, Rukundo GZ, Beinempaka F, Ntaro M, LeBlanc JC (2015). Maternal depression and malnutrition in children in southwest Uganda: a case control study. BMC Public Health 15:1303.

Ayaya SO, Esamai FO, Rotich J, Olwambula AR (2004). Socio-economic factors predisposing under five-year-old children to severe protein energy malnutrition at the Moi Teaching and Referral Hospital, Eldoret, Kenya. Eastern African Med J 81:415–421.

Christiaensen L, Alderman H (2001). CChild Malnutrition in Ethiopia: Can Maternal Knowledge Augment The Role of Income? The World Bank. [Internet]. Available from: http://www.worldbank.org.za [Assessed January 7th, 2007].

Cummings EM, Kouros CD (2007). Maternal depression and its relation to children's development and adjustment. In: Tremblay RE, Boivin M, Rdev P, editors. Encyclopedia early child development. University of Notre Dame, USA Vanderbilt University, USA. pp. 1–10.

Derogatis LR, Savitz KL (2000). The SCL-90-R and the Brief Symptom Inventory (BSI) in primary care. In: Maruish ME, editor. Handbook of psychological assessment in primary care settings, 236 Mahwah. NJ: Lawrence Erlbaum Associates; pp. 297–334.

Duarte CS, Shen S, Wu P, Must A (2012). Maternal depression and child BMI: longitudinal findings from a US sample. Pediatr Obes 7:124–133.

Edward DB, Natasha K, Jane N.g, Sarah KGJ (2013). Prenatal maternal depression symptoms and nutrition, and child cognitive function. Br J Psychiatry 203:417–421.

El Behery A (1984). Symptom Checklist-90- Revised (SCL-90-R), Arabic Form. Cairo, Egypt: Al-Nahda Al-Messria Library.

Faruque ASG, Ahmed AMS, Ahmed T, Islam MM, Hossain MI, Roy SK, *et al.* (2008). Nutrition: basis for healthy children and mothers in Bangladesh. J Health Popul Nutr 26:325–339.

Folstein MF, Folstein SE, McHugh PR (1975). 'Mini-Mental State' a practical method for grading the cognitive state of patients for the clinician. J Psychiatr Res 12:189–198.

Grantham-McGregor SM (1984). The social background of child malnutrition, and behaviour: critical assessment of key issues. In: Brozek J, Schurch B, editors. Lausanne Nestle Foundation; 358–374.

Haithar S, Kuria MW, Sheikh A, Kumar M, Vander Stoep A (2018). Maternal depression and child severe acute malnutrition: a case-control study from Kenya BMC Pediatrics. BMC Pediatr 18:289.

Husain N, Cruickshank JK, Tomenson B, Khan S, Rahman A (2012). Maternal depression and infant growth and development in British Pakistani women: a cohort study. BMJ Open 2:e000523.

Iqbal Hossain M, Yasmin R, Kabir I (1999). Nutritional and immunization status, weaning practices and socio-economic conditions of under five children in three villages of Bangladesh. Indian J Public Health J 43:37–41.

Joshi MN, Raut AV (2019). Maternal depression and its association with responsive feeding and nutritional status of infants: a cross-sectional study from a rural medical college in central India. Nurs Res Pract 65:212–218.

Kandala NB, Madungu TP, Emina JB, Nzita KP, Cappuccio FP (2001). Malnutrition among children under the age of five in the Democratic Republic of Congo (DRC): does geographic location matter?. BMC Public Health 11:261.

Kleynhans IC, MacIntyre UE, Albertse EC (2006). Stunting among young black children and the socio-economic and health status of their mothers/caregivers in poor areas of rural Limpopo and urban Gauteng – the NutriGro Study. South African J Clin Nutr 19:163–172.

Lima TFM, Maciel WM, de Alencar MN, da Silva Cruz JA, de Carvalho CA, da Silva AM. (2017). Association between maternal depressive symptoms with child malnutrition or child excess weight. Rev Bras Saúde Matern Infant Recife 17:591–601.

Mamabolo RL, Alberts M, Steyn NP, Delemarre-van de Waal HA, Levitt NS (2005). Prevalence and determinants of stunting and overweight in 3-year-old black South African children residing in the Central Region of Limpopo Province, South Africa. Public Health Nutr 8:501–508.

Martin RM (2001). Commentary: Does breastfeeding for longer cause children to be shorter?. Int J Epidemiol 30:481–484.

Musaiger AO, Hassan AS, Obeid O (2011). The Paradox of nutrition related diseases in the Arab countries. The need for action. Int J Environ Res Public Health 8:3637–3671.

National Food Consumption Survey (NFCS) (1999). Children aged 1-9 years. South Africa. National Library of Medicine

Pangman VC, Sloan J, Guse L (2000). An examination of psychometric properties of the Mini-Mental Status Examination and the Standardized Mini-Mental Status Examination: implications for clinical practice. Appl Nurs Res 13:209–213.

Qamar S, Nadia S, Sumera I, Kashif S (2017). Maternal depressive symptoms and child nutritional status: a cross-sectional study in socially disadvantaged Pakistani community. J Child Health Care 21:331–342.

Rajeh S, Ogunniyi A, Awada A, Daif A, Zaidan R (1999). Preliminary assessment of an Arabic version of the mini-mental state examination. Ann Saudi Med 19:150–152.

Santos IS, Matijasevich A, Dominguess MR, Barrow AJD, Barrow FCF (2010). Long lasing maternal depression and child growth at 4 years of age: a cohort study. J Pediatr 157:401–406.

Surkan PJ, Ettinger AK, Hock RS, Ahmed S, Strobino DM, Minkovitz CS (2014). Early maternal depressive symptoms and child growth trajectories: a longitudinal analysis of a nationally representative US birth cohort. BMC Pediatr 14:185.

Zottarelli LK, Sunil TS, Rajaram S (2007). Influence of parental and socioeconomic factors on stunting in children under 5 years in Egypt. East Mediterr Health J 13:1330–1342.