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Prevalence and Determinants of Malnutrition among Under-Five Children in a Rural Village in Giza Governorate

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Abstract

BACKGROUND: Malnutrition remains a serious problem to child survival, growth, and development in underdeveloped countries.

AIM: The aim of this study is to assess the prevalence and determinants of malnutrition among under-five children.

METHODS: This study is a cross-sectional community-based study. It was conducted on 320 mother-child pairs through household visits in Nahia; a rural village in Giza governorate, Egypt. A structured questionnaire was developed to collect data regarding sociodemographic characteristic, feeding pattern, including breastfeeding and weaning practices. Anthropometric measurements (weight, height) and Hb level were measured for all the studied participants.

RESULTS: The mean age of the children was 35.98 ± 15.8 months, and the mean age of mothers was 28 ± 4.6 years. Stunting was found in 16.2%, wasting in 9%, and underweight in 15.6% of children, with a total malnutrition of 79 (24.7%). Nearly half of children were anemic(51.2%). Many risk factors were contributing to malnutrition as socioeconomic status, age of mother at giving her first birth, and child birth weight.

CONCLUSION: Stunting and anemia were the predominant nutritional problems among children so nutritional counseling for mothers is needed to improve feeding practices of their children.

Introduction

Growth is a typical characteristic of childhood; it is regarded as the best global indicator of children's well-being as growth impairment has both short- and long-term consequence [1].

In 2016, 52 million children under the age of five were wasted globally, with 17 million severely wasted and approximately 22.9% stunted growth [2].

Micronutrient deficiencies, particularly those of Vitamin A, zinc, iodine, and iron, are estimated to affect more than 2 billion people worldwide, with negative consequences including premature death, poor health, blindness, stunting, impaired cognitive development, and low productive capacity [3].

Nutrition assessment is considered the best way to determine the nutritional needs. It provides evidence-based information for planning and evaluating programs aiming at reduction of the burden of malnutrition [4].

According to the latest EDHS 2014 [5], one in every five children is stunted. Less than 10% of children are wasted or underweight. Stunting and underweight are very similar to rates reported in 2000 and 2005 while wasting is increasing slightly over time. More than one in four children in Egypt suffers from some degree of anemia. Ten percent were found to be moderately anemic.

Our nation performs better than other low/middle-income neighbor countries, but some countries with similar income have lower rates of child stunting: Malnutrition can be caused by a variety of factors such as insufficient food intake, infections, psychosocial deprivation, an unsanitary environment, social inequality, and possibly some genetic contribution [6].

Malnutrition has an impact on the community in both direct and indirect ways.

The occurrence of subclinical nutritional deficiency diseases such as kwashiorkor and marasmus is a direct effect. The indirect effect is that nations are trapped in intergenerational cycle of poor nutrition, illness, and poverty [7], [8].

According to Egypt's Cost of Hunger Study, the economic and social cost of child malnutrition is 20.3 billion EGP. Without measures to combat and eliminate undernutrition, this cost is projected to rise by approximately 32% by 2025, so systematic response within the national health agenda is needed [9].

The current study is intending to assess the prevalence and determinants of malnutrition among rural under-five children in a trial of improving health of the upcoming generations.

Methods

Study design

This was a descriptive cross-sectional community-based study, conducted in "Nahia" a rural village in Giza governorate, Egypt.

Study setting and population

The study population is mother-child pairs. The study sample was accessed through household visits where they were asked to participate and agreed.

Inclusion criteria

1. Children from 6 months to 5 years and free of medical problems.

Exclusion criteria

1. Children who were younger than 6 months or older than 5 years
2. Children with chronic morbidity
3. Children whose birth date were not appropriate or not known.

Sample size and sampling technique

The sample size was calculated using the statistical program of the CDC, Atlanta, Georgia, U.S.A.,. The sample size was estimated to determine a prevalence of malnutrition in developing countries including Egypt of 27%, with 5% acceptable margin of error and 95% confidence level. The estimated sample size is 295, after adjustment for non-response, the sample size was increased to 320.

The village is selected purposively. The mother-child pairs were selected through door-to door visit. The study used a multistage sampling technique: Cluster, then simple random sampling; the whole village is divided into 8 clusters almost equal clusters regarding size and number of streets (guided with the map for the village), the village is divided into almost similar 8 blocks and each cluster is assigned to retrieve 40 children from it by simple random sampling (320" total sample"/8 clusters) guided by one of the experienced nurses issued in vaccination campaigns and the health inspector. In households with more than one eligible child, one child was chosen at random lottery method.

Data collection tools

A structured questionnaire

A structured questionnaire was designed to collect data during the household visits. Most of questions were close-ended and precoded. Pilot testing was done to check for data clarity, reliability, and acceptance of questionnaire.

Sociodemographic part was adopted from Fahmi and El-Sherbini sociodemographic score with modifications to [10]. Feeding practices were adopted from WHO/UNICEF tool [11].

The questionnaire consists of the following sections

Sociodemographics

Family size, income, education, occupation, ownership of livestock and of farmland, etc.

Child characteristics

Age, sex, birth order, place, and type of delivery.

Maternal characteristics

Current age and age at giving her first birth, weight. and height; environmental health condition: Water source, sanitation means.

Child feeding pattern

Breastfeeding or artificial feeding, complementary feeding, and weaning practices.

Anthropometric measurements

All measurements were taken using a standardized protocol with calibrated equipment and following the recommendations of international standards for anthropometric measurement. The anthropometric measurements have been entered in the WHO Anthro software version 3.2.2 and macros [12]. This data have then been analyzed and compared to the WHO standards in the growth curves.

Weight measurement

In case of infants up to the age of 2 years, they were weighed on a baby scale wearing light clothes (one set of underwear) and without their nappies. In case of children above the age of 2 years, weight was measured using electric scale, set on a hard, flat, and uncarpeted surface.

Height measurement

Supine length or standing height was measured. In the case of all infants up to the age of 2 years, they were measured using a supine measuring device; a horizontal wooden length board with the infant in recumbent position. In case of children above the age of 2 years, height was measured using Harpenden stadiometer; a Vertical wooden height board which was set on a hard, uncarpeted floor, and children were measured without shoe.

Laboratory investigations

A coded card, with the child full name and a serial number, was given to the mother of the child in order to go to the primary health care laboratory, to perform a blood HB level test. the cutoffs used for classifying child anemia status in this study are mild: 10.0–10.9 g/dl, moderate: 7.0–9.9 g/dl, severe: <7.0 g/dl, any: <11.0 g/dl).

Data analysis and management

Pre-coded data were transferred and entered into the statistical package of IBM SPSS Statistics for Windows, Version 24.0. Armonk, NY: IBM Corp. Quantitative variables were summarized using mean and standard deviation. Qualitative variables were summarized using frequency and percentage. Comparison between groups was performed using chi-square test and Fisher exact for qualitative variables. Z-test for 2 proportions used for WHO indicators. $p < 0.05$ were considered statistically significant.Logistic regression was performed. Three models were generated using binary logistic regression, backward stepwise (Wald), to find the predictors of stunting, underweight, and wasting.

Ethical issues

The study protocol was revised and approved by the ethical committee at the public health and community medicine department of Faculty of medicine, Cairo University.

Verbal consents were obtained from all the participants in the study and data confidentially was preserved according to the revised Helsinki decelerations of biomedical ethics [13].

Results

Regarding the sociodemographic, 149 (46.6%) were males and 171 (53.4%) were females. Nearly half of mothers had a secondary level of education and higher (53.4%), while fathers were (63.4%) (Table 1).

Table 1: Sociodemographic characteristics of studied participants

Sociodemographic characterestics	Frequency, n (%)
Gender	
Males	149 (46.6)
Females	171 (53.4)
Age group distribution (months)	
6–11	24 (7.5)
12–23	61 (19.1)
24–35	64 (20)
36–47	72 (22.5)
48–60	99 (30.9)
Child age (months), mean ± SD	35.98 ± 15.8
Mother age at first birth, mean ± SD	20.3 ± 2.5
Father education	
Below secondary	114 (35.6)
Secondary and higher	203 (63.4)
Father occupation (n = 317*)	
Unskilled manual worker	37 (11.7)
Skilled manual worker\farmer	171 (53.9)
Trades-business	30 (9.5)
Semiprofessional-clerk	47 (14.8)
Professional	32 (10.1)
Mother education	
Below secondary	149 (46.6)
Secondary and higher	171 (53.4)
Mother occupation	
Not working\housewife	284 (88.8)
Working mother	36 (11.2)
Family type	
Nuclear	109 (34.1)
Extended	211 (65.9)
Crowding index (persons\room)	
≤ 2	181 (56.6)
> 2	139 (43.4)

SD: Standard deviation.

Near half of families were of high-middle social level (54.1%).

Mother age at first birth (Mean ± standard deviation) was 20.3 ± 2.5. The majority of mothers (95%) had ever breastfed their children, for those children younger than two years, the mean duration of exclusive breastfeeding was 13.7 ± 4.2 months (Table 2).

Table 2: Feeding pattern among studied children

Feeding pattern	Frequency, n (%)
Ever breastfed (n = 320)	
Yes	304 (95)
No	16 (5)
Type of feeding (n = 95)	
Breastfeeding	59 (62.1)
Formula feeding	6 (6.3)
Both	30 (31.6)
Exclusive breastfeeding	
Yes	8 (9)
No	81 (91)
Duration of exclusive breastfeeding, mean ± SD	3.57 ± 1.04
Duration of breastfeeding, mean ± SD	13.7 ± 4.2
Introducing fluids before 6 months (n = 95)	
Yes	87 (91.6)
No	8 (8.4)
Age of introducing semisolid foods (months)	
2–4	35 (36.8)
4–6	32 (33.7)
≥6	28 (29.5)
Type of foods introduced	
Yogurt	36 (37.9)
Rice	4 (4.2)
Bread and biscuits	28 (29.5)
Plain thin porridge	12 (12.6)
Mashed fruits and vegetables	15 (15.8)
Dietary diversity (food groups)	
< 4	183 (57.2)
≥ 4	137 (42.8)
Meal frequency	
As recommended for age	192 (60)
Less than recommended	128 (40)

SD: Standard deviation.

Studied children who suffered from stunting were 16.2%, 15.6% were underweight, 9% were wasting. Nearly half of studied children were anemic 51.2 % (Table 3).

Table 3: Summary of malnutrition status among studied children

Malnutrition status	Frequency, n (%)
Stunting	52 (16.2)
Underweight	50 (15.6)
Wasting	29 (9)
Overweight and obesity (≥ + 2SD)	8 (2.5)
Anemia status	164 (51.2)
HB level, mean ± SD	10.5 ± 1.1

SD: Standard deviation, HB: Hemoglobin.

Trend of anemia was increasing with age, the most affected group (12-23 months). Only 0.6% of children had a severe degree of anemia; stunting was more evident among older children (36–47 mo), underweight was mainly among younger (12–23 mo), and wasting was more among oldest group (48–60 mo).

Social level was strongly related to stunting, underweight, and wasting with p values (p = 0.001, 0.01, 0.026, respectively). Stunting was higher among males (61.5%) compared to females (38.5%). Child gender was significantly related to stunting (p = 0.018) and to wasting (p = 0.032) (Table 4).

Children born to short mothers were 2 times more likely to be stunted. Children of mothers giving birth at younger ages were 5 times more likely to be stunted. Those children with low-birth weight were 2 times more likely to be stunted than those with a normal birth weight.

Social level was a predictor of being underweight, where children of lower social level were 1.1 times more likely to be underweight. Children receiving less diverse diets were 3 times more likely to be wasted. There was significant difference between anemic and non anemic (normal) groups regarding diversity score, meal frequency score, child age, malnutrition status and social sore with p values (0.001, 0.001, 0.001, 0.001, 0.001 respectively) (Table 5).

Discussion

Child health is now considered as an essential component of the ministry of health plan in Egypt. This study showed a sex distribution of 46.6% males and 53.4% females. Child gender was significantly related to stunting (p = 0.018) and to wasting (p = 0.032) Table 4.

This coincides with study [14] in Pakistan which found that boys were more stunted than girls (p <0.001), but no significant difference found regarding wasting and underweight among under five children.

Around one-third of studied households were in the lower two wealth quartiles (33.4%), which is consistent with *EDHS 2014* [5] data, where 41% of rural Upper Egypt falls into the lowest wealth quintile, thus, spatial disparities continue to be an enduring feature across rural and urban areas.

In this study, there's a significant relation between mother education level and child malnutrition (Table 4). This coincides with study [15] which found that children of mothers with secondary or higher education were at lower risk of childhood stunting, underweight, and wasting (odds ratio [OR]: 0.82, 95% confidence interval [CI]: 0.74, 0.91) compared with children of mothers with no education.

Mother age at first birth is closely related to teenage fertility and a major health concern. In this study, the mean age of mothers at first birth was 20.3 years which indicates that childbearing begins early for many Egyptian women, especially in rural areas, and also consistent with EDHS 2014 data where more than one quarter of women age 25–49 had their first birth by age 20 and 45% gave birth by age 22.

Breastfeeding remains the norm in Egypt. Our study results found that majority of mothers (95%) had ever breastfed their children (Table 2) which came in

Table 4: Relation between malnutrition and sociodemographic characteristics of studied children

Sociodemographic characteristics	Total, n (%)	Stunting		Underweight		Wasting	
		n (%)	p	n (%)	p	n (%)	p
Father education							
Below secondary	114 (36)	42 (80.7)	0.001*	29 (59.2)	0.001*	10 (34.5)	0.862*
Secondary and above	203 (64)	10 (19.3)		20 (40.8)		19 (65.5)	
Mother education							
Below secondary	149 (46.6)	49 (94.2)	0.001*	40 (80)	0.001*	17 (58.6)	0.172*
Secondary and above	171 (53.4)	3 (5.8)		10 (20)		12 (41.4)	
Mother work							
Working	36 (11.3)	3 (5.8)	0.172*	4 (8)	0.428*	2 (6.9)	0.756**
Not working	284 (88.7)	49 (94.2)		46 (92)		27 (93.1)	
Crowding index							
≤ 2	181 (56.6)	8 (15.4)	0.001*	14 (28)	0.001*	12 (41.4)	0.084*
> 2	139 (43.4)	44 (84.6)		36 (72)		17 (58.6)	
Child sex							
Male	149 (46.6)	32 (61.5)	0.018*	20 (40)	0.311*	8 (27.6)	0.032*
Female	171 (53.4)	20 (38.5)		30 (60)		21 (72.4)	
Child age							
6–11	24 (7.5)	0	0.055*	1 (2)	0.195*	1 (3.4)	0.371*
12–23	61 (19.1)	11 (21.2)		12 (24)		6 (20.7)	
24–35	64 (20)	6 (11.5)		6 (12)		3 (10.3)	
36–47	72 (22.5)	15 (28.8)		12 (24)		6 (20.7)	
48–60	99 (30.9)	20 (38.5)		19 (38)		13 (44.8)	
Social level							
High social level	40 (12.5)	0	0.001*	3 (6)	0.01*	6 (20.7)	0.026*
High-middle level	173 (54.1)	5 (9.6)		10 (20)		8 (27.6)	
Low-middle level	97 (30.3)	40 (76.9)		35 (70)		14 (48.3)	
Low level	10 (3.1)	7 (13.5)		2 (4)		1 (3.4)	

*Chi-square test, **Fisher's exact test.

Table 5: Possible determinants of anemia among studied children

Determinants of anemia	Total, n (%)	Anemia, n (%)	Normal, n (%)	p
Child sex				
Male	149 (46.6)	72 (43.9)	77 (49.4)	0.328*
Female	171 (53.4)	92 (56.1)	79 (50.6)	
Ever breastfed				
Yes	304 (95)	154 (93.9)	150 (96.2)	0.356*
No	16 (5)	10 (6.1)	6 (3.8)	
Diversity score (food groups)				
< 4	137 (42.8)	135 (82.3)	2 (1.3)	0.001*
≥ 4	183 (57.2)	29 (17.7)	154 (98.7)	
Meal frequency score				
As recommended for age	192 (60)	49 (29.9)	143 (91.7)	0.001*
Less than recommended	128 (40)	115 (70.1)	13 (8.3)	
Vitamin intake				
Yes	71 (22.2)	36 (22)	35 (22.4)	0.917*
No	249 (77.8)	128 (78)	121 (77.6)	
Child age				
6–11	24 (7.5)	8 (4.9)	16 (10.3)	0.001*
12–23	61 (19.1)	50 (30.5)	11 (7.1)	
24–35	64 (20)	21 (12.8)	43 (27.6)	
36–47	72 (22.5)	38 (23.2)	34 (21.8)	
48–60	99 (30.9)	47 (28.7)	52 (33.3)	
Malnutrition status				
Malnourished	79 (24.7)	76 (46.3)	3 (1.9)	0.001*
Normal	241 (75.3)	88 (53.7)	153 (98.1)	
Social level				
High social level	40 (12.5)	5 (3)	35 (22.4)	0.001*
High-middle level	173 (54.1)	54 (32.9)	119 (76.3)	
Low-middle level	97 (30.3)	95 (57.9)	2 (1.3)	
Low level	10 (3.1)	10 (6.1)	0	

*Chi-square test.

agreement with national figures where 96% of children born in 2 years preceding the *EDHS2014* [5] were ever breastfed.

Unfortunately, most mothers did not introduce foods of good nutrition values; where 37.9% first introduced yogurt, 29.5% first introduced plain biscuits, 12.6% first introduced plain thin porridge like cereals, and only 15.8% first introduced mashed vegetables and fruits, which reflects poor nutritional knowledge of mothers and more efforts should be exerted to raise their awareness and practice of healthy nutritious feeding.

This study revealed that only 9% of children below than 2 years were exclusively breastfed. This finding is much lower than the national figure and should be interpreted carefully as it is affected by many factors as the minimum age for calculation of this indicator was 6 months, on the other hand, the national survey included newly born infants who have much more chance for exclusive breastfeeding while our study did not, so the recall error of mothers can be a bias.

According to *EDHS* 2014 [5], exclusive breastfeeding is not widely practiced. Furthermore, the *JPFHS* [16] showed that only 23% of children 0-5 months were exclusively breastfed and by age 4–5 months.

Four food groups are considered as the minimum acceptable dietary diversity in feeding of infants and young children. It was selected because it was associated with better quality diets for children [11]. Nearly half (57.2%) of studied children was given foods of appropriate diversity (Table 2); this was consistent with *EDHS* 2014 report (43%) of children was given foods of appropriate diversity.

Minimum acceptable diet is an indicator reflecting both quantity and quality of food intake. To meet the minimum acceptable diet, the mother needs to feed her child diverse diet and the recommended number of meals in addition to breastfeeding or at least 2 milk feeds for non-breastfed infants. This can be difficult to achieve in poor societies [17]. This explains our findings that less than half children (47%) had received minimum acceptable diet.

In this study, being stunted was the most prevalent form of malnutrition secondary to anemia (16.2%, and 51.2%, respectively), the prevalence of stunting was higher among males compared to females (61.5% and 38.5 %, respectively). This was statistically significant (Table 4); this was consistent with [18], a study conducted upon under-five children in North Sudan, where the proportion of boys stunted was higher than girls (45.3% and 37.2%, respectively). The exact reason behind this may not be so clear; however, as boys spend most of the time outdoor, in contrast to girls, therefore, girls may receive more care by their families, however, some authors suggested that boys were more influenced by environmental stress than girls.

In this study, children born to short mothers were 2 times more likely to be stunted; this was also concluded by [19] where children born to mothers <150 cm in height were 3 times more likely to be stunted. This might also be explained by quite high prevalence of consanguinity (23.8%); so, genetic factors may play a role in this condition.

Mother age at giving her first birth was considered a contributing risk for malnutrition especially stunting, where children of mothers giving birth at younger ages were 5 times more likely to be stunted. This result was also concluded by [20] in Bangladesh where more stunted children belong to younger mothers (OR = 1.36, 95% CI = 1.11, 1.67).

Low-birth weight were 2 times more likely to be stunted than those with a normal birth weight. This highlights the importance of application of the 1000 Day Series to improve maternal and child health and help reduce morbidity and mortality in Egypt [21].

In our study, a significant association between anemia and stunting was found, which is quite common and can be expected among this vulnerable age group. A study was done among young Ethiopian children [22] and found a concurrent prevalence of stunting and anemia where 23.9% of them were anemic.

Regarding underweight, studied children who are suffering from underweight were 15.6% which is higher than the national figure_6 percent_ *(EDHS,* 2014). The difference can be explained by the trend of increasing in the prevalence of underweight over the last preceding years, from 2008, 2014, and till now, which is expected from deteriorated breastfeeding practices and increasing food insecurity and poverty rates in Egypt *(EDHS, 2014).* Underweight females were more than their male counterparts (60 and 40%, respectively), however, there was no significant statistical difference between studied children regarding their gender. The most affected age group was 12–23 mo, this could be attributed to many risk factors like breastfeeding, and there was a significant relation between exclusive breastfeeding duration and being underweight (p = 0.009).

In a previous study [23], there was a significant relation between suboptimal exclusive breastfeeding duration and underweight.

Social level was a predictor of being underweight, where children of lower social level were 1.1 times more likely to be underweight. This could be explained by the purchasing power of family to obtain nutritious food in adequate quantities. Besides, HB level was significantly associated with underweight, where children with lower HB levels were 2.6 times more likely to be underweight.

Childbirth weight was a common predictor of both stunting and underweight, children born as a low-birth weight were 9 times more likely to become underweight. This was proved by many researches where [24] children with low birth weight had significantly increased risk of becoming underweight compared to their counterparts with RR 1.47 (95% CI: 1.38–1.56).

Adequate dietary diversity had to be at least of four food groups daily, thus. In our study, children who did not receive adequate diet diversity were 5 times more likely to be underweight; this came in agreement with a study in Cambodia where [25] found that decreased dietary diversity was associated with underweight.

Regarding wasting, studied children who suffered from wasting were 9% which is higher than the national figure of 8% *(EDHS, 2014).* The prevalence of wasting is increasing gradually with time from 7% in 2008 to 8% in 2014 which necessitate national based interventions for improving the current situation from further deterioration.

The most affected age group was the oldest one (48–60 mo), however, there was no significant relation between child age and wasting (Table 4), this could be attributed to that wasting is a measure that reflects the effects of recent food shortage, or recent episodes of diarrhea or other illnesses that contribute to malnutrition, so, older children are more vulnerable to food shortage and infections, counter to younger children who are quietly protected by being breastfed. Dietary diversity and meal frequency were incriminated in wasting, where children receiving less diverse diets were 3 times more likely to be wasted. This was also concluded when a study done in Addis Ababa [26] among preschoolers where limited diet diversity associated with wasting (AOR: 0.33; 95% CI: 0.26–0.42).

Regarding anemia, Our results revealed that 51.2% of children suffer from anemia; which is quite higher than *EDHS* 2014 where the prevalence of anemia among under-five children was 27.2%, with a peak at age 9–11 months which is the period of complementary feeding, so children in this period considered a vulnerable group for anemia.

Suffering from anemia is a direct outcome of suboptimal food intake. Our study demonstrated a significant association with meal frequency, dietary diversity, and social level with anemia, a well-documented fact that poor families are not resilient enough to buy expensive high-biological value proteins or provide enough amounts of foods all time.

Moreover, the most affected age is those children between 12 and 23 months, this age group is most affected by stunting, and the strong relation between anemia and stunting is well documented by many researches where [27] found that stunted children had increased odds of developing anemia (OR: 1.76, 95% CI: 1.10–2.83).

Anemia in our study was strongly associated with all malnutrition forms (stunting, underweight, and wasting). This was expected as anemia actually a form of micronutrient deficiency which is a form of malnutrition and has the same causes. This association could be of practical importance in the prediction of anemia (paid blood test) from abnormal anthropometric measurements (free routine service in PHC units), especially among younger age group who are already seen routinely during vaccination. The physician or the nurse who takes anthropometric measures for the child can recommend blood hemoglobin test for malnourished child who detected during vaccination settings or PHC follow-up visits and consider the guidelines to recommend iron supplements for growth failure.

Conclusion

Stunting and anemia were the predominant nutritional problems among children so nutritional counseling for mothers is needed to improve feeding practices of their children.

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