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Original Article

Factors Affecting Nutritional Status of Infants Attending Primary Health Care Centers in Suez, Egypt

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Abstract

Background: Child malnutrition is one of the public health problems in Egypt. It might be affected by the political and economic transition occurring in Egypt and the Middle East.
Objective(s): Assessment of the nutritional status and related factors among infants attending urban and rural primary health care (PHC) centers in Suez Governorate.
Methods: This cross-sectional analytical study was conducted on 333 mother-infant pairs attending vaccination sessions in PHC centers in Suez Governorate. Participants were interviewed using a structured questionnaire for assessment of socio-demographic characteristics, feeding and weaning. In addition, weight and length were measured. Whenever affordable, a blood sample for hemoglobin estimation was taken from above one-year infants.
Results: Stunting was detected among 12.3% of infants, underweight among 12.9% and wasting among 9.3%. Infants with normal anthropometric measurements presented 77.2% of the sample. Being a female, with no history of sickness in the last two weeks were found to be predictors of normal nutritional status. Anemia was detected among 75.0% of examined infants (71.4% in urban and 78.2% in rural areas).
Conclusion: Assessment of the nutritional status of infants attending vaccination sessions in urban and rural health centers in Suez Governorate revealed that 28.2% are suffering from one or more form of protein energy malnutrition (PEM). Three quarters of examined infants suffered from anemia. These high levels of malnutrition among infants attending PHC services represent missed opportunities to implement health promotion and preventive activities in association with vaccination sessions.

Keywords: child nutritional disorders, malnutrition, middle east, public health

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INTRODUCTION

Egypt is recognized as one of the 36 countries in which the majority of the global burden of malnutrition falls. This executes a huge burden on Egypt's economy. Prevalence of stunting among under 5 children is higher than the average in the middle east and North Africa, while wasting has increased significantly since 2005 and is progressively rising.(1) Stunting is a sign of chronic malnutrition. According to the latest Egypt Demographic and Health Survey (EDHS) 2014, 20% of children are stunted. About 10% of children are wasted or underweight. Wasting is a sign of acute malnutrition. Rates of stunting and underweight are similar to those reported in 2000 and 2005 but wasting is somewhat increasing over time.(2)

Our country may be better than other low/middle - income countries, but some countries with comparable income have lower rates of child stunting.(3) Egypt has a little chance to encounter Global Nutrition Targets 2025 which are "Increase rate of exclusive breast feeding in the first six months up to 50%" and "40% decline in the number of under-five stunted children".(4)

Poor infant feeding practices, together with high rates of infectious diseases, are the main causes of malnutrition during the first two years of life.(5) Appropriate feeding practice depends on demographic, biological, social, and psychological variables.(6)

Introducing nutritionally-adequate and safe complementary feeding at 6 months together with continuing breastfeeding is essential for optimum growth. Complementary foods should be adequate in quality and quantity.(7)

In Egypt, 5341 Primary Health care (PHC) facilities provide child health care.(8) Child health care includes nutrition education, monitoring of growth and

development and immunization.[9] In 2014, 91% of children were considered fully immunized. [2] This finding reflects contact with the health care system which could be used for providing health promotion activities. There appears to be lost opportunities for maternal health education and support.[10]

The aim of the present study was to assess the nutritional status and related factors among infants attending PHC vaccination sessions in urban and rural centers in Suez Governorate.

METHODS

This is a cross-sectional analytical study. The study population was infants attending vaccination sessions in an urban and a rural PHC center in Suez governorate over a period of 15 months (April 2017 - June 2018).

The sample size was calculated using Epi-info software with 5% confidence limit and a prevalence of 21% of stunting in under five children.[2] The total sample size was calculated to be 256 from both centers. The study was conducted on 333 mother-infant pairs.

A convenient sample of mother-infant pairs was taken from the two centers. The sample was accessed through visiting the center on vaccination days (Saturday or Tuesday). Participants were interviewed using a structured questionnaire. Almost all questions were close-ended and answers were pre-coded. The socio-demographic part was adopted from Fahmi and El-Sherbini socio-demographic score.[11] Feeding practices questions were adopted from WHO/UNICEF tool.[12] The questionnaire consisted of the following sections: Socio-demographics (8 questions), breastfeeding (19 questions), artificial feeding (12 questions), complementary feeding and weaning patterns (14 questions) and current feeding (13 questions). In addition mothers were asked about history of sickness (diarrhea and/ or acute respiratory infection) in the last two weeks.

Anthropometric measurements were taken with calibrated equipment using a standardized protocol following the recommendations of International Standards for Anthropometric Assessment.[13] Weight and length were analyzed using ***WHO anthro-software*** (***version 3.3.2, 2011***).[14] Standard WHO Growth charts were used in the study including Z-scores for Length-for-age; weight- for-age and weight-for-length. Z-scores were exported to SPSS where they were analyzed to find the prevalence of malnutrition. Stunting was defined as < -2 SD length for age, wasting defined as < -2 SD weight for length and underweight defined as < -2 SD weight for age.[15]

Hemoglobin estimation is not a free service at the PHC. A blood sample was taken from 104 infants above one year, whose parents could afford the cost. Hemoglobin was estimated among 49 urban and 55 rural infants aged 12 months or more. Anemia was diagnosed if Hb level was less than 11.0 g/dl.

Pilot testing was done on 20 participants to check the clarity of the questionnaire and to estimate the contact time needed to complete the form.

Statistical analysis

All data were revised for completeness and inconsistencies. Pre-coded data was entered into Microsoft Office Excel software program and then transferred to version 24 SPSS to be cleaned and analyzed.

Categorical variables were summarized using frequency and percentage. Comparison between groups was performed using chi-square and Fisher's exact tests for categorical variables. Regression model was generated using logistic stepwise conditional regression to find the predictors of normal nutritional status. *P* value less than 0.05 was considered statistically significant.

Ethical considerations

The scientific and ethical committee of the Public Health and Community Medicine Department, Faculty of Medicine, Cairo University approved the study protocol in July 2017. The participation in the study was optional. Verbal consent from all participants was obtained after illustration of the study objectives before starting the interview. All data were confidentially handled.

RESULTS

The current study included 333 mother-infant pairs attending an urban and a rural health center in Suez Governorate. Age of infants ranged from 2-23 months. According to table 1 the anthropometric measurements showed an overall prevalence of underweight 12.9%, stunting 12.3%, and wasting 9.3%. Infants with normal anthropometric measurements for age presented 77.2% of the sample (79.5% among females and 75.1% among males) and were more among urban than rural infants with no statistically significant differences. In general, males suffered more of malnutrition except for wasting. However, differences were not statistically significant. Females suffered more than males from anemia with no significant difference.

The prevalence of stunting, underweight and wasting were higher among the rural group than the urban group with no statistically significant difference (Figure 1).

Hemoglobin was estimated among 49 urban and 55 rural infants aged 12 or more months. Anemia was detected among 75.0% of examined infants (71.4% in urban and 78.2% in rural centers) (Figure 2).

Table 1: Malnutrition and anemia among infants attending Primary Health Care Centers in Suez

Type of malnutrition	Males (n = 177)		Females (n = 156)		Total (n = 333)		*p- value**
	No.	(%)	No.	(%)	No.	(%)	
Stunting (low length for age)	27	15.3	14	9.0	41	12.3	0.082
Underweight (low weight for age)	26	14.7	17	10.9	43	12.9	0.303
Wasting (low weight for length)	15	8.5	16	10.3	31	9.3	0.577
Normal anthropometric measurements	133	75.1	124	79.5	257	77.2	0.346
Type of malnutrition	**Urban (n = 151)**		**Rural (n = 182)**		**Total (n = 333)**		***p- value****
	No.	**(%)**	**No.**	**(%)**	**No.**	**(%)**	
Any form of malnutrition	31	20.5	45	24.7	76	22.8	0.364
Normal anthropometric measurements	120	79.5	137	75.3	257	77.2	
Level of anemia	**Males (n = 59)**		**Females (n = 45)**		**Total (n = 104)**		***p- value****
	No.	**(%)**	**No.**	**(%)**	**No.**	**(%)**	
Mild	19	32.2	21	46.7	40	38.5	
Moderate	22	37.3	16	35.6	38	36.5	
Normal	18	30.5	8	17.8	26	25.0	0.216

* Chi-square test

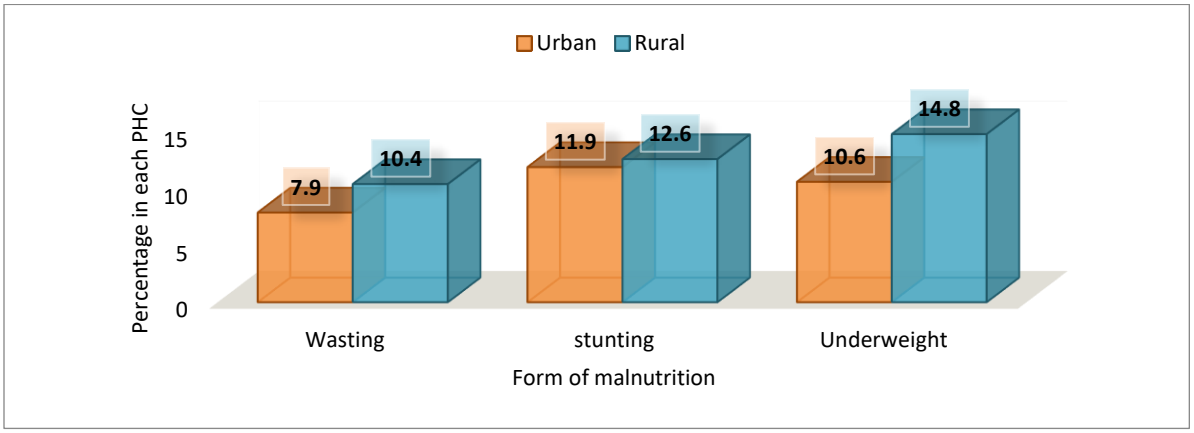

Figure 1: Malnutrition among infants attending Primary Health Care Centers in Suez

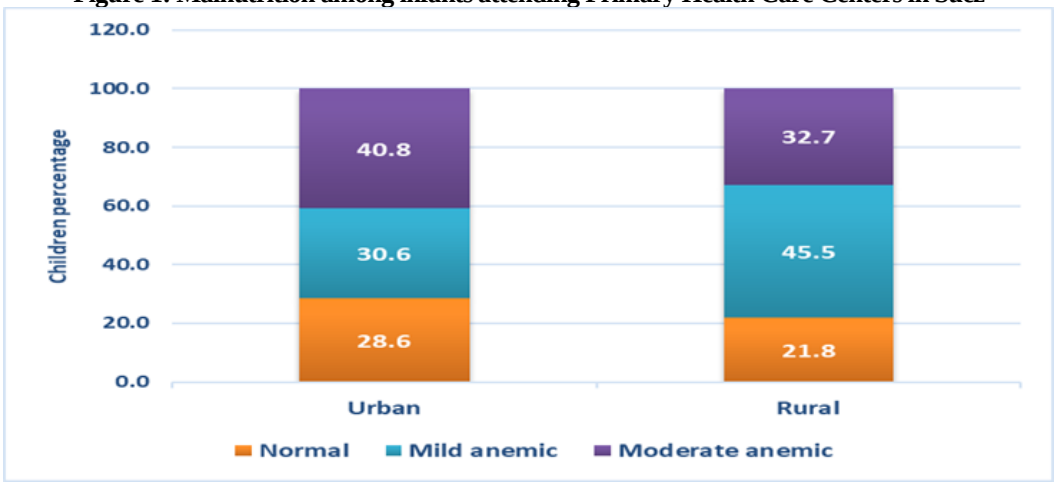

Figure 2: Anemia among infants attending Primary Health Care Centers in Suez

For infants, in the first six months of age, early initiation of breastfeeding was significantly associated with lower rates of all forms of malnutrition. Infants receiving exclusive breastfeeding for less than two months suffered more from stunting and underweight. Infants receiving artificial feeding suffered more from stunting (Table 2).

Table 2: Factors affecting the nutritional status of infants < 6 months attending Primary Health Care Centers in Suez

	Total (n = 91)	Stunting (n = 12)			Underweight (n = 16)			Wasting (n = 10)		
	No.	No.	%	p-value	No.	%	p-value	No.	%	p-value
Breastfeeding initiation										
Within 1 hour	**52**	**2**	**3.8**	**0.002***	**2**	**3.8**	**0.0001***	**2**	**3.8**	**0.015****
After 1 hour	**39**	**10**	**25.6**		**14**	**35.9**		**8**	**20.5**	
Pre-lacteal feeding										
Yes	**57**	**9**	**15.8**	**0.27****	**11**	**19.3**	**0.57***	**9**	**15.8**	**0.54****
No	**34**	**3**	**8.8**		**5**	**14.7**		**1**	**2.9**	
Exclusive breast-feeding duration										
Less than 2 months	**56**	**11**	**19.6**	**0.02****	**14**	**25.0**	**0.02****	**4**	**7.1**	**0.107****
2 – less than 4 months	**27**	**0**	**0.0**		**2**	**7.4**		**6**	**22.2**	
4 or more months	**8**	**1**	**12.5**		**0**	**0.0**		**0**	**0.0**	
Received artificial feeding										
Yes										
No	**35**	**8**	**22.8**	**0.039****	**8**	**22.8**	**0.327****	**3**	**8.3**	**0.397****
	56	**4**	**7.1**		**8**	**14.3**		**7**	**12.5**	
History of sickness in the last 2 weeks										
Yes	**14**	**0**	**0.0**	**0.120****	**4**	**28.6**	**0.201****	**4**	**28.6**	**0.042****
No	**77**	**12**	**15.6**		**12**	**15.6**		**6**	**7.6**	

*****Chi square ******Fisher exact test

For infants aged six months or more, higher prevalence of stunting was observed among infants receiving less than recommended meal frequency and among infants who had a positive history of sickness in the last two weeks. In addition, a higher prevalence of underweight was observed among bottle users (Table 3).

Table 3: Factors affecting the nutritional status among infants ≥ 6 months attending Primary Health Care Centers in Suez

	Total (n= 242)	Stunting (n = 29)			Underweight (n = 27)			Wasting (n = 21)		
	No.	No.	%	p-value	No.	%	p-value	No.	%	p-value
Diversity score										
< 4 food groups	**153**	**18**	**11.8**	**0.529***	**21**	**13.7**	**0.68***	**13**	**8.5**	**0.541***
≥ 4 food groups	**89**	**11**	**12.4**		**6**	**6.7**		**8**	**9.0**	
Meal frequency										
Less than recommended	**147**	**23**	**15.6**	**0.028***	**19**	**12.9**	**0.269***	**13**	**8.8**	**0.547***
As recommended for age	**95**	**6**	**6.3**		**8**	**8.4**		**8**	**8.4**	
Breastfeeding										
Ongoing	**175**	**21**	**12.0**	**0.97***	**21**	**12.0**	**0.492***	**18**	**10.3**	**0.148***
Weaned	**67**	**8**	**11.9**		**6**	**9.0**		**3**	**4.5**	
Baby bottle used										
Yes	**160**	**21**	**13.1**	**0.435***	**23**	**14.4**	**0.025***	**2**	**1.3**	**0.54****
No	**82**	**8**	**9.8**		**4**	**4.9**		**19**	**8.9**	
History of sickness										
Yes	**54**	**11**	**20.4**	**0.033***	**9**	**16.7**	**0.148***	**6**	**11.1**	**0.32****
No	**188**	**18**	**9.6**		**18**	**9.6**		**15**	**8.0**	

*****Chi square ******Fisher exact test

For infants 12 months or more of age accepting laboratory investigations, the prevalence of anemia was significantly higher among infants receiving less than recommended meal frequency and among those suffering from other forms of malnutrition (Table 4).

A logistic regression model was generated to control the effect of covariates on each other using stepwise logistic regression as a multivariate analysis relying on explored possible determinants to find the predictors of normal nutritional status. The entered variables were infant sex, age, mother education, mother work, crowding index, family size, child order, birth-weight, breastfeeding initiation, duration of exclusive breastfeeding, pre-lacteal feeding, baby bottle use, receiving artificial feeding, diversity score, meal frequency score, and history of sickness in the last two weeks.

A test of the full model against a constant only model was statistically significant (p = 0.013). Overall, the prediction success was 80.3%. Being a female with no history of sickness in the last two weeks, were found to be predictors of normal nutritional status (Table 5).

Table 4: Determinants of anemia among infants < 12months of age attending Primary Health Care Centers in Suez

	Total (n = 104)	Anemia (n = 78)		Normal (n = 26)		p-value*
	No.	No.	%	No.	%	
Diversity score:						
< 4 food groups	48	40	83.3	8	16.7	0.069
≥ 4 food groups	56	38	67.9	18	32.1	
Meal frequency score:						
Less than recommended	66	59	89.4	7	10.6	0.000
As recommended for age	38	19	50.0	19	50.0	
Malnutrition						
Malnourished (any form)	25	23	92.0	2	8.0	0.024
Normal anthropometric	79	55	69.6	24	30.4	

*Chi square

Table 5: Logistic regression analysis predicting normal nutritional status for infants attending Primary Health Care centers in Suez

Variables	Odds ratio	95% confidence interval for the odds ratio		p-value
		Lower limit	Upper limit	
Infant sex (female vs. male**)**	**2.34**	**1.12**	**4.88**	**0.02**
Birth-weight (normal vs. below normal**)**	2.68	0.99	7.22	0.05
Infant's order (>4th vs. < 4th**)**	0.36	0.02	4.96	0.44
Birth feeding initiation (within 1 hour vs. after 1 hour**)**	0.85	0.41	1.76	0.67
Pre-lacteal feeding (no vs. yes**)**	1.37	0.60	3.12	0.45
Bottle use (yes vs. no**)**	1.59	0.62	4.04	0.32
Ever artificial fed (no vs. yes**)**	0.41	0.68	0.27	1.70
Food diversity score (> 4 food groups vs. ≤ 4 food groups**)**	1.05	0.49	2.21	0.90
Meal frequency score (Adequate vs. inadequate**)**	1.56	0.71	3.44	0.26
Mother education (Secondary & above vs. Below secondary education**)**	2.09	0.87	5.04	0.09
Mother work (housewife vs. working mother**)**	1.49	0.49	4.52	0.47
Crowdedness index (≤ 2 vs. > 2**)**	1.09	0.48	2.43	0.83
History of sickness (No history of sickness in the last 2 weeks vs. There is history of sickness in the last 2 weeks**)**	**2.19**	**1.04**	**4.63**	**0.04**
Family size				
Reference 7 or more				0.17
(1) 3-4 members	0.18	0.02	1.35	0.09
(2) 5 members	2.50	0.15	39.72	0.51
(3) 6 members	1.49	0.10	21.94	0.77
Constant	1.009			**0.00**

DISCUSSION

Child malnutrition is an important public health problem. Nutrition-related factors contribute to about 45% of under-five child deaths.[16] According to UNICEF "Malnutrition is a violation of a child's right to survival and development".[17] Egypt loses significant sums of money yearly as a result of child under-nutrition through increased health care costs, additional burdens to the education system and lower productivity. An estimated 1.9% of Gross Domestic Product in 2009 are lost as a result of child under-nutrition. "Without measures to combat and eliminate under-nutrition, this cost is expected to increase by about 32% by 2025".[18] "Investment in nutrition brings high returns and is a key to meeting the SDGs".[19]

Child malnutrition is caused by several immediate and underlying factors. Multiple stakeholders, have to effectively work together to scale-up nutrition and realize the vision of "a world free from malnutrition by 2030".[19]

The Ministry of Health & Population is quite aware of the problem; child health care including nutrition care, growth monitoring, health and nutrition education and immunization are core components of PHC services.[9] Despite that, infant and child malnutrition is still unacceptably high compared to other countries with similar per capita incomes.[3]

In the present study, stunting has been identified as the "best overall indicator" of children's well-being; "it is a symptom of past deprivation and predictor of future poverty". [20] Our findings show a prevalence of 12.3%, which is lower than the latest national EDHS figures, even when compared to the same age groups.[2] The difference could be attributed to the difference in sampling, our sample is from attendance of a PHC center; it could also be a reflection of the general trend of decrease in prevalence observed in the last two national surveys.[2] However, our results are slightly higher than those of Jordon, an Arabian country having similar culture.[21]

Underweight was present among 12.9% of studied infants which is higher than the national EDHS figure of 5.5%. Wasting was also higher; 9.3% compared to 8.6%.[2]

As expected, infants can present by more than one form of under-nutrition. Infants not suffering from any form of deviated anthropometric measurement presented 77.1% of the group; indicating that 22.9% of infants in this age group are suffering one or more form of under-nutrition. We are still far behind Goal 2.2 of the sustainable development Goals (SDGs) 2030 which states: "By 2030, end all forms of malnutrition".[22]

Anemia was detected among 71% of tested infants whose parents agree to pay the fees for the test. This is not a representative sample; parents, who are suspecting or identifying their infants to be suffering health problems, were motivated for such a paid investigation. However, the percentage is still alarmingly high. The E***DHS*** 2014 reported a high prevalence of anemia among under-five children with a peak of 49.2% at age 9-11 months.[2] In our study, anemia was strongly associated with other forms of under-nutrition (stunting/ underweight and wasting). This is expected as malnutrition is related to same predisposing factors.[17]

The high prevalence of different forms of malnutrition is related to many predisposing/ associated factors. Some of these factors could not be modified through direct PHC interventions e.g. infant sex, mothers' education, family size and crowdedness index. Other factors could and should be addressed by proactive measures.

In the present study, attendants of PHC are supposed to be receiving the health promotion and preventive health services during antenatal, postnatal and under-five health care.[9]

Promotion and support of proper breastfeeding should start during antenatal care and extends through natal and postnatal care.[23] All urban and all except five rural deliveries were conducted at the hospital, where mothers are expected to receive support for proper initiation and future continuation of successful breast feeding. In our study, early initiation of breast feeding is significantly associated with lower prevalence of malnutrition among infants less than six months. This finding was consistent with many studies conducted in Africa and developing countries as Ghana which shows strong positive influence of early initiation of breastfeeding on infant health.[24] An Egyptian cohort study was assembled in two villages located in the Abu Homos district of El-Behera Governorate in Egypt. This study concluded that early initiation of breastfeeding has a positive influence on infant health through less episodes of diarrhea.[25] Our study as well as others'[1] have shown association between morbidity in the last two weeks and under-nutrition.

Other factors found to be related to malnutrition are exclusive breast feeding less than two months, artificial feeding, food diversity score and meal frequency. Only half of urban and one quarter of rural infants aged six or more months achieved minimum dietary diversity (≥ 4 food groups). The minimum recommended meal frequency for age was reported by 51.9% urban & 29.6% rural infants. All these findings reflect deficiency in the nutrition education activities provided by the PHC centers.

The risk of being malnourished was higher among LBW infants as seen in the regression analysis. These findings are consistent with previous studies in Zambia, Bangladesh, Malaysia, and Indonesia.[26, 27] LBW should be addressed by proper antenatal care.

According to UNICEF 2018 "Malnutrition is a preventable disease; we have the power to stop malnutrition before it starts."[17] Targets, approaches and policy briefs are set to address this issue. The six nutrition targets endorsed by the World Health Assembly in May, 2012, have been extended to 2030. [28] Comprehensive implementation plan on maternal, infant and young child nutrition and a policy brief have been developed by the WHO.[29]

In Egypt, 5341 Primary Health care (PHC) facilities provide child health care.[8] There is a great potential for implementing nutrition related interventions that could reach almost all infants and a great proportion of mothers. According to EDHS

2014, 99.4% of infants have received at least one vaccine.[2] PHC services cover the 1000 critical days of life (pregnancy and the first two years). It provides all direct and indirect nutrition interventions, including family planning and community outreach activities.

A USAID-funded Maternal and Child Health Integrated program (MCHIP) was implemented in Egypt in the period from October 2011–June 2014.[30] The project focused on the 1000 days approach to improve maternal and neonatal health and nutrition. It worked through community development associations in Upper and Lower Egypt to train physicians and Community Health Workers (CHWs) to improve newborn care, nutrition, and the use of modern family planning methods. The project developed 13 training manuals for physicians, nurses and CHWs. These could be used as resource material for health education activities.

Currently, UNICEF is engaged in specific action areas to support Egypt in developing a national policy plan to scale up a standardized model for the "first 1000 days" to improve infant and young child feeding related knowledge, behavior and practices and to strengthen the social protection framework to support government of Egypt to deliver nutrition sensitive interventions.[16]

CONCLUSION AND RECOMMENDATIONS

Assessment of the nutritional status of infants attending vaccination sessions in an urban and rural health center in Suez Governorate revealed that 28.2% were suffering from one or more form of protein energy malnutrition (PEM). Three quarters of examined infants suffered from anemia. Being a female, with no history of sickness in the last two weeks were found to be predictors of normal nutritional status. These high levels of malnutrition are unacceptable among infants attending PHC services and represent missed opportunities to implement health promotion and preventive activities in association with vaccination sessions. Findings of this study would help policymakers to design and implement evidence-based solutions to improve the nutritional status of infants.

CONFLICT OF INTEREST

No conflict of interest

FUNDING

No funding sources

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