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*Observational Study*

**Effect of nutrition -related infodemics and social media on maternal experience: A nationwide survey in a low/middle income country**

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**Abstract**

BACKGROUND

**Background:**

Undernutrition is a crucial cause of morbidity and mortality among children in a low- or middle-income country (LMIC). A better understanding of maternal healthy general nutrition knowledge, as well as misbeliefs, is highly essential, especially in such settings. In the current era of infodemics, it is very strenuous for mothers to select not only the right source for maternal nutrition information but the correct information as well.

AIM

To assess maternal healthy nutritional knowledge and nutrition-related misbeliefs and misinformation in an LMIC. In addition, this research aimed to determine the sources of such information and their assessment methods.

METHODS

This cross-sectional analytical observational study enrolled 5148 randomly selected Egyptian mothers who have one or more children less than 15 years old. The data were collected through online questionnaire forms: one was for the general nutrition

knowledge (GNKQ) assessment, and the other was for the nutritional myths score. Sources of information and ways of evaluating internet sources using the Currency, Relevance, Authority, Accuracy, and Purpose (CRAPP) test were additionally analyzed.

## RESULTS

The mean general nutrition knowledge score was  $29 \pm 9$ , with a percent score of  $70.8\% \pm 12.1\%$  (total score: 41). The median myths score was 9 (IQR 6,12) (total score: 18). The primary sources of nutrition knowledge for the enrolled mothers were social media platforms (55%). Half of the mothers managed information for currency and authority, except for considering the author's contact information. More than 60% regularly checked information for accuracy and purpose. The mothers with significant nutrition knowledge checked periodically for the author's contact information ( $P = 0.012$ ). The nutrition myths score was significantly lower among mothers who periodically checked the evidence of the information ( $P = 0.016$ ). Mothers dependent on their healthcare providers as the primary source of their general nutritional knowledge were less likely to hold myths by 13% ( $P = 0.044$ ). However, using social media increased the likelihood of having myths among mothers by approximately 1.2 ( $P = 0.001$ ).

## CONCLUSION

Social media platforms were found to be the primary source of maternal nutrition information in the current era of infodemics. However, healthcare providers were the only source for decreasing the incidence of maternal myths among the surveyed mothers.

## INTRODUCTION

Undernutrition is one of the salient causes of morbidity and mortality among children less than five years old in low- or middle-income countries (LMICs) [1]. Accordingly, proper and adequate nutrition is vital for normal child's growth and development and prevention of long-term morbidity and subsequent mortality. Different previously

published data support the effectiveness of variable nutritional interventions in improving the nutritional status of children and reducing mortality [2, 3].

Mothers are the primary care providers for their children in all household affairs, especially nutrition [4]. Therefore, the level of maternal general nutritional knowledge usually impacts their nutrition behavior and practice [5]. Subsequently, evaluation of maternal health understanding is crucial to filling the gap in training. This will help identify the most deficient points in this community's upcoming nutrition education programs. In addition to parental nutrition knowledge, nutrition myth is another essential factor previously reported in the literature as a determinant factor affecting their feeding style [6].

The phenomenon of infodemics refers to the abundant and widespread dissemination of information, whether accurate or not, through different media platforms, including mass media, social media, and online forums [9]. It can be challenging for mothers to select the correct information from the flow of sources. Different sources of nutrition education are available in this current era of infodemics, such as healthcare providers, family members, mass media, and social media. The sources of nutrition education, with the advent of internet technology and smartphones, have become much more diverse [7]. Despite the fact that this technology facilitates the delivery of information, acquiring the right information at the right time in the appropriate form is of greater importance [8].

To the researchers' knowledge, this is the first published data from Egypt evaluating this problem despite its significance in this LMIC.

This study's main objective is to assess healthy nutritional knowledge and nutrition-related misinformation and misbeliefs among a large sample of Egyptian mothers. In addition, this study aimed to determine the sources of nutritional information and how those mothers manage the sources of nutritional-related knowledge.

## **MATERIALS AND METHODS**

**Study design:** A cross-sectional analytical observational study.

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**Sample type:** A convenient sample (easy access).

**Sample size and sampling technique:** The sample size of 5100 was calculated using the following formula for sample size calculation for surveys <sup>[10]</sup> in which:

n = sample size

z = z score  $\pm$  2.58 of the CI of 99%

p = degree of variability (proportion of outcome), 81.2% of the mothers have a high to moderate level of nutritional knowledge, according to a study performed in Bangladesh <sup>[11]</sup>.

e = level of precision (1%)

N = study population size: females are most likely mothers of children under 15 (32% of the Egyptian population aged 15 to 60 years, equal to 32 million) <sup>[12]</sup>.

**Study population:** Egyptian mothers with one or more children (age of at least one child under 15). The participants were recruited from many governorates all over Egypt: the upper Egypt governorates included Giza, Fayoum, Menia, and Assiut; the lower Egypt governorates included Dakahlia, Gharbia, and Kafr El-Sheikh; Cairo and Alexandria.

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### **Data collection tool**

A pre-tested e-questionnaire was used to collect data from the study participants. It included four sections:

i) **Socio-demographic characteristics:** Maternal, paternal, and siblings' age in years; sex of siblings; maternal and paternal education and occupation; residence; number of home bedrooms; and number of family members.

ii) General nutrition knowledge questionnaire (GNKQ): It contains 41 questions that were derived from the validated general health questionnaire <sup>[13]</sup>. The questions of the original questionnaire were adapted to the Egyptian situation. Reliability analysis was conducted on the GNKQ, in which Cronbach's alpha was 0.73. <sup>8</sup> Correct answers were coded with 1 and incorrect answers with 0. The total GNKQ score was 41. The percent score of the GNKQ was calculated, and the participants were categorized according to their responses into two groups: high to moderate knowledge (GNKQ percent score  $\leq$

70%) and low knowledge (GNKQ percent score > 70%) [14] (Supplementary material, part A).

iii) Nutritional myths (misinformation): 18 misinformation questions were derived from 45 pediatric nutrition consultants based on their clinical experience. The questions had five-level responses (Likert scale): strongly disagree, disagree, neutral, agree, and strongly agree. The strongly agree, agree, and neutral levels were coded as 0, and disagree and strongly disagree responses were coded as 1. (N.B., the scales of the 2<sup>nd</sup> and 9<sup>th</sup> questions were reverted.) Cronbach's alpha was 0.76 for the 18-item myths questionnaire. The respondents were categorized into two groups: holding myths (below median score ≤ 9) and not holding myths (above median score > 9) [15] (Supplementary material, Part B).

iv) The source of information and methods to evaluate internet sources were assessed using the CRAPP test (Currency, Relevance, Authority, Accuracy, and Purpose) [16].

5 Two language experts translated the questions into Arabic and back-translated to English by another two independent language experts. (CRAAP)

Data collection tool accuracy, validity and reliability:

A pre-test was performed to confirm the content validity of the questions and assure the validity of the results. In order to eliminate common mistakes and unclear wording and to ensure that the questions were understandable, a panel of 50 volunteers from various backgrounds reviewed the question construction. The final version of the questionnaire was updated to include the expert panel's comments. The questionnaires were distributed to the participants following this pilot study (the pilot results were not included in the final results). Reliability internal test (Cronbach's) was done for the 18-item questionnaire (nutrition misinformation); where Cronbach's alpha was 0.76 (high reliability).

Data collection technique: A Google form was created, and participants were invited through personal communication (via Facebook groups, WhatsApp contacts, and emails) with the researchers to complete the form and submit it.

<sup>1</sup> Statistical analysis: All the collected data were revised for completeness and logical consistency. The data were extracted from the Google form into the Microsoft Office Excel Software Program, 2019, then transferred and analyzed into the Statistical Package of Social Science Software program, version 26 (SPSS, Chicago, Illinois) for statistical analysis.

Quantitative variables were described as mean  $\pm$  S.D., median, minimum, and maximum and compared using an independent T-test and a Mann-Whitney U-test for two groups, with a significant p-value of  $p < 0.05$ .

<sup>1</sup> Qualitative variables were described as frequency and percentage. Moreover, qualitative variables were compared using the Chi-square and Fisher exact tests, with a significant p-value of  $p < 0.05$ .

A binary logistic regression model was used to determine which source of knowledge could predict the likelihood of holding myths, and being more knowledgeable in nutrition.

#### **Ethical considerations:**

<sup>1</sup> The study protocol was approved by the scientific committee of the Public Health and Community Medicine Department, Faculty of Medicine, Cairo University. It was approved by the International Ethical Committee at the Faculty of Medicine, Cairo University (N 318-2023). Written informed consents were obtained from all study participants after thoroughly explaining the study's aim and the importance of the online form before data collection. Only those who agreed were included, and those who refused were excluded from the study by submitting an empty form after answering "Not willing to participate." All procedures for data collection were treated with confidentiality according to the Helsinki Declarations of Biomedical Ethics.

<sup>2</sup> Participants were informed that this was an anonymous survey and participation was voluntary. <sup>6</sup> The assessment did not involve any invasive procedures or induce any change in dietary patterns.



## **RESULTS**

The response rate for the online form was 99.4%. It reached 5148 responses from mothers with one or more children aged less than 15 years. The sociodemographic background information was collected and illustrated in **(Table 1)**. It was found that more than half of the mothers (56.9%) and fathers (52.5%) were aged from 30 to 40 years; extreme age was found in 2.2% of mothers and 0.5% of fathers aged less than 20 years; 1.6% of mothers and 5.7% of fathers aged more than 50 years. Mothers and fathers had higher university grades by 59.1% and 65.1%, respectively. However, mothers and fathers who could only read and write were 64 and 59, representing 1.2% and 1.1%, respectively. Working mothers were 3321 (64.5%), and 96.3% (5061) of fathers were working. Most families were from urban areas (81.6%) and had a house crowding index of two or less (94.8%). Most mothers had fewer than five children; 23.2%, 43.7%, 24.9%, and 6.5% of mothers had one, two, three, or four children, respectively. The questions were asked about the gender and age of the children (from one child to seven children). Their sex was almost the same; their 1–5 year age was more evident with the 2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup>, 5<sup>th</sup>, and 6<sup>th</sup> child (Figure 1). The total general nutrition knowledge score was 41. It was found that the mean available nutrition knowledge score was  $29 \pm 9$ , with a percent score of  $70.8\% \pm 12.1\%$ . The median score was 27 (IQR from 27 to 33), with a percent score of 73.2% (IQR from 65.9 to 80.5%). The nutrition myths question scores were 18. The mean score was  $9 \pm 4$ , and the mean myths per cent score was  $50.9\% \pm 23.7\%$ . The median myths score was 9 (IQR 6,12), and the median myths percent score was 50% (IQR 33.3, 66.7%).

**Figure 2** shows the percentage of mothers holding nutrition myths. As an example, it was found that 37% of mothers agreed that fish and milk should be avoided if the child is suffering from fever. Only 12% of mothers agreed that using candy to reward a child was a good idea.

The participants were categorized according to their responses to the GNKQ into the low knowledge group ( $\leq 70\%$  GNKQ percent score) and the moderate to high



knowledge group (> 70% GNKQ percent score). When comparing those groups based on their socio-demographic backgrounds, it was found that <sup>7</sup> there was no statistical difference between the two groups regarding the socio-demographic backgrounds of the mothers and their families.

In the comparison between the mothers who held myths (with a median score of less than 9) and those who did not have myths (with a median score of 9 or more) by their socioeconomic background, it was detected that there was no statistically significant difference except for maternal and paternal education and maternal occupation (p values = 0.003, 0.004, and 0.013, respectively), as illustrated in **(Figure 3)**.

The primary source of nutrition knowledge for the enrolled mothers was social media, with 55% **(Figure 4)**.

Table 2 portrays how the mothers used to collect health information, with around half managing information for currency and authority except for viewing the author's contact information. More than 60% regularly checked information for its accuracy and purpose.

Table 3 shows ways of managing information among participants with low, intermediate, and high nutritional knowledge and participants who held and did not hold dietary myths. It was discovered that mothers with significantly high nutrition knowledge regularly checked for the author's contact information ( $P = 0.012$ ). The nutrition myths score was considerably lower among mothers who periodically checked the evidence of the information ( $P = 0.016$ ).

The bivariate analysis demonstrates that the likelihood of holding myths is significantly higher among those who did not depend on their study at school and university and among mothers who rely on knowledge from friends, relatives, television, radio, newspapers, and magazines (p-values of 0.037, < 0.001, and 0.027, respectively). The multivariate analysis identified individuals depending on television, radio, newspapers, magazines, opinions of friends and relatives, and social media as independent predictors of holding myths (OR 1.15, 1.3, and 1.22, respectively). In addition to that, the

bivariate analysis illustrates that the likelihood of being more knowledgeable in nutrition is significantly higher among those who did not depend on television, radio, newspapers and magazines, friends, relatives, and social media (p-value < 0.001) and among mothers who rely on knowledge from health care providers and scientific websites (p-value=0.05). Furthermore, the multivariate analysis identified that individuals not depending on learning from television, radio, newspapers and magazines, friends and relatives, and social media were independent factors for being more knowledgeable in nutrition (OR 1.1, 1.2, and 1.4, respectively) (Table 4).

## **DISCUSSION**

The current study focused on evaluating healthy maternal nutritional knowledge and exploring nutrition-related myths among the surveyed mothers in the setting of an LMIC such as Egypt, where the per capita income ranges between 1136 and 4465 dollars, according to the World Bank, 2023 [17]. In addition, it determined the sources of this nutritional information and the assessment of their sources.

The response rate was 99.4% among the surveyed mothers, with 5148 maternal responses for the online survey. The present work reported that the median maternal nutritional knowledge score on 13 identified questions was 27 out of 41 (73.2%). Accordingly, about half (57.6%) of the respondents had good nutritional knowledge.

The present study demonstrated that mothers referred to multiple sources of nutrition information. The primary source of nutrition information among interviewed mothers was social media platforms (55%). At the same time, healthcare providers were the source for 22% of the surveyed mothers. Consistent with the results of this study, what was reported by **Griauzde *et al*, 2020** [18] found that 46.3% of recruited Hispanic mothers in Michigan (United States) used social media to explore feeding information for their children. However, other studies in Australia reported that mothers gained their knowledge mainly from their mothers and, to a lesser extent, from healthcare professionals [19, 20].

Moreover, the parents' online health-seeking behavior about their children's general health was similarly reported by a systematic review by **Kubb and Furrán, 2020** <sup>[21]</sup>. The current study reflects the significant impact of social platforms on disseminating nutrition-related information among mothers in the community. Additionally, it highlights the great need for the health care provider to make every visit a chance to provide education and revise already-known information among those mothers. This continuous maternal education process through their healthcare providers will minimize the need to gain experience from untrusted resources.

Surprisingly, an evolving term in public health medicine, "infodemic," has emerged. This new term came out with coronavirus disease 2019 (COVID-19) pandemic <sup>[22]</sup>. An infodemic is defined as an epidemic of information <sup>[23]</sup>. This overflow of information is not always correct; some are accurate, and others are inaccurate (misinformation and misbeliefs). Unfortunately, in LMICs like Egypt, the unfavorable effects of such a phenomenon are aggravated by health illiteracy and limited resource settings. Therefore, defining the level of knowledge and the extent of myths is critical to outlining the best approach <sup>[24]</sup>.

The complicated scientific information and sources that cannot easily reach the general public were the leading causes behind mothers' searching other channels for information, mainly social media platforms <sup>[25]</sup>. According to this study, this is the situation among the surveyed mothers and the reason behind their preference for social media as a source of nutrition information. It is very challenging for mothers to determine what is reliable and evidence-based.

In light of this unique phenomenon, the researchers gained a more profound insight into how these mothers are dealing with the sources of information. The maternal behavior towards the sources of information was analyzed. It was found that 50% of mothers checked for information, currency, and authority except for contact details. Furthermore, more than 60% of mothers checked the accuracy of the information. Aligned with the data in this study, another study among low-income Hispanic mothers in the United States demonstrated that most social media users extracted

feeding information from reliable websites to avoid doubtful information on that platform [18]. Consequently, it is vital to provide accessible and trustworthy sources of nutrition information through e-health education or smartphone health applications supplied by the Ministry of Health.

Further analysis of factors affecting maternal knowledge scores was conducted by comparing those mothers with good nutrition knowledge to those with inappropriate nutrition knowledge. It was previously reported in Turkey that maternal age is one of the essential factors affecting knowledge, attitude, and behavior [26]. As expected, when getting older, the mother becomes more experienced and able to gain and process information wisely. However, the data in this research demonstrated no significant differences between different maternal age groups regarding maternal knowledge scores, with a p-value of 0.31. A similar result from Turkey was found by **Demir *et al*, 2020** [27], who reported that knowledge scores were almost identical among different maternal age groups except for those between 26 and 30 years, who had higher scores.

In addition, the maternal knowledge status was analyzed according to maternal education and paternal education, and it was not significantly different (p values: 0.64 and 0.64, respectively). However, it was different from other reports from Ghana, the United Arab Emirates, and Turkey, where the level of knowledge score was positively correlated with maternal education level [27-30].

It is assumed that mothers acquire experience in nutrition and different health aspects when having more than one child or when children are getting older. However, this research discovered no difference regarding the nutrition knowledge scale according to the child's age, order, or sex.

A dietary myth is a negative or positive belief regarding nutritional concepts that cannot be supported or opposed by scientific evidence [31]. According to the extent of belief in myths, the healthy behavior of parents and, consequently, the nutritional status of their children are affected.

Regarding the nutrition myths score, the median score was 9 out of 18 (50%). Therefore, 56% of the mothers did not hold nutrition myths. This study found that the most

frequent nutrition myth was reported by about 37% of respondents about avoiding eating fish and milk if the child was feverish.

However, the least frequently determined myth by only 12% of respondents was about rewarding children with candy. This behavior supports the recommendation of the American Academy of Pediatrics, which is against the administration of unnecessary additional calories as it increases the risk of obesity among children.

This study demonstrated that maternal education was significantly different among those with nutrition myths than those without,  $P = 0.003$ . Those with higher education (above the university) had substantially lower myth scores. Although the education level of mothers was not related to the maternal nutrition knowledge score, it was related to the lower myth group. This information emphasizes the importance of maternal education, even if only it positively reduces the myth belief. This differed from the results of Mrošková and Lizáková (2021) [32], who found that maternal education was related to food choices, whether healthy or not, but not associated with paternal myth belief.

Further analysis of other factors related to nutrition myths revealed that maternal occupation was significantly different between the two groups. Substantially, more working mothers were not holding nutrition myths, with a p-value of 0.013. It could be assumed that employment raises socialization and awareness among mothers.

Additionally, logistic regression analysis was conducted to evaluate the impact of the five different sources of nutrition information on the development of nutrition myths. Interestingly, it was found that using social media, consulting with family members, and depending on knowledge from television, radio, newspapers, and magazines increased the likelihood of holding myths among mothers approximately 1.2, 1.3, and 1.14 times more than mothers who do not depend on those sources as a source of knowledge. However, mothers dependent on their health care providers and scientific websites are less likely to hold myths by 13% (remaining of the odds ratio of 0.866). This information emphasizes that informal sources of nutritional information increase the incidence of nutrition myths. However, using formal sources through health care

providers and scientific websites positively decreased the misinformation rate. Regulatory health authorities should provide sufficient nutrition training for general pediatricians for that finding. In addition to that, adequate auditing for non-supervised nutrition training courses is deeply needed to minimize the incidence of myths among physicians and mothers.

**Strength and limitation:**

Since the survey was online, this gave the researcher more freedom to answer than a physical interview. Furthermore, it was less expensive and took less time. The study was a nationwide survey with randomly selected mothers from many governorates nationwide.

The online survey involved only mothers who could access the internet, which limited the conclusion. Future research, including all mothers, is needed to help identify the different sources and barriers of nutritional myths and knowledge among different socioeconomic levels.

**CONCLUSION**

In our LMIC setting, almost 50% of the mothers had good nutrition knowledge level scores. In the era of infodemics, social media platforms were the principal source of nutrition information, with more than 50% of mothers managing information currency and authority. For this finding, novel strategies are needed to raise maternal awareness for proper evaluation and selection of the suitable material offered through this platform. In addition, updated maternal nutrition information sources should be developed and managed by different health authorities. Mothers holding nutritional myths represented 56% of the surveyed mothers. Maternal education and occupation reduced the frequency of myths and beliefs. Health care providers, as sources of nutritional information, are the only source of information, decreasing the mythic incidence among mothers.

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SIMILARITY INDEX

### PRIMARY SOURCES

- 1

Esraa El-Mayah, Marwa M Zein, Bassam Essam Hassan, Eman O Abdelghany. "Assessment of level of awareness about children eye diseases and routine eye screening among a sample of Egyptian general population", British Journal of Visual Impairment, 2023

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