

Determinants of Infant and Young Child Feeding Practices in Lower Egypt: A Community- Based Cross-Sectional Survey

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Abstract

Background: The optimal feeding practice in infants and young children is the key in shaping their adequate growth and development.

Methods: The study aimed to explore the multiple interactions that influence the complexity of infant feeding in Egypt and acknowledge the common beliefs, attitudes and practices regarding breastfeeding and weaning process. Energy and nutrients daily intake provided by complementary foods was also investigated. Structured interview survey gathering data on maternal feeding practices related to infants and young children, clinical and nutritional status of infants and their nutrient daily intake was administered to 235 mother-infant pairs recruited from Nile Delta.

Results: Exclusive breastfeeding was significantly reported in 55.8% ($p < 0.001$), being optimum in only 8.9 % of infants and significantly predicted in mothers aged 25-29 years. The complementary feeding started at ≥ 6 months in 58.3 % of infants and significantly based on commercial recipes ($p < 0.001$). Cessation of breastfeeding (34.5 %) was mainly associated with maternal perception of insufficient breast milk (16.2 %) and significantly associated with female gender ($p < 0.001$), rural residence ($p < 0.001$), maternal age (25-29 years), parental occupation and paternal education ($p < 0.001$). Calcium (58.7 %), vitamin B2 (45.1 %) and vitamin C (55.7 %) were the only nutrients adequately consumed.

Conclusions: In Egypt, infant and young feeding practices are still far from the recommended levels. Collaboration between government entities and non-profit organizations is required to improve maternal knowledge, beliefs, attitudes and practices.

Background

Optimal breastfeeding provides substantial short and long-term health benefits to infants and young children such as protection against infections, reduced risk of allergy and cardiovascular diseases [1]. Around 6 months of age, breastfeeding can no longer fulfill the daily requirements of energy and nutrients, hence, complementary foods are expected to bridge this gap in terms of quality and quantity [2]. Over the last decades, there has been increasing attention to the promotion of exclusive breastfeeding (EBF) accompanied by significant progress in action plans to achieve the goals of appropriate infant and young child feeding (IYCF) [3]. A series of reviews on maternal and infant nutrition showed that approximately 800,000 child deaths every year in low-income countries were attributed to suboptimal feeding practices [4]. Scientific reports from these countries have found that non-breast fed infants had mortality rate nine to ten times higher than breastfed ones during their first few months of life [3]. World Health Organization (WHO) in association with United Nations Children's Fund (UNICEF) recommended EBF for the first 6 months, thereafter introduction of safe, adequate complementary foods, with continued breastfeeding until 2 years and beyond; to achieve optimal breastfeeding [5]. However, In Egypt, IYCF patterns are still far from the recommended levels [6]. The wide range of infant practices, in the context of country basis, was usually overlooked by many authors who have concerned with breastfeeding,

particularly exclusive [7]. Therefore, the current study has three main objectives. Firstly, to explore the multiple interactions that emerge and influence the complexity of infant feeding in Egypt. Secondly, to acknowledge the common beliefs, attitudes and practices regarding breastfeeding and weaning process and thirdly to investigate energy and nutrients daily intake provided by complementary foods based on the guidelines of recommended daily allowances (RDA).

Materials And Methods

Study design and setting

We conducted a cross-sectional, community-based survey employing structured questionnaire through face-to-face oral interviews from July to December 2018. Study participants were childbearing-age women (15–49 years) who were recruited from maternal and child health care centers in two selected governorates in the Lower Egypt (Nile delta), Damietta and El-Dakahlia.

At the time of the study, approximately 43 % of Egyptian populations were inhabitants of the Nile Delta region which encompasses 9 administrative governorates and represents 2 % of the total area of the country. Purposive sampling was undertaken proportional to the size of rural and urban regions in the two governorates. Based on the population estimates from 2015 survey, the majority of residents in Damietta and El-Dakahlia governorates live in rural areas, with urbanization rate of 38.7 % and 28.2 %, respectively [8].

For this study, 4 health facilities providing maternal and child health care for large number of populations were purposively selected to be included in the study.

Study population

All mothers (15–49 years) who had children aged 0–24 months on the day of interview and living in the catchment area of the selected health facilities were invited to participate in the study. Caregivers rather than mothers attending with children, preterm infants, twins and those whose mothers refused to consent were excluded from the study. Only one complete questionnaire was considered for each mother to allow recruitment of more participants. A total of 250 respondents were interviewed of which 235 mothers completed the questionnaires, giving a response rate of 94 %.

Study instrument and administration

The survey was conducted by a team of seven postgraduate students, living in the sampled areas, in pursuit of their diploma degree at “National Nutrition Institute” and three experts in the fields of nutrition, pediatrics and public health. The survey tool was developed by one of the main authors (DA) with more than 15 years’ experience in the field of nutrition. The questionnaire was initially constructed and administered to participating mothers in Arabic then forward- translated into English by two independent bilingual experts acquainted with the medical terminology. Arabic and English versions of questionnaire are available from the authors.

A pre-coded, close-ended questionnaire was administered to gather information on three domains: (1) sociodemographic characteristics of study participants, (2) infant and young child feeding practices based on WHO indicators [9] and (3) clinical assessment of nutritional and health status of children. Anthropometric measurements of infants (weight and length) were measured and compared with the appropriate age- and sex-specific growth charts [10]. Capillary blood samples were collected by pricking heel or annular finger from each participating infant to directly measure the hemoglobin level using the portable HemoCue photometer (HemoCue AB, Ängelholm, Sweden). Also, WHO chart booklet of integrated management of childhood illnesses was employed to define and assess infant illnesses encountered one month prior to the study [11].

Infant dietary intake during the last 24 hours was collected using a structured 24-hour recall method at two time points during the study period with one week interval: the initial visit and scheduled follow-up. Mothers were instructed to provide detailed information about all foods and drinks consumed since the moment the infant woke up on the previous day till the moment he woke up on the day of interview. In addition, a validated Food Frequency Questionnaire (FFQ) was administered during the first visit for assessment of dietary intake one-month prior to the interview. Further details on FFQ were described elsewhere [12].

Local household utensils and standardized dishes were used to calculate portion sizes of different food items commonly consumed by Egyptians and identified by Egyptian Institute of Nutrition [13]. A set of digital photographs (n = 18) depicting standardized portion sizes were added for certain missing food items.

The food data retrieved from methods of dietary assessments were converted to estimate energy and daily nutrient intake using Egypt food composition databases [13, 14]. Considering these data, foods were categorized into five groups: dairy products, flesh foods, legumes/nuts, carbohydrates, fruits and vegetables.

Data reliability and validity

To ensure the reliability of data collection, small-group practice sessions were held over a six-day period to train interviewers for data collection, assessment and entry. Two principle investigators were assigned to monitor the adherence to the study protocol and ensure the integrity and quality of the data collected on weekly-basis during which the study progresses. In the same context, quality control measures including all study instruments and laboratory procedures were delegated to a group of trained investigators (n = 3). The survey was piloted in two health care centers two months before implementing the final study. Based on the pilot testing, minor modifications were made and incorporated in the last version of the questionnaire. Information and responses of pre-test participants were excluded from the results of the study.

Definitions

We used WHO general guidelines [9] for assessing IYCF practices to define the following:

Exclusive breastfeeding was defined as giving infant no other food or drink, not even water except breast milk at the time of interview. While there was considerable evidence that exclusive breastfeeding was not associated with complementary food since birth. *Artificial feeding* means feeding an infant, who is not currently receiving breast milk at all, artificial breast-milk substitutes including commercial infant formula and liquid, powdered or evaporated animal milk. *Mixed feeding* means giving other liquids such as infant formula and or/ food in association with breast milk. For this study, *low birth weight (LBW)* has been defined as infant whose birth weight was less than 2500 grams despite being full term [15]. We also used the term “*weaned*” to imply the complete cessation of breastfeeding.

For clinical assessment of nutritional status, the following terminology was adopted: *Underweight* defined for infants whose weight for age < - 2 standard deviations (SD) of the WHO Child Growth Standards median [9]. *Stunting*: height for age < - 2 SD of the WHO Child Growth Standards median. *Wasting*: weight for height < - 2 SD of the WHO Child Growth Standards median. *Overweight*: weight for height > + 2 SD of the WHO Child Growth Standards median. *Anemia* was defined as a condition characterized by a decrease in the concentration of hemoglobin in the blood below the age and gender-specific cut-off points [10].

Dentition status was evaluated according to the primary teeth eruption chart provided by American Dental Association (ADA) (<http://www.ada.org/en>).

Based on World's Bank international poverty's lines cut off points, a person in Egypt is considered *extremely poor, poor, near poor and not poor* if he spends ≤ \$1, \$1–1.99, \$2–2.99 and ≥ \$3) per day, respectively. These figures were converted from Egyptian pounds to US\$ according to the market exchange rate during the study period (2015) [16].

Data analysis

All data were computed using Microsoft Excel 2010 and analyzed with Statistical Package for the Social Science (SPSS) Version 16 (SPSS for Windows, Version 16.0; SPSS Inc, Chicago, IL). Descriptive statistics was used for illustrating the mean and standard deviation (SD) for quantitative data, while simple frequency tables were utilized for simple qualitative variables. Statistical tests were used to determine significant differences between the results of patients and controls. Bivariate analysis was done using Chi-square and Fisher exact tests to examine the relationships between dependent and independent categorical variables. A multi-variable logistic regression model was constructed to identify the socio-demographic variables associated with cessation of breastfeeding. The differences between proportions were assessed using the P value for heterogeneity. A P value < 0.05 was considered statistically significant.

Results

General description of study population

In total, 235 mother-infant pairs participated in the current study with response rate 94 %. Their socio-demographic characteristics are shown in Table 1. The mean age of infant participants was 12 (\pm 5.1) months, with the majority (61.3 %) being aged 6 to 12 months. Approximately 4 % of infants experienced developmental delays and 12 % exhibited delayed primary tooth eruption.

Table 1
Socio-demographic data of study participants

Characteristics	Number	%
Infant characteristics		
Gender		
- Males	117	49.8
- Females	118	50.2
Age (months) ^a	12 ± 5.1 (5–24)	
- 0–6 months	6	2.6
- 6–12 months	144	61.3
- 12–24 months	85	36.2
Birth weight		
- Normal	225	95.8
- Low	10	4.3
Mile stones		
- Normal	226	96.2
- Delayed	9	3.8
Teeth eruption		
- Normal	207	88.1
- Delayed	28	11.9
Residence		
- Urban	63	26.8
- Rural	172	73.2
Maternal age (years)		
- 19–24	41	17.5
- 25–29	157	66.8
- 30–35	37	15.7
Maternal education [years (y)]		

^a Values are expressed as mean ± Standard deviation (range)

Characteristics	Number	%
- Illiterate/no education	6	2.6
- 1ry incomplete (≤ 6 y)	3	1.3
- 1ry complete and some sec (6- <12 y)	12	5.1
- Sec./vocational complete, higher (≥ 12 y)	214	91
Father education [years (y)]		
- Illiterate/no education	7	3
- 1ry incomplete (≤ 6 y)	2	0.9
- 1ry complete and some sec (6- <12 y)	9	3.8
- Sec./vocational complete, higher (≥ 12 y)	217	92.3
Maternal occupation		
- Housewives	139	59.2
- Working for cash	96	40.9
Father occupation		
- Working for cash	233	99.1
- Not working for cash	2	0.8
Family income		
- Low (extremely poor/poor)	7	2.9
- Medium (near poor)	206	87.7
- High (not poor)	22	9.4
Maternal marital status		
- Currently married	232	98.7
- Single	3	1.3
^a Values are expressed as mean \pm Standard deviation (range)		

The majority of participating mothers lived in rural areas (72.8 %), being aged 25–29 years (66.8 %), had ≥ 12 years full-time education (91%) and were housewives (59.2 %).

Assessment of nutritional and clinical health status of study infants

In terms of anthropometry, 63.8 % of studied infants demonstrated normal weight measurements and 32.3 % were identified as being stunted (Table 2). The anemic group comprised 202 infants (86 %) with hemoglobin levels below 5th percentile and those whose hemoglobin percentile values fluctuated between 5th and 50th percentiles for age (Table 2).

Table 2
Nutritional status of participating infants

Anthropometry	Number	%
<i>Weight (Kg)</i> ^a (mean ± SD)	9.7 ± 2.2 (5–17)	
- < 2nd percentile	4	1.7
- 5 - < 50th percentile	72	30.6
- ≥ 50th – 97th percentile	150	63.8
- > 97th percentile	10	4.3
<i>Length (cm)</i> ^a (mean ± SD)	72.7 ± 9.3 (50–94)	
- < 2nd percentile	76	32.3
- 5 - < 50th percentile	75	31.9
- ≥ 50th – 97th percentile	55	23.4
- > 97th percentile	29	12.3
Hemoglobin (mg %) ^a (mean ± SD)	10.9 ± 1.3 (8–13.5)	
- < 5th percentile	145	61.7
- 5- < 50th percentile	57	24.3
- ≥ 50th – 97th percentile	33	14
- > 97th percentile	0	0
^a <i>Values are expressed as mean ± Standard deviation (range)</i>		

Common infant illnesses encountered during the last month prior to the study are presented in Fig. 1. The mothers reported different types of illness, with prevalence of fever (52.8 %), diarrhea (21.7 %) and vomiting (17.5 %). Twelve infants (5.1 %) exhibited allergic reactions (e.g. atopic dermatitis, rash, runny nose, itching, gastrointestinal manifestation...etc.) to a particular food started in the age range of 1 to 9 month. Of those, only 7 patients had physician-diagnosed food allergy.

We roughly evaluated the digestive tolerance of the entire study infants. On assessment of bowel movements and fecal characteristics, the majority of studied infants had regular bowel habits ranged from 0 to 6 motions/day with a mean of 2 (SD = 1.02) motions daily. Only 2.6 % (n = 6) of the infants had, on average, one bowel movement every three days. Based on the mothers' estimates regarding the

infant's fecal consistency, 31 respondents naturally produced soft stool of an average volume and frequency, with 41.2 % (n = 14) and 22.6 % (n = 7) of these subjects were exclusively breastfed and bottle-fed, respectively ($p = 0.031$).

Infant feeding practices

Table 3 shows the details of maternal feeding practices for infants and young children during 1st two years of life. More than half (55.8 %) of the study mothers had significantly reported to exclusively breastfeed their infants ($p < 0.001$). Only, 8.9 % of them have been recognized as feeding their infants optimally. Forty-four percent of study infants (n = 103) started receiving cow's milk at the mean age of 4.3 (SD = 5.3) months and one-fifth of these infants have significantly consumed whole milk compared to those drinking low-fat and skimmed milk ($p < 0.001$). All participating mothers were supplementing their infants with plain water from 1 to 7 months of age, with a mean age of 4 (SD = 1.8) months. On inquiring about pacifiers, more than three-quarters (77 %) of the study infants were not currently using it Table 3.

Table 3
Distribution of maternal feeding practices for infants and young children during first two years of life

Feeding practices	Number (%)
Type of infant milk feeding	
- Exclusive breastfeeding	131 (55.8)
- Formula feeding	35 (14.5)
- Mixed	23 (9.8)
Weaned (not breastfed)	46 (19.6)
- Frequency of feeding/day ^a	
- Breastfeeding	4 ± 3.7 (1-8)
- Formula feeding	1 ± 2 (1-10)
Duration per feed (minutes)	
- < 10 min	85 (36.2)
- 10-19 min	70 (29.8)
- 20-30 min	21 (8.9)
- > 30 min	13 (5.5)
Cow's milk	
- Yes	103 (43.8)
- No	132 (6.2)
Onset of Cow's milk intake (months) ^a	4.3 ± 5.3 (4-18)
Types of Cow's milk	
- Whole milk	50 (21.3)
- Low-fat	32 (13.6)
- Skimmed	21 (8.9)
Age at introducing Plain water (months) ^a	4 ± 1.8 (1-7)
Infant's pacifier	
- Yes	54 (23)
- No	181 (77)
^a Values are expressed as mean ± Standard deviation (range)	

Table 4 shows the complementary feeding practices of the interviewed mothers. Almost all respondents (n = 234, 99.6 %) have initiated complementary feeding, with the majority of them started to introduce solid, semi-solid and soft food at the age of 6 month (58.3 %). Insufficient breast milk (n = 38, 16.2 %), other maternal concerns (n = 27, 11.5 %) and infant milk refusal (n = 22, 9.4%) were the most common reasons significantly reported for cessation of breastfeeding ($p < 0.001$). The group of mothers (69.8 %) commenced the weaning process using commercial baby food was significantly more than those (29.8 %) who used fresh food ingredients made at home ($p < 0.001$).

Table 4
Distribution of complementary feeding among study participants

	Number (%)
Cessation of breastfeeding	81 (34.5)
Onset of cessation [Mean \pm SD] (months) ^a	3.3 \pm 5.9 (1–22)
Reasons for cessation of breastfeeding	
– Maternal health problems	19 (8.1)
– Maternal concerns	27 (11.5)
– Return to work	19 (8.1)
– Infant illness	1 (0.4)
– Insufficient milk	38 (16.2)
– Infant breast refusal	22 (9.4)
Introduction of solid, semi-solid and soft food	234 (99.6)
Onset of introducing food	
– < 6 months	98 (41.7)
– \geq 6 months	137 (58.3)
Source of food	
– Home-made only	70 (29.8)
– Home- made and commercial	164 (69.8)
Reasons for using commercial food (n = 164)	
– Maternal work	46 (28)
– Recommended from others	66 (40.2)
– More nutritious	95 (57.9)
Frequency /day ^a	3 \pm 0.6 (1–5)
Number of snacks/day ^a	2 \pm 0.9 (1–4)
Method of serving food	
– Bottle with nipple	70 (29.8)
– Cup	164 (69.8)
^a Values are expressed as mean \pm Standard deviation (range)	

	Number (%)
- Spoon	0
Vitamin/mineral supplement intake	
- Yes	201 (85.5)
- No	34 (14.5)
Types of supplements (n = 201)	
- Calcium	118 (58.7)
- Vitamin D	92 (45.8)
- Iron	69 (34.3)
^a Values are expressed as mean ± Standard deviation (range)	

Decisions of using readymade commercial baby food were significantly influenced ($p < 0.001$) by maternal beliefs of being more nutritious (57.9 %) and recommendations from others (40.2 %). Relatives/friends (75.3 %) and health care professionals (61.7 %) were the most commonly cited sources of knowledge and advice for all study participants (Fig. 2). Among all infants of the study, 50.2 %, 39.2 % and 29.4 % were regularly given calcium, vitamin D and iron supplements, respectively.

As shown in “Fig. 3”, the type of complementary food varied within the age group. Infants who started complementary feeding younger than 6 months of age significantly consumed dairy products (n = 61) and fruits (n = 48) compared to other food groups. Fruits/vegetables (n = 155) and carbohydrates (n = 153) were the most common food items in the weaning process initiated for infants aged 6–8 months. In addition, flesh foods (n = 105) were the commonest in the diet of infants aged 9 to 12 months. Of those who started complementary feeding, there was statistically significant difference for using cup (69.8 %) compared to bottle and spoon feeding ($p < 0.001$) Table 4.

As presented in “Fig. 4”, the overall prevalence rate of herbal use was 49.8 %. Although giving herbal remedies was attributed to many reasons, relief of infant colic (n = 59, 25.1 %) and promoting infant sleep at night (n = 48, 20.4 %) were the most common causes significantly reported by study mothers ($p < 0.001$).

The nutrient content of infant foods was comprehensively investigated (Table 5). Based on the WHO reference dietary intake values, the study revealed that the majority of participating infants were more likely to consume higher nutrient intake of energy, proteins, fat, and micronutrients including sodium, potassium, phosphorus, magnesium and zinc ($p < 0.001$) than recommended. In the same context, 81.3 %, 95.8 % and 67.2 % of the infant participants received inadequate intake of iron, selenium and vitamin A, respectively ($p < 0.001$).

Table 5

Assessment of nutrient content (macronutrients and micronutrients) of infant food among study respondents

	Mean \pm SD ^a	RDA ^b			P value
		Adequate Intake (AI)	< RDA Intake	> Tolerable Upper Intake Levels (UL)	
		N (%)	N (%)	N (%)	
Energy (K/Cal)	919.3 \pm 308.4 (135.5- 1803.6)	29 (12.3)	49 (20.9)	72 (30.6)	< 0.001
Proteins	28.4 \pm 10.9 (2.1–55.6)	15 (6.4)	8 (3.4)	212 (90.2)	< 0.001
Fat	37.5 \pm 15.9 (1.9-100.9)	39 (16.6)	47 (20)	64 (27.2)	0.016
Carbohydrates	116 \pm 46.7 (26.1- 316.2)	69 (29.4)	87 (37)	79 (33.6)	0.211
Fibers	2.5 \pm 3.6 (0-18.5)	N/A	95 (40.4)	N/A	-
Iron	4.8 \pm 4.8 (0.4–27.4)	44 (18.7)	191 (81.3)	N/A	< 0.001
Calcium	395 \pm 104.3 (14.2– 600)	138 (58.7)	69 (29.4)	N/A	< 0.001
Phosphorus	494.8 \pm 249.6 (18.2– 1532)	40 (17)	64 (27.2)	131 (55.8)	< 0.001
Magnesium	90.6 \pm 34.7 (6.7–253)	18 (7.7)	59 (25)	158 (67.2)	< 0.001

^a Values are expressed as mean \pm Standard deviation (range), ^b Values are expressed as number of infants (percentage), RDA; Recommended Daily Allowance, AI; Adequate Intake, UL; Tolerable Upper Intake Levels

	Mean \pm SD ^a	RDA ^b			P value
		Adequate Intake (AI)	< RDA Intake	> Tolerable Upper Intake Levels (UL)	
		N (%)	N (%)	N (%)	
Sodium	6.02 \pm 5.1 (0.08– 29.2)	3 (1.3)	N/A	232 (98.7)	< 0.001
Potassium	11.1 \pm 4.5 (1.6–25.8)	1 (0.4)	N/A	234 (99.6)	< 0.001
Selenium	10.4 \pm 5.9 (0.5–36.7)	10 (4.3)	225 (95.8)	N/A	< 0.001
Zinc	5.9 \pm 3.7 (0.1–21.7)	77 (32.8)	58 (24.7)	100 (42.6)	0.130
Vitamin A	387.4 \pm 169.1 (5.6-684.7)	66 (28.1)	158 (67.2)	11 (4.7)	< 0.001
Vitamin B1	0.3 \pm 0.2 (0.0-0.9)	112 (47.7)	123 (52.3)	N/A	< 0.001
Vitamin B2	0.7 \pm 0.5 (0.0–2.4)	106 (45.1)	91 (38.7)	38 (16.2)	< 0.001
Vitamin C	35.9 \pm 15.6 (0.0-59.9)	131 (55.7)	104 (44.3)	N/A	< 0.001
^a Values are expressed as mean \pm Standard deviation (range), ^b Values are expressed as number of infants (percentage), RDA; Recommended Daily Allowance, AI; Adequate Intake, UL; Tolerable Upper Intake Levels					

Table 6 shows the socio-demographic variables associated with cessation of breastfeeding (n = 81, 34.5 %) using multivariate regression analysis model. With respect to their demographic characters, gender and residence were the only variable significantly associated with early discontinuation of breastfeeding ($p < 0.05$). Working parents, family income, marital status, maternal age and paternal education were identified as significant variables associated with cessation of breastfeeding ($p < 0.05$) (Table 6).

Table 6

Socio-demographic variables associated with cessation of breastfeeding using multivariate logistic regression analysis model

Variables	Category* N (%)	Coefficients	SE	t Stat	P-value	CI 95 %	
						Lower	Upper
Gender							
- Males	37 (45.7)	0.008	0.003	2.562	0.011	0.002	0.014
- Females	44 (54.3)						
Birthweight							
- Normal	74 (91.4)	0.006	0.003	1.817	0.071	-0.0004	0.011
- Low birth weight	7 (8.6)						
Maternal age (years)							
- 19-24	23 (28.6)	-0.251	0.009	26.668	< 0.001	-0.269	-0.233
- 25-29	53 (65.7)						
- 30-35	5 (5.7)						
Residence							
- Urban	59 (23.7)	- 0.239	0.011	21.404	< 0.001	-0.261	-0.217
- Rural	22 (76.3)						
Maternal education attainment							
- Illiterate/no education	1 (3.1)	0.002	0.019	0.088	0.930	-0.039	0.036
- 1ry incomplete (≤ 6 y)	1 (1.5)						
- 1ry complete and some sec (6- <12 y)	4 (5.3)						
- Sec./vocational complete, higher (≥ 12 y)	75 (90.1)						
Paternal education							
- Illiterate/no education	1 (1.2)						

* Number and percent of infants stopped breastfeeding, SE; Standard Error, CI; Confidence Interval,

Variables	Category*	Coefficients	SE	t Stat	P-value	CI 95 %	
	N (%)					Lower	Upper
- 1ry incomplete (≤ 6 y)	1 (1.2)	-0.196	0.026	7.588	< 0.001	-0.246	-0.145
- 1ry complete and some sec (6- <12 y)	3 (3.7)						
- Sec./vocational complete, higher (≥ 12 y)	76 (93.8)						
Maternal occupation							
- Housewives	39 (48.1)	-0.019	0.006	3.626	< 0.001	-0.031	-0.009
- Working	42 (51.9)						
Paternal occupation							
- Working	79 (97.5)	0.149	0.035	4.468	< 0.001	0.084	0.215
- Not working	2 (2.5)						
Family income							
- Low	0	-0.022	0.008	2.645	0.009	-0.038	-0.006
- Medium	72 (88.9)						
- High	9 (11.1)						
Maternal marital status							
- Married	80 (98.8)	0.12	0.033	3.117	0.002	0.039	0.172
- Divorced	1 (1.2)						
* Number and percent of infants stopped breastfeeding, SE; Standard Error, CI; Confidence Interval,							

Discussion

The rates of exclusive breastfeeding vary substantially across the populations and even between different regions within the same country (1 % – 89 %) [17]. The current study revealed unexpectedly high rate of EBF in sampled Egyptian mothers (55.8 %). This was approximately 1.5 to 5 times higher than the rates reported from Egypt (29.9 %, 32 %, and 9.7 %) [18–20], Africa (35.7 %) [21] and other Arab countries (25 % and 16.3 %), respectively [22, 23]. Although, our prevalence exceeded the global and regional trends (39 %) in the developing countries [24], higher rates were reported from recent studies conducted in Egypt (65 %) and Northwest Ethiopia (74.1 %) [25, 26]. Employing different survey strategies, coexistence of

various perspectives, cultural norms and traditional beliefs may have influenced such difference. Moreover, participants were predominately non-working mothers who were full-time housewives (n = 139, 59.1 %), supposed to spend considerable amount of time taking care of their infants. This observation wasn't identified as being associated with EBF in our study (p = 0.085), however it was in agreement with other researches from the Middle East [27] and Asia [28] where the working mothers were more likely to abandon EBF.

Inconsistent with previous studies from Egypt [18, 20, 23, 25], we identified maternal age of 25–29 years (68.3 %) as being the only predictor correlated with EBF (p < 0.001). A survey of 349 Latin mothers found that younger mothers were more likely to exclusively breastfeed their infants [29]. Although not statistically significant, most of those mothers (n = 154, 98.1 %) had earned a high education credentials. Similar results were also observed in studies from Egypt and other developing countries [18, 19]. This education level may influence the rate of EBF through increasing knowledge about its benefits and improving mothers' attitudes; which will eventually improve their practices.

Although Islamic teachings of Koran recommend breastfeeding until 2 years of age [30], infant feeding is still a subject of intense debate within the Egyptian community [31]. Based on our results, more than nine-tenths of the respondents (91.1 %) exhibited suboptimal feeding practices. For example, only a small proportion of mothers (n = 18; 11.6 %) practiced effective breastfeeding in terms of positioning and attachment as evaluated by WHO B-R-E-A-S-T- Feed Observation Form [32], with the majority of them aged 30–35 years (n = 17; 94.4 %). Eighty-one mothers, comprising more than one third of the total respondents (34.5 %), prematurely terminated breastfeeding at a mean infant age of 3.3 (SD = 5.9) months. Perceived insufficient milk-supply, maternal concerns about infant weight gain and infant breast refusal were the most frequent reasons addressed for discontinuation of breastfeeding, a finding corroborated by other studies [33, 34].

The current study investigated infant and parental socio-demographic factors as determinants of breastfeeding cessation. Consistent with other studies [33, 35], we found maternal age, occupation and residence had significant negative impact on mothers' infant feeding decisions. This highlights the importance of antenatal health educational programs as a key entry-point for improving future trends in maternal and infant nutrition. Orientation of maternal stressors existing within a broader social context such as working and living conditions could combat the early termination of breastfeeding.

The last three decades have seen a remarkable increase in using bottle-feeding, particularly in developing countries. This use has drastically compromised breastfeeding either by being a substitute or complementary to breast milk [36]. This finding was reported in 24.7 % (n = 58) of the study participants, predominantly in middle-class mothers (n = 48, 82.2 %) residing in urban areas (n = 38, 65.5 %). Similar trends have been identified in a recent study which reported higher rates of artificial milk consumption in low-income countries compared to middle-income ones [37]. Despite significant global progress in implementing International Code Marketing of Breast-milk Substitutes, several factors such as innovative long-term and in-depth strategies, particularly digital marketing along with constraints in enforcement of

the Code under various national laws have been linked to increased prevalence of bottle-feeding [38]. Moreover, Egyptian Government has maintained a budget of ~ 50 million US dollars for subsidizing infant milk formulas with subsequent decline in EBF rate [39]. As noted in earlier study [40], we found that 58.6 % (n = 34) of bottle-fed infants had non-working mothers. This may be related to the relatively higher number of housewife participants in the current survey.

Solid, semi-solid and soft foods were introduced by almost all participants at the time of the study. Significantly, more than half of study infants (58.3 %) started receiving complementary food at ≥ 6 months of age ($p < 0.001$) in addition to breast milk. Consistent with other studies [41, 42], we recognized socio-cultural factors as major determinants of complementary feeding practices. For example, 73.4 % of the study mothers had acknowledged giving herbs, plain water, non-milk fluids and dropping night milk feeds as the most common inherited beliefs frequently practiced in rural and urban settings.

Family members, relatives and friends played a fundamental role in shaping the process of weaning in terms of onset, sources and contents (n = 75.3 %, $p < 0.001$). These practices are probably similar in most developing countries from Africa and Asia [39, 41, 42]. Yet, there was ample evidence that the health care providers had influenced the maternal attitudes towards infant feeding displayed in 61.7 % of study mothers. Recent studies found that the grandmothers and healthcare providers have a significant impact which is more likely to be associated with adverse infant and maternal health outcomes [43, 44]. This poses a challenge for setting multicomponent interventions tailoring messages for mothers, household members, particularly older adults, and primary health care personnel.

For all children younger than 2 years of age, growth and development entail high nutrient needs; therefore, complementary foods should be optimal in terms of affordability, diversity and being nutrient-rich [45]. In the majority of developing countries, commercial fortified infant foods are often far away and purchasing those products is beyond the mean of the poor [3], however, we found that diets predominantly based on home-made recipes were significantly consumed lower than commercially-prepared ones ($p < 0.001$).

Based on the analysis of daily intakes from all food sources, this study revealed that the infants aged 5–24 months of age appeared to have inadequate dietary intake except for calcium, vitamin B2 and vitamin C which significantly met their recommended reference values ($p < 0.001$). The mean energy, proteins and fat daily consumption was substantially higher than recommended ($p < 0.001$), a finding found to be consistent across different countries around the world [47]. An increased consumption of dairy products (n = 209, 88.9 %) or milk, including cow's milk and formula, put infants, particularly the 1-year old, at risk of being overweight, a prediction confirmed in 52.7 % of infant participants (n = 124) [46].

Consistent with previous study [47], we reported a considerable percentage of infants exceeding the Tolerable Upper Intake levels for sodium, potassium, magnesium, phosphorus and zinc.

In the same context, consumption of carbohydrates, fibers, iron, selenium, vitamins A and B1 was below recommendations for the vast majority of infants ($p < 0.001$). This may be attributed to the fact that fiber is linked only to carbohydrate portion of the diet which is reduced in the Arab Middle East diet. Moreover,

a study conducted in Lower Egypt demonstrated lack of dietary diversity and daily meal frequency that might contribute to such insufficient intake [48]. Based on previous studies, consuming recommended portions from different food groups instead of a specific one was associated with adequate micronutrient intake [49].

In contrast to data from other Arab countries [48, 49], fruits and vegetables were considered essential for meals commonly served to 93.6 % (n = 220) of infant participants. This dietary consumption pattern of vitamin C-rich food along with inadequate iron intake can largely explain the high prevalence rate of anemia in our study.

Similar to other studies [50, 51], undernutrition, predominantly, stunting, was prevalent across all age groups. Inadequate breastfeeding, poor weaning practices and recurrent diarrhea have been reported as risk factors for undernutrition in developing countries [50, 51].

Although these findings had identified that the Egyptian mothers may share some common features with women from other Arab countries, however, they sustain more healthy food choices.

The findings of the current study should be interpreted in view of its strengths and limitations.

The current study is cross-sectional study relying on the mothers' memories, which may be subject to recall bias; as most of study participants were interviewed 5–24 months after childbirth. The relatively small sample size may be not sufficient to yield a good indicator for IYCF practices in Egypt. Moreover, we couldn't evaluate all potential confounding factors that might be associated with infant feeding and weaning practices. For example, a lot of participants refused to give data on infant's birth order and family size. The fact that many Egyptians continue to hold a strong superstitious belief in "Evil Eye", which is so much dreaded, particularly by mothers in reference to their children, along with concerns of being interviewed in overcrowded facilities, with long queues and lack of adequate privacy may be related to such response. Nonetheless, to the best of our knowledge, few studies have been reported in Egypt investigating the daily food intake in children ≤ 2 years of age with concomitant diversity of dietary patterns observed in Egyptian community.

Conclusions

In conclusion, maternal feeding beliefs, attitudes and practices exert strong influence on infant and considered a key that shapes his growth and development either positively or negatively. Collaboration between government entities and non-profit organizations is required to set a strategic framework for improving maternal and child health. Implementation of population-based mass media breastfeeding campaign, expansion of primary health care facilities, introducing mobile health clinics particularly in remote areas and frequent home visits by community health workers would contribute to raise the awareness and improve the breastfeeding practice.

Abbreviations

ADA: American Dental Association; EBF: exclusive breastfeeding; FFQ: Food Frequency Questionnaire; IYCF: infant and young child feeding; LBW: low birth weight; RDA: recommended daily allowances; SD: standard deviation; SPSS: Statistical Package for the Social Science; UNICEF: United Nations Children's Fund; WHO: World Health Organization

Declarations

Ethics approval and consent to participate

Approval was acquired from the Research Ethics Committee of Clinical Nutrition Institute before commencing the study. All study-related procedures and examinations were conducted as per the declaration of Helsinki. In the context of limited literacy of Egyptian community and political concerns with signing documents, oral consent was approved for the study. Participants were informed about the purpose of the research and voluntary nature of participation. They were asked for verbal consent to interview and assured of data confidentiality.

Consent for publication

Not applicable

Availability of data and material

The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors have declared no competing interests.

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Authors' contributions

NEK conceived and planned the study, supervised the project, validated the data and assisted with writing up. EMIM conceived and planned the study, assisted in the data validity, performed the formal analysis and wrote the original manuscript draft. DHME conceived and planned the study, collected and validated the data and supervised the project. ST assisted in data collection and analysis. All authors read and approved the manuscript.

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Figures

Fig.1 Infant health problems during the last month

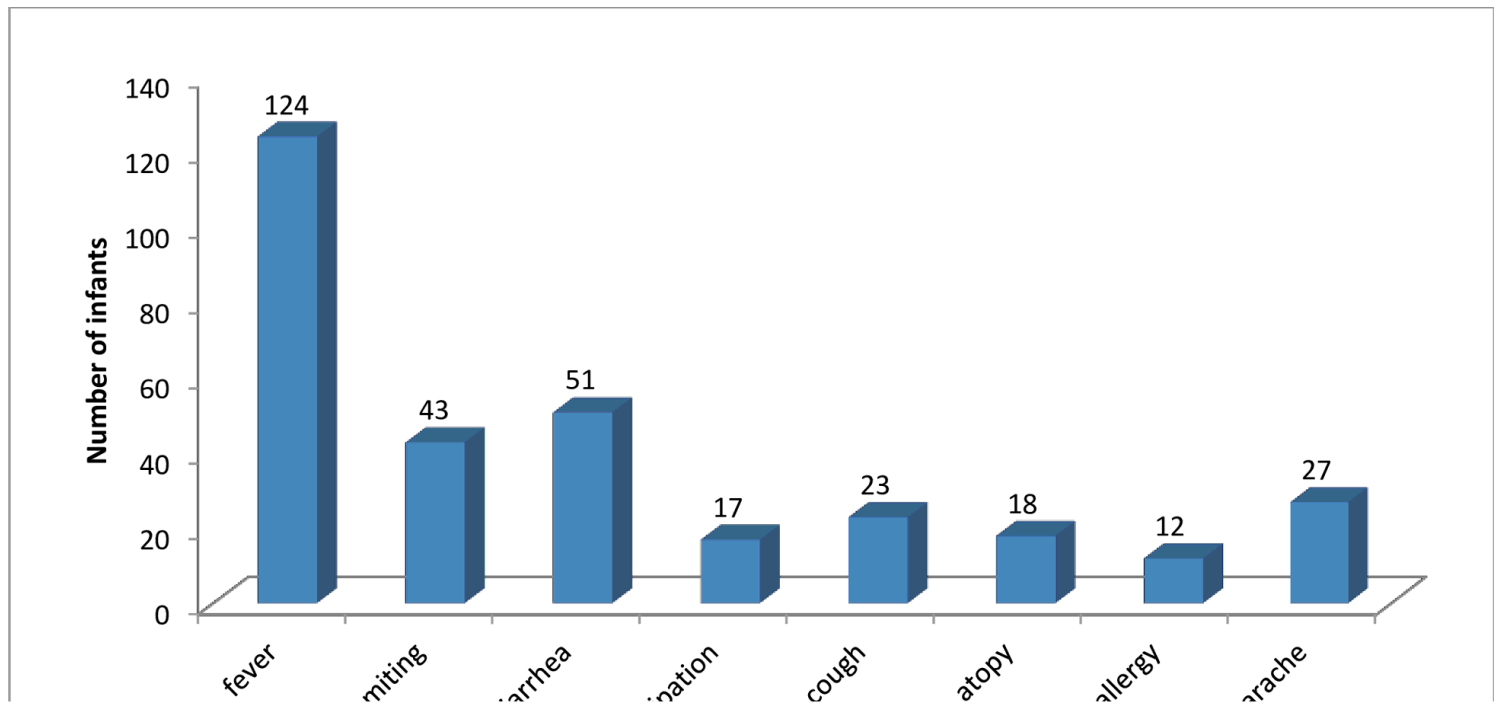


Figure 1

Infant health problems during the last month

Fig.2 Source of knowledge related to weaning

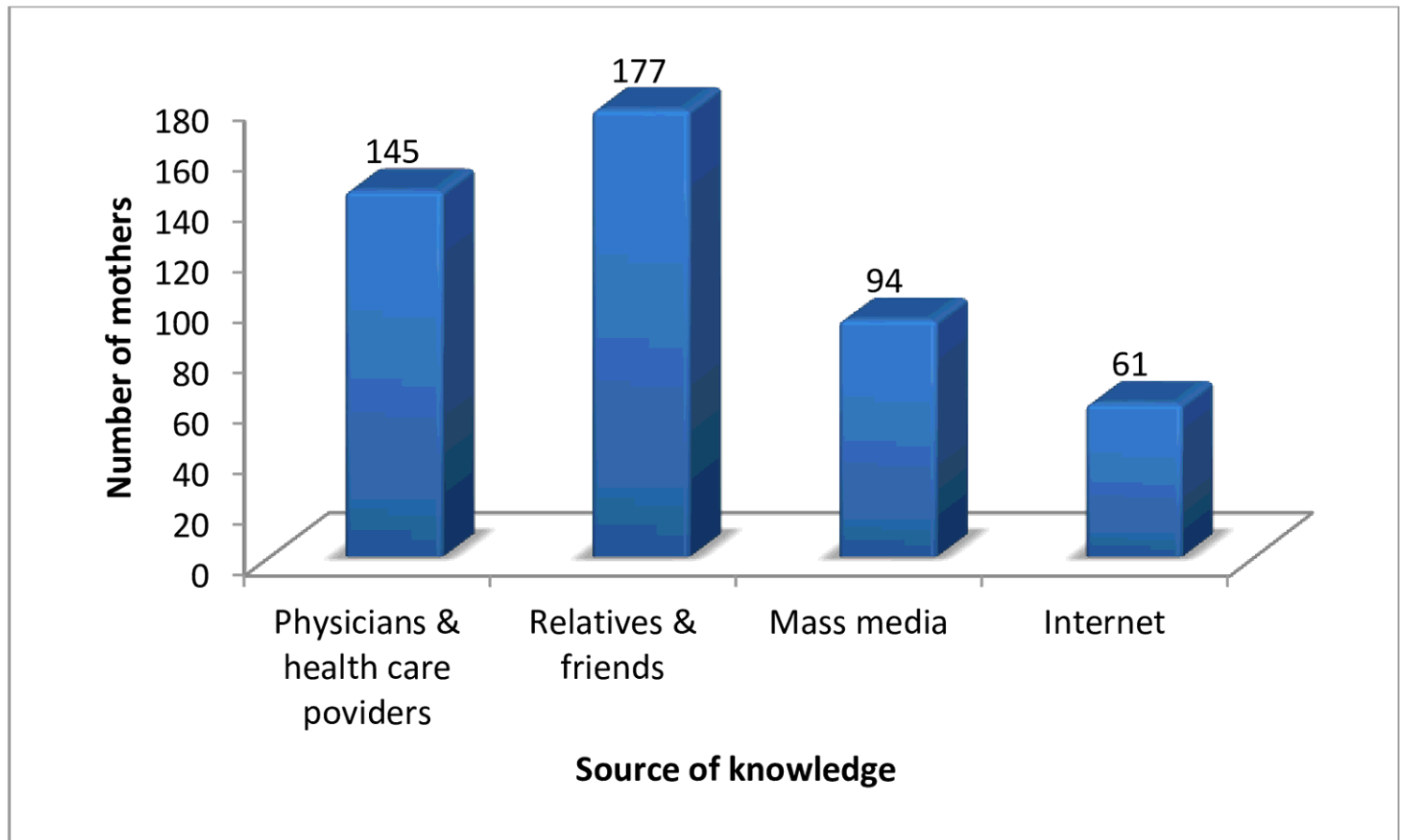


Figure 2

Source of knowledge related to weaning

Fig.3 Type of infant food (home-made and commercial)

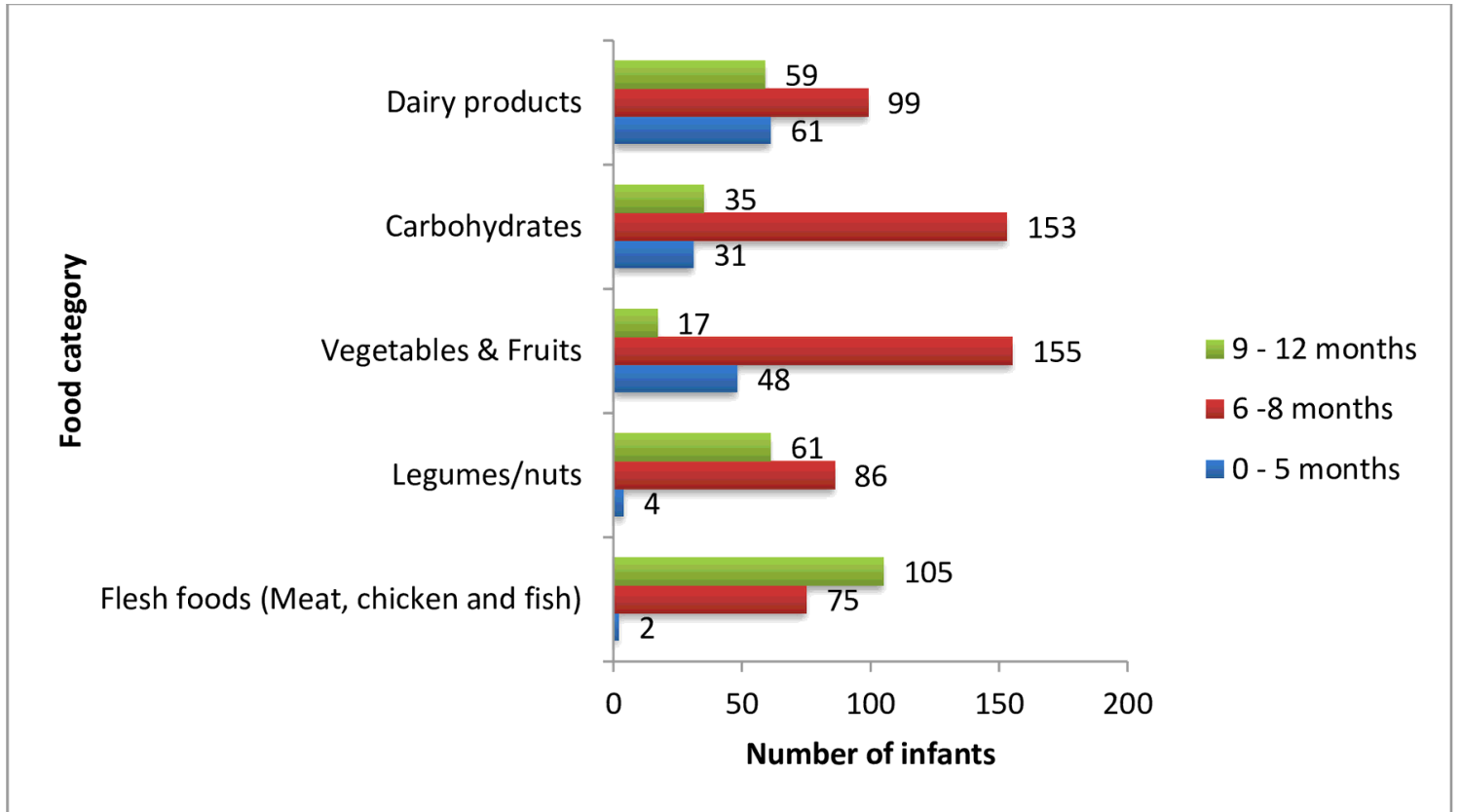


Figure 3

Type of infant food (home-made and commercial)

Fig.4 Maternal beliefs related to herbal use

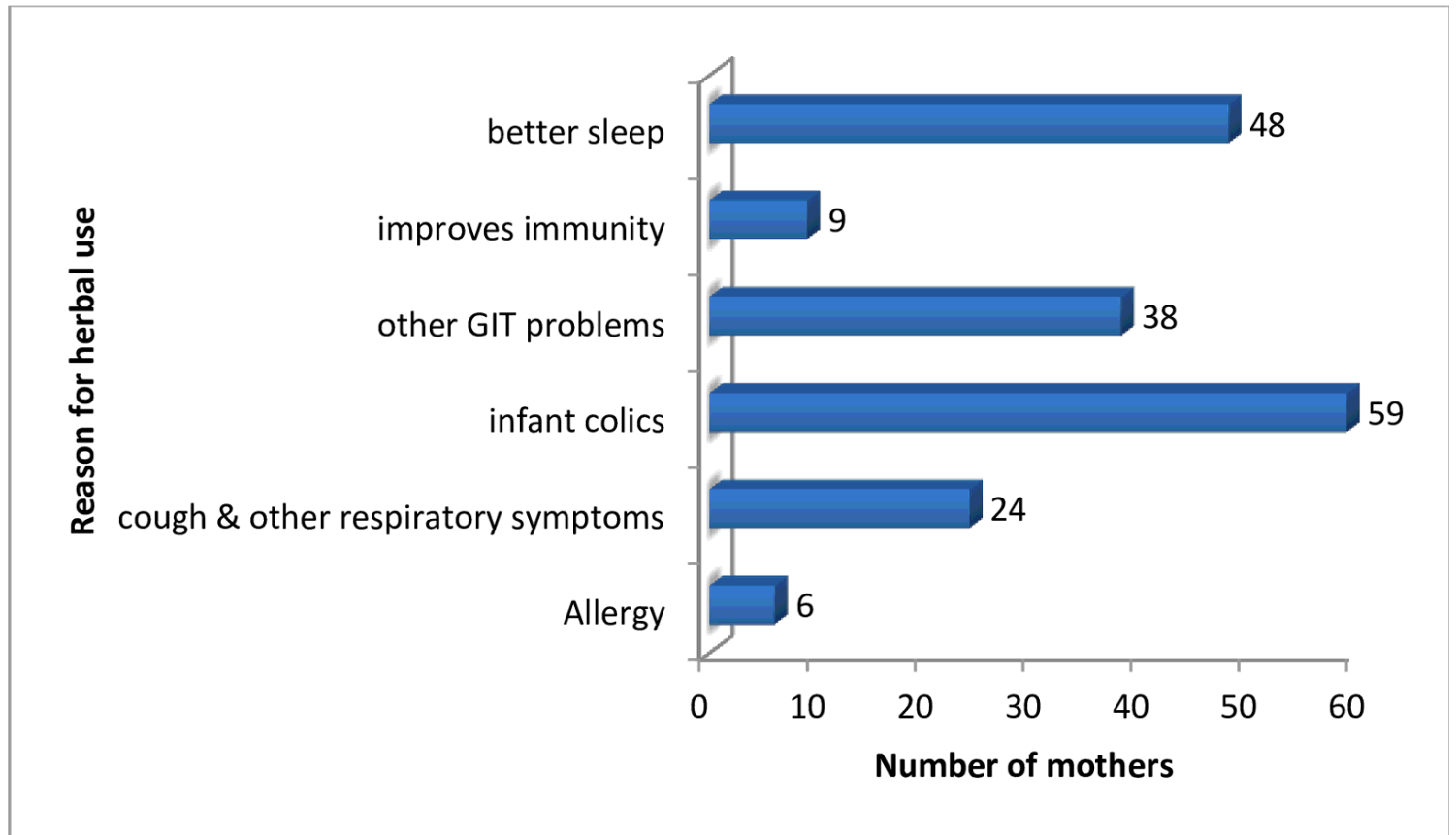


Figure 4

Maternal beliefs related to herbal use