

# Perceptions, practices, and traditional beliefs related to neonatal jaundice among Egyptian mothers

## A cross-sectional descriptive study

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### Abstract

Neonatal jaundice (NNJ) is one of the most common neonatal disorders worldwide. It is still a main cause of avoidable brain damage, physical and mental impairment, and probable death in newborns.

We aimed to assess perceptions, practices, and traditional beliefs among Egyptian mothers toward NNJ that may contribute to delayed presentation and inappropriate management of hyperbilirubinemia.

This descriptive, cross-sectional study was conducted from January to May 2015. We interviewed 400 Egyptian mothers who gave birth in <1 month before the study using a structured questionnaire. Participants were recruited from outpatients of Cairo University Teaching Hospital.

This study revealed unexpected moderate knowledge and attitude scores of Egyptian mothers in most domains with a mean of 6.6 and 20.6, respectively, although the majority of them were illiterate or had low educational attainment. In terms of knowledge, 52.3% of participants had adequate knowledge about NNJ in the aspects of awareness, risk factors, management, and complications. Almost all participants exhibited moderate (89.8%) and high levels (10%) of positive attitudes toward NNJ. Maternal sociodemographic factors influenced knowledge level, attitudes, and behaviors related to NNJ in Egypt. Working mothers and those residing in urban areas were significantly more knowledgeable ( $P=0.023$  and  $0.021$ , respectively), and attained higher attitude scores ( $P<0.001$  and  $P<0.001$ , respectively) than housewives and rural ones. Moreover, significantly higher attitude scores ( $P<0.001$ ) were attained by those who had completed their university [22.3 (SD=3.1)] or postgraduate education [22.2 (SD=3.6)].

The majority of Egyptian mothers have a satisfactory level of knowledge and attitudes related to NNJ. However, cultural beliefs and traditional infant care practices still have an impact on mothers regardless of their educational level.

**Abbreviations:** EDHS = Egypt Demographic and Health Survey, LMICs = low- and middle-income countries, NNJ= neonatal jaundice, OBGYN = obstetrics and gynecology, SD = standard deviation, SPSS = Statistical Package for the Social Science.

**Keywords:** attitude, Egypt, knowledge, mothers, neonatal jaundice

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## 1. Introduction

Neonatal jaundice (NNJ) is a condition characterized by yellow discoloration of the skin and sclera of newborn infants. It occurs in approximately 50% to 60% of full-term newborn babies and 80% of preterm newborn babies.<sup>[1–3]</sup> It is a common disorder worldwide and accounts for 75% of hospital readmissions in the first week of life.<sup>[3,4]</sup> The jaundice is usually due to unconjugated hyperbilirubinemia. It may be benign if its progression to extreme hyperbilirubinemia is recognized, monitored, and prevented or managed in a timely manner.<sup>[5]</sup> Nevertheless, it can be neurotoxic and cause kernicterus with diffuse neuronal damage or even death in newborns.<sup>[6]</sup> Surviving infants may acquire long-term neurodevelopmental sequelae such as cerebral palsy, sensorineural hearing loss, intellectual difficulties, or gross developmental delays.<sup>[7,8]</sup>

The exact blood level above which unconjugated bilirubin will be neurotoxic is unpredictable.<sup>[3,9]</sup> However, the incidence of kernicterus increases with serum bilirubin levels exceeding 20 mg/dL in normal birth weight babies who are otherwise healthy.<sup>[6]</sup> Kernicterus is preventable by early recognition and prompt effective therapy of NNJ. At present, once the early stages of hyperbilirubinemic brain damage occur, therapeutic options are limited to the prompt (<8 hours) use of exchange transfusion, hence the imperative for preventive approaches.<sup>[5]</sup>

Discharge of newborns from the hospital within 48 hours after birth with relatively short postnatal hospital stay make jaundice unapparent to the health care provider at the time of hospital discharge.<sup>[4]</sup> Moreover, breast-fed infants may receive relatively suboptimal milk supply in the first few days of life which may participate in inadequate fluid and nutritional intake, thereby increasing the incidence of NNJ.<sup>[10]</sup> Hence, the role of the parents, in early recognition of NNJ and seeking medical care at the right place, is pivotal. Any action of the parents is influenced by their knowledge, perception of, and their attitude toward the condition.

We are not aware of any study that appraised Egyptian mothers' knowledge, attitude, or behavior on the subject of NNJ. Therefore, we designed our present study to assess perceptions, practices, and traditional beliefs among Egyptian mothers toward NNJ that may contribute to delayed presentation and inappropriate management of severe hyperbilirubinemia.

## 2. Methods

### 2.1. Study design and setting

We conducted a prospective, cross-sectional, interview-based study from January to May 2015. Study participants were recruited from outpatients of Cairo University Teaching Hospital, one of the largest tertiary care referral centers all over the country, Africa, Middle East, and the Arab Region. It incorporates 36 departments, 44 specialized units, 5500 beds over 11 hospitals, which serve approximately >2 million patients a year.<sup>[11]</sup>

Cairo, capital of Egypt, is one of the most densely populated cities in the world. Administratively, Greater Cairo (catchment area) encompasses 3 adjacent governorates: Cairo, Giza, and Qalubia.<sup>[12]</sup> Based on the 2014 Egypt Demographic and Health Survey (EDHS), the total ever-married female population (15–49 years), potential study respondents, was 21.762 million, with 22.4% were inhabitants of Greater Cairo governorate.<sup>[13]</sup>

### 2.2. Study population

A purposeful convenience sample was used to recruit a total of 400 Egyptian mothers who gave birth in <1 month before the study. In the current study, the term “mother” was given for first-time mothers and those who already have children. Participants were selected from mothers attending postnatal clinics, neonatal follow-up clinics, and immunization clinics of Center for Social and Preventive Medicine affiliated with the Medical School, Cairo University.

Excluded from the study were as follows: mothers who had mental disorders, those whose babies died or were admitted to neonatal intensive care units, and also those who refused to respond to the survey.

### 2.3. Study measurement and data collection

The field staff consisted of 2 well-trained house officers, obstetrics and gynecology (OBGYN) physician, field editor, and field supervisor administered a pretested structured interview questionnaire to collect all relevant data from study participants. Before the final survey, a small pilot study was conducted in 45 mothers to assess the performance characteristics and feasibility of the study. The questionnaire was revised by 3 professionals and expertise from the field of public health, OBGYN, and

pediatrics with substantial modifications of some contents. The questionnaire was originally in English and translated into Arabic following an established forward–backward translation procedure. To ensure consistency and quality of the collected data, the completed questionnaires were submitted daily to field supervisor and feedback was disseminated before the next day's survey.

The study instrument consisted of 4 sections obtaining information about maternal sociodemographic data, knowledge, attitude, beliefs, and behaviors related to NNJ. One part included 15 close-ended questions, totally 15 scores, concerned with participants' knowledge about NNJ. A graded question had a correct and incorrect answer. Based on the total score of the correct answers, mothers were categorized as poor knowledge (0–5), moderate knowledge (6–10), and good knowledge (11–15). Also, a 5-point Likert scale (strongly agree/agree/do not have any idea/disagree/strongly disagree)<sup>[14,15]</sup> was used to assess the participants' attitudes about NNJ. The attitude scores were graded to poor (0–12), moderate (13–24), and good (25–35).

Ethical clearance was obtained from Institutional Review Board of Faculty of Medicine, Cairo University, before commencement of the study. Only mothers from whom voluntary informed consent was obtained were enrolled for the study.

### 2.4. Data analysis

Data were prepared in 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). Simple frequency tables were used for the qualitative variables, and we calculated simple statistical parameters, such as mean and standard deviation (SD), for the quantitative variables. The differences between proportions were assessed using the *P* value for heterogeneity. *chi-square* and Fisher exact tests were used to estimate differences in qualitative variables. A *P* < 0.05 was considered statistically significant.

## 3. Results

During the study period, 400 mothers, who gave birth in <1 month before commencing the study, were interviewed using a structured questionnaire. Sociodemographic characteristics of the study participants are shown in Table 1. The maternal mean age was 27 years (SD=5.8), with the majority of mothers being aged 19 to 34 years (81.25%).

The majority of participants delivered vaginally (59.3%), lived in rural areas (89.5%), had 9 years of full-time education (38.3%), and were housewives (92.5%, n=370).

Table 2 shows mothers' experience and perspectives about education of NNJ. Of all 400 participants, 75 had a past history of their infants developing NNJ (18.8%). The group of mothers who received information about NNJ [40%, (n=160)] comprised all mothers with past experience of jaundiced neonates and those who had no previous experience (n=85). All participants agreed to be educated about the condition and recognized one-to-one counseling by doctors and antenatal talk sessions as the most favorable methods of health education.

Table 3 shows the results of the assessment of maternal knowledge about NNJ. In terms of basic knowledge, the majority of mothers were able to define NNJ correctly (86%). Yet, only 34% of mothers had considered NNJ >2 weeks abnormal.

Analysis of maternal perspectives on factors that put infants at risk of NNJ had identified some areas of global concern. Breast

**Table 1**  
**Sociodemographic data of study participants.**

	Mean ± SD	(Range)
Maternal age, y*	27 ± 5.8	(16–42)
<19†	34 (8.5%)	–
19–34†	324 (81%)	–
≥35†	41 (10.3%)	–
Maternity code*		
Gravity	1.87 ± 1.13	(1–5)
Parity	2.408 ± 1.62	(1–10)
Live births	1.82 ± 1.08	(1–5)
Abortion	0.54 ± 0.96	(0–5)
Preterm	0.05 ± 0.25	(0–2)
Term	1.82 ± 1.11	(1–5)
	n	%
Mode of delivery†		
Vaginal delivery	221	55.3
Caesarean section	159	39.8
Residence†		
Urban	42	10.5
Rural	358	89.5
Occupation†		
Housewives	370	92.5
Working	30	7.5
Education level† (number of years of education)		
Illiterate	33	8.3
Primary education (≤6 y)	119	29.8
Preparatory education (6–9 y)	153	38.3
High school (10–12 y)	55	13.8
University	15	3.8
Postgraduate	25	6.3

\* Mean ± SD (range).

† n, %.

feeding, preterm labor, and infection were underestimated as potential risk factors of NNJ, and reported only by 23%, 33%, and 30.8% of mothers, respectively. Approximately half of the participants believed that maternal and fetal blood group difference, some maternal food intake in breast-fed babies, as well as exposure to sunrays, may be risk factors for NNJ (52.3%, 52.8%, and 47.3%, respectively). Almost half of the study participants (n = 212, 53%) exhibited adequate knowledge about phototherapy as the main treatment of hospitalized jaundiced infants. In the same context, sequelae of severe NNJ were

**Table 2**  
**Mothers' experience and perspectives on education of NNJ.**

	Total	
	n	%
Participants with past experience of jaundiced neonates	75	18.8
Mothers who had been informed about NNJ	160	40
Mothers agreed to be instructed on NNJ	400	100
Agreement to different strategies to instruct mothers on NNJ		
One-to-one counseling by doctors	400	100
Antenatal talks	400	100
Regular programs in television	27	6.8
Articles in magazines and/or newspapers	10	2.5
Regular talks in radio programs	29	7.3
Educational programs in school	13	3.3
Others	0	—
Don't know	7	1.8

NNJ = neonatal jaundice.

**Table 3**  
**Assessment of maternal knowledge about NNJ.**

Variables on neonatal jaundice	Correct response	
	n	%
Assessment of general knowledge about NNJ (awareness)		
It is a yellowish discoloration of the skin of newborn	344	86
It is a common problem in neonates	183	45.8
It is an abnormal condition if appears within first 36 h	111	27.8
It is abnormal if persisted >2 wk	136	34
Assessment of knowledge about risk factors of NNJ		
Breast feeding	92	23
Preterm labor	132	33
Maternal and fetal blood group difference	209	52.3
Exposure to sunrays	189	47.3
Some maternal food intake increases jaundice in breast-fed babies	211	52.8
Infection	123	30.8
Assessment of knowledge about management		
NNJ may need investigations	199	49.8
Phototherapy is the treatment	212	53
Assessment of knowledge about complications		
Severe jaundice may lead to brain damage	183	45.8
Severe jaundice may lead to death	202	50.5
Severe jaundice can lead to deafness	115	28.8

NNJ = neonatal jaundice.

adequately recognized among respondents except for deafness (28.8%).

**Table 4**  
**Assessment of maternal practices and beliefs related to NNJ.**

	Responses (yes)	
	n	%
Feeding during first 3 d		
Exclusively breast-fed	54	13.5
Mixed formula and breast feeding	192	48
Exclusively formula-fed	153	38.3
Feeding after 1 wk		
Exclusively breast-fed	49	12.3
Mixed formula and breast feeding	308	77
Exclusively formula-fed	43	10.8
Home environment		
Keep newborn in dark room	216	54
Avoid exposure to sun rays	220	55
Mothballs in home	43	10.8
Beliefs on sun rays effect on newborn baby		
Beneficial	147	36.8
Harmful	211	52.8
Neither harmful nor beneficial	20	5
Don't know	22	5.5
Traditional practices		
Oral drinks (e.g., herbal drinks, glucose)	267	66.8
Exposure to home conventional lights (e.g., fluorescent)	58	14.5
Nothing	75	18.8
Barriers to health care access		
High cost	400	100
Bad service	23	5.8
Underestimation of caregiver to NNJ	27	6.8
Baby is too young to go outside	34	8.5
Bad weather conditions	48	12
Long distance	241	60.3
Lack of transportation	48	12

NNJ = neonatal jaundice.

**Table 5****Assessment of maternal attitudes related to NNJ.**

	Maternal responses				
	n (%)				
	Strongly agree	Agree	Don't know	Disagree	Strongly disagree
Worried about progress of NNJ	42 (10.5)	207 (51.8)	80 (20)	54 (13.5)	17 (4.3)
Worried about investigations; several blood samples may result in anemia	35 (8.8)	17 (4.3)	82 (20.5)	207 (51.8)	58 (14.5)
If jaundice increased, I can give oral herbs	10 (2.5)	94 (23.5)	64 (16)	188 (47)	44 (11)
If jaundice increased, I have to consult a physician	353 (88.3)	47 (11.8)	0	0	0
Would consult as it is a serious condition	62 (15.5)	189 (47.3)	91 (22.8)	51 (12.8)	7 (1.8)
Would consult as it is a curable condition	35 (8.8)	215 (53.8)	138 (34.5)	7 (1.8)	5 (1.3)
Afraid of hospitalization	6 (1.5)	7 (1.8)	16 (4)	259 (64.8)	112 (28)

NNJ = neonatal jaundice.

Table 4 shows the results of assessment of maternal practices and beliefs related to NNJ. Approximately half of the mothers combined breast feeding with formula (48%) during the first 3 days after delivery. This percentage increased after the first week of life to involve 77% of the mothers.

In respect of their beliefs about the benefit of sunlight exposure, 52.8% of mothers deemed that it was harmful for babies; a belief induced 54% of participants to keep infants in a dark room. However, 36.8% (n=147) emphasized that it was beneficial for NNJ. The traditional practice of giving oral drinks (e.g., herbal drinks and glucose) in case of NNJ was acceptable by approximately two-thirds of our participants (66.8%).

By asking about the possible obstacles that might hinder their access to medical care, all participants were worried about the financial cost of management. Moreover, more than half of them (60.3%, n=241) believed that distances between their residence and health facilities are long enough to delay proper management of NNJ.

Table 5 shows the different attitudes of the interviewed mothers toward NNJ. More than half of the mothers agreed that NNJ is a worrisome condition (62.3%). On the question whether they consider that investigations of NNJ and frequent blood samples might result in anemia, 66.3% did not agree with that. Meanwhile, only 13.1% (n=52) gave affirmative answers. In case if jaundice increased, only 25.5% of the participants admitted that they would give herbal drinks as a possible treatment. Nevertheless, all mothers agreed consulting physician if jaundice increased. Of those, approximately two-thirds (62.8%) agreed that it is a serious condition that necessitates early medical consultation. On inquiring about their fear of hospitalization, the majority of mothers (92.8%) gave affirmative answers.

Table 6 shows maternal variables associated with knowledge score. Overall, the total mean knowledge score of participants was 6.6 (SD=2.8).

Based on maternal age and education, mothers aged  $\geq 35$  years and those who were graduated up to the university level had the

**Table 6****Variables associated with maternal knowledge scores related to NNJ.**

Variable	Mean score $\pm$ SD (range)*	P	Score grading n (%) <sup>†</sup>			P
			Poor (0–5)	Moderate (6–10)	Good (11–15)	
Age, y						
13–18 (n=34)	6.8 $\pm$ 2.6 (1–12)	0.479	10	22	2	0.250
19–34 (n=325)	6.6 $\pm$ 2.9 (1–12)		141	160	24	
$\geq 35$ (n=41)	7.1 $\pm$ 2.5 (3–12)		13	26	2	
Parity (children)						
<3 (n=311)	6.6 $\pm$ 2.8 (1–12)	0.559	129	161	21	0.832
$\geq 3$ (n=89)	6.8 $\pm$ 3 (2–12)		34	48	7	
Residence						
Urban (n=42)	7.9 $\pm$ 2.6 (3–12)	0.021	10	26	6	0.002
Rural (n=358)	6.5 $\pm$ 2.8 (1–12)		153	183	22	
Occupation						
Housewives (n=370)	6.6 $\pm$ 2.8 (1–12)	0.023	155	190	25	0.252
Working for cash (n=30)	7.8 $\pm$ 2.6 (3–12)		8	19	3	
Education level						
Illiterate (n=33)	6.9 $\pm$ 2.8 (2–12)	0.455	9	21	3	0.314
Primary education (n=119)	6.5 $\pm$ 2.8 (1–12)		53	58	8	
Preparatory education (n=153)	6.3 $\pm$ 2.7 (1–12)		68	79	6	
High school (n=55)	6.8 $\pm$ 2.9 (2–12)		3	27	25	
University (n=15)	7.5 $\pm$ 2.5 (3–12)		3	10	2	
Postgraduate (n=25)	6.1 $\pm$ 2.8 (1–12)		7	15	3	

NNJ = neonatal jaundice.

\* Mean  $\pm$  SD (range).

<sup>†</sup> n, %.

**Table 7****Variables associated with maternal attitude scores related to NNJ.**

Variable	Mean score $\pm$ SD (range)*	P	Score grading n (%)†			P
			Poor (0–12)	Moderate (13–24)	Good (25–35)	
Age, y						
13–18 (n=34)	21 $\pm$ 2.53 (15–26)	0.799	0	29	5	0.270
19–34 (n=325)	20.5 $\pm$ 2.8 (8–27)		1	297	30	
$\geq$ 35 (n=41)	21.1 $\pm$ 2.9 (16–27)		0	34	7	
Parity (children)						
<3 (n=311)	20.5 $\pm$ 2.9 (5–27)	0.242	1	277	33	0.644
$\geq$ 3 (n=89)	20.9 $\pm$ 2.6 (15–27)		0	82	7	
Residence						
Urban (n=42)	22 $\pm$ 3.5 (16–27)	<0.001	0	33	9	<0.001
Rural (n=358)	17.4 $\pm$ 2.7 (6–25)		117	209	31	
Occupation						
Housewives (n=370)	16.5 $\pm$ 2.7 (5–27)	<0.001	79	261	30	<0.001
Working for cash (n=30)	22.4 $\pm$ 3.4 (16–27)		0	20	10	
Education level						
Illiterate (n=33)	21 $\pm$ 2.5 (16–26)	<0.001	0	31	2	<0.001
Primary education (n=119)	20.1 $\pm$ 2.5 (14–27)		0	114	5	
Preparatory education (n=153)	20.3 $\pm$ 2.4 (14–27)		0	145	8	
High school (n=55)	20.9 $\pm$ 3.6 (9–28)		1	42	12	
University (n=15)	22.3 $\pm$ 3.1 (17–31)		0	12	3	
Postgraduate (n=25)	22.2 $\pm$ 3.6 (16–27)		0	17	8	

NNJ = neonatal jaundice.

\* Mean  $\pm$  SD (range).

† n, %.

highest knowledge score [7.1 (SD=2.5); 7.5 (SD=2.5), respectively], despite being statistically nonsignificant. Working mothers and those residing in urban areas were significantly more knowledgeable than housewives and rural ones ( $P=0.023$  and  $0.021$ , respectively).

Table 7 shows the maternal attitude score in relation to different variables. The total mean attitude score of mothers was 20.6 (SD=2.8). Similar to knowledge, maternal age and parity had no significant correlation to the attitude score of mothers. However, the highest score was gained by multiparous mothers and those aged  $\geq 35$  years [20.9 (SD=2.6), 21.1 (SD=2.9), respectively]. In addition, mothers residing in rural areas got a significantly lower mean attitude score than those in urban areas [17.4 (SD=2.7) vs. 22 (SD=3.5);  $P<0.001$ ]. Significantly higher attitude scores ( $P<0.001$ ) were attained by working mothers [22.4 (SD=3.4)] and those who had completed their university [22.3 (SD=3.1)] or postgraduate education [22.2 (SD=3.6)].

#### 4. Discussion

Neonatal severe hyperbilirubinemia represents a significant, yet preventable health problem, particularly in low- and middle-income countries (LMICs).<sup>[16,17]</sup>

Adequate maternal knowledge, early perception, and care seeking behavior are fundamental components of effective management of NNJ.<sup>[18]</sup> This study revealed unexpected moderate knowledge and attitude scores of Egyptian mothers in most domains with a mean of 6.6 and 20.6, respectively, although the majority of them were illiterate or had low educational attainment. This may be partly associated with successful implementation of extensive primary care network in Egypt, as well as frequent broadcasting free health messages.<sup>[19]</sup>

In terms of knowledge, 52.3% of participants had adequate knowledge about NNJ in the aspects of awareness, risk factors, management, and complications. Nonetheless, only 23% and 33% of mothers had addressed breast feeding and preterm labor

as risk factors for NNJ, respectively. This warrants adequate antenatal and postnatal dissemination of information on neonatal hyperbilirubinemia to the vast majority of mothers in Egypt. Generally, frequency of correct responses of knowledge related to NNJ was inconsistent across studies conducted in developing world such as Ethiopia (63.5%),<sup>[20]</sup> Nigeria (57%),<sup>[21]</sup> Iran (77%),<sup>[22]</sup> and Turkey (46%).<sup>[23]</sup> Utilization of different questionnaires, cultural diversity, and traditional beliefs could be factors that might have influenced such difference.

Consistent with previous studies from Nigeria<sup>[24]</sup> and Sri Lanka,<sup>[25]</sup> almost all participants exhibited moderate (89.8%) and high levels (10%) of positive attitudes toward NNJ. For example, 88.3% of participants strongly agreed to seek medical care if their babies developed NNJ. A study from Iran<sup>[26]</sup> reported similar results in perspective of the mean score; however, 63% of their study population had shown higher levels of attitudes. This difference might be attributable to the time lag between the onset of NNJ and seeking medical help, a finding corroborated by other studies.<sup>[21,24]</sup> This observation is an important reminder that providing education and knowledge is not sufficient itself to change maternal behavior.<sup>[27]</sup> Thus, more studies are needed to investigate the complexity of influences on maternal health-seeking behaviors in Egypt.

Our study provides insight into maternal sociodemographic factors as determinants of knowledge and attitudes related to NNJ in Egypt. Maternal age, education, working status, parity, and residence had a strong influence on the knowledge level and behavior. Although not statistically significant, we found more accurate knowledge and a relatively safe behavior among mothers with parity of  $\geq 3$  and maternal age of  $\geq 35$  years, a finding replicated in other comparable studies.<sup>[18,21,23,28]</sup> We also found that working mothers and those residing in urban areas were significantly ( $P<0.05$ ) more likely to have perception and attitudes better than housewives and rural mothers. Similar findings were reported in studies conducted in India,<sup>[29]</sup> Sri Lanka,<sup>[25]</sup> and Nigeria.<sup>[20]</sup> A recent Egyptian survey has found

that only 49% of women in rural Upper Egypt receiving regular maternal care, compared with 75% in Upper Egypt urban areas.<sup>[30]</sup> Also, working mothers may acquire more knowledge from participation in the labor market with subsequent interactions with the surrounding community.<sup>[31]</sup> Several previous studies have found that a high maternal educational level is associated with better outcome of NNJ, which is confirmed by the findings in our study.<sup>[24,32]</sup>

Consistent with previous work from LMICs,<sup>[18,20,32]</sup> we reported a substantial number of mothers sustain traditional practices with negative outcomes. For example, only 13.5% of study participants had exclusively breast-fed their infants. A 2008 EDHS found that only 29% of Egyptian infants were exclusively breast-fed.<sup>[33]</sup> We also found that prelacteal feeding (defined as giving liquids other than breast milk to an infant before mother's milk freely flows)<sup>[33]</sup> and complementary formula feeding were common during first 3 days after birth.

Although 53% of study participants had identified phototherapy as the standard management of NNJ, many respondents still considered home remedies and exposure to sunlight as initial treatment options. These practices are probably similar in most undeveloped countries from Africa and Asia.<sup>[34,35]</sup>

At virtually all social classes, mothers have identified information received from health care personnel as the most important intervention the health care system could have offered either through one-to-one counseling or as a part of group antenatal care sessions. Several previous studies have demonstrated significant improvement of maternal knowledge and behavior concerning neonatal care following antenatal visits.<sup>[36,37]</sup> The health care provider can influence mothers' attitudes and practices related to NNJ. However, 5.8% of respondents were frustrated with medical personnel due to lack of skills, neglect, or poor medical care. This highlights the need for better handling of patients' complaints concerning medical staff to identify problems that might interfere with proper utilization of health facilities.<sup>[38]</sup>

Most of our study participants have acknowledged high cost and limitation of accessibility to health facilities in terms of long distance and lack of transportation as the main barriers to seek medical care services. These findings are consistent with other studies from Egypt and India,<sup>[39,40]</sup> emphasizing the necessity to put more efforts into overcoming barriers to improve access to health care for mothers and children particularly in rural settings.

## 5. Implications

Neonatal hyperbilirubinemia has been recognized as a condition which deserves more global health attention.<sup>[41]</sup> Our study outlined the knowledge, beliefs, attitudes, and practices of Egyptian mothers related to NNJ. Based on our findings, there is a lot to be done in context of health care infrastructures. For example, an implementation of a larger national strategic plan adopting integration of primary health care facilities and social services is required to achieve affordability and sustainability of the health care system.<sup>[42]</sup> Adequate health education program targeting medical personnel should be applied to ensure delivering quality health services. Also, our data help in understanding how the levels of knowledge and attitudes may correlate with maternal factors such as age, education, and residence. This should be considered in future plans such as effective maternity coverage in rural areas, home visit approach, and mass media campaigns.

## 6. Limitations

To our best knowledge, this study is the first to investigate maternal knowledge, attitudes, and practice related to NNJ in urban and rural Egyptian communities. Nonetheless, important study limitations should be addressed. First, the nature of voluntary participation in our survey is subject to selection bias. Participants who had infants with NNJ might be more concerned with answering questions about them. Second, we used hospital-based study and thus may limit the representation of the maternal extent of knowledge, attitudes, and practice related to NNJ in the general population. Third, we were restricted in our ability to evaluate all of the factors known to influence awareness, beliefs, and behavior of mothers toward NNJ such as number of antenatal care visits, and socioeconomic factors including household income, and fathers' education level. In the context of the Egyptian society, such socioeconomic factors could not be assessed because the culture and traditions of the Egyptians, particularly in rural communities, mean they are conservative in providing such information. Finally, the study was conducted on a relatively small scale in purposively one selected governorate, which might limit generalizability of our results.

## 7. Conclusion

In conclusion, the majority of Egyptian mothers have a satisfactory level of knowledge and attitudes related to NNJ. However, cultural beliefs and traditional infant care practices still have an impact on mothers regardless of their educational level. Health care providers serve as the cornerstone in maternal and infant health promotion. All these factors should be taken into consideration while planning national maternal and child health education program.

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