



## **Knowledge and Attitude of Egyptian Mothers Regarding Neonatal Screening Tests for Metabolic Disorders and Hearing Loss**

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### **ABSTRACT**

**Introduction:** Despite the fact that pre-screening education for mothers is widely acknowledged as important, mothers still have little information about neonatal screening. **Aim of the study:** this study aimed to assess the knowledge and attitude of Egyptian mothers regarding neonatal screening tests for metabolic disorders and hearing loss. **Design:** to conduct this study, a descriptive cross-sectional research approach was selected. **Setting:** The study was carried out at Neonatal Unit and Pediatric Outpatient Clinics of Tanta Main University Hospital, El-Menshawy Hospital and El-Mabara Hospital. **Subjects:** A convenience sampling of 1500 mothers. **Tools:** Three tools were used. Tool I: Mothers' sociodemographic characteristics. Tool II: Mothers' knowledge about neonatal screening tests. Tool III: Mothers' attitude towards neonatal screening tests. **Results:** nearly two thirds of mothers showed sufficient level of general knowledge, while the majority of them had insufficient level of total specific knowledge about neonatal screening tests. More than three-quarters of mothers showed a positive attitude regarding neonatal screening tests. **Conclusion:** mothers had sufficient level of general knowledge and insufficient level of specific knowledge with positive attitude about screening tests. **Recommendations:** develop an educational program for mothers regarding neonatal screening at maternity and child health centers.

**Keywords:** Attitude , Knowledge, Mothers , Neonatal, Screening tests.

### **Introduction**

A state-funded healthcare program known as neonatal screening comprises newborn screening as well as parent education, proper follow-up, disease management, and continuous assessment.

(McCandless et al., 2020). The screening is crucial for identifying disorders such as phenylketonuria, congenital hypothyroidism, abnormal hormone levels, hearing status, and glucose-6-phosphate dehydrogenase deficiency

(G6PD). These illnesses have similar traits in addition to being rare, they frequently require early treatment to avoid significant health issues, disability and even death (**Bailey & Zimmerman, 2019**).

The majority of neonatal screening tests typically use a heel prick blood spot that is taken and let to dry on filter paper cards. They are frequently carried out following birth within the first several hours or days. Since neonatal screening test findings are frequently equivocal, confirmation testing is required for positive neonatal screening results. (**IJzebrink et al., 2021 & Powell, 2019**). In more recent times, neonatal screening has grown to incorporate hearing detection at the bedside. Undoubtedly, the screening lowers the incidence and risks associated with significant health issues in children as well as their effects which may include death or irreversible disabilities (**Powell, 2019**).

The neonatal screening program for congenital hypothyroidism in Egypt commenced in April 2000 while, the test for phenylketonuria was initiated in November 2015. The Egyptian Ministry of Health and Population has launched a program for early detection and management of hearing defects in May 2019 as part of the presidential initiative to discover any hearing issues. Nationwide, the hearing of one million and 151, 284 infants has been assessed (**WHO, 2020**).

Nurses as healthcare practitioners are considered the front liners and in the first contact

with parents. They should be aware of their practical, educational, and enlightening roles toward mothers to maximize the screening results. Mothers should be informed promptly and completely about the benefits of neonatal screening as well as the significance of coming back immediately for additional testing if the initial results are abnormal. Scientific data, however, shows that mothers' educational levels and neonatal screening understanding are now far from optimal levels (**Powell, 2019**).

There are a variety of issues with parents not receiving enough information regarding neonatal screening. First, the crucial role of parents as participants and customers of neonatal screening programs. Efficient collaboration between professionals and parents is critically important to complete the screening process. Second, parents have a right to know the basics about medical and nursing treatments performed on their neonates (**White et al., 2021**). Third, nurses must answer parents' questions about the newborn screening procedure, go over the possible implications of the results as well as any potential ethical issues, and support the parents (**Bailey & Zimmerman, 2019**).

### **Significance of the study:**

The most common congenital metabolic disorder in children is congenital hypothyroidism, particularly in the first few years of life as thyroid hormones are crucial for growth and neurological development. (**Cherella & Wassner, 2017**). According to **Dussault et al. (2017)**, the

prevalence (1 in 1209) in Egypt is substantially greater than the global incidence (1 in 14199) of live births. On the other hand, the genetic metabolic disorder phenylketonuria impairs cognitive abilities because it results from an inability to metabolize phenylalanine, which builds up harmful byproducts in the brain with a significantly higher prevalence of 1/3000 (0.03%). It is the most prevalent inborn error of amino acid metabolism in Egypt. (Palermo et al., 2017).

Glucose-6-phosphate dehydrogenase deficiency represents about 8.9% of Egyptian neonates with a global incidence of 5% (Abo El Fotoh & Rizk, 2016). Hearing loss is one of the most prevalent health issues affecting children today. It affects 16% of the population in Egypt, with a 14% incidence rate in children under the age of 14 years (Egypt Today, 2020).

The targeted mothers are still unaware about neonatal screening. In order to raise their knowledge about screening tests. It is necessary to educate them about the procedures, advantages, and consequences of screening. This is because providing mothers with sufficient information encourages them to adhere to further testing. As a result, raises mothers' knowledge and attitude towards neonatal screening tests.

### **Aim of the study**

This study aimed to assess the knowledge and attitude of Egyptian mothers regarding neonatal screening tests for metabolic disorders and hearing loss.

### **Research question:**

What is the level of mothers' knowledge and attitude regarding neonatal screening tests?

### **Subjects & Method**

#### **Research design:**

A descriptive cross-sectional research design was used to accomplish this study.

#### **Setting:**

The study was conducted at the Neonatal Department and Pediatric Outpatient Clinics of Tanta Main University Hospital (Ear, Nose, and Throat clinics (ENT), Chest clinic, Endocrine clinic, Neurology clinic, and Nutrition clinic) which is affiliated to the Ministry of Higher Education and Scientific Research. The Neonatal Department and Pediatric Outpatient Clinics ( ENT and Chest clinics) of El-Menshawy Hospital and El-Mabara Hospital which are affiliated to the Ministry of Health and Population.

#### **Subjects**

A convenience sampling of 1500 mothers who have a neonate and attended the previously mentioned settings.

#### **Tools of data collection:**

**Tool I: Mothers' sociodemographic characteristics:** such as age, occupation, residence, educational status, consanguinity, number of children, and family history about diseases included in neonatal screening.

**Tool II: Mothers' knowledge about neonatal screening tests which consisted of two parts:**

**Part 1: Mothers' general knowledge about neonatal screening tests** which the researchers created after looking over relevant and recent literature (White et al., 2021) and had 13 questions. For example simplicity, importance, ability of tests to **discover** the diseases, best time of doing test, and heel pricking procedure.

**Part 2: Mothers' specific knowledge about neonatal screening tests.** It was created by researchers after reviewing the related literature (Hussein et al., 2022). It was created to assess the mothers' knowledge of congenital hypothyroidism, hearing impairment, phenylketonuria, and G6PD deficiency. Each metabolic illness and hearing impairment had six elements (the description or definition, etiology or risk factors, signs and symptoms, investigations, treatment, and complications). The total number of items was 24.

#### **Scoring system:**

Total of all scores for every statement in general and specific knowledge ranged from zero for incorrect or don't know, one for correct/incomplete response, and two for correct/complete response. Sufficient knowledge is  $>60\%$  while insufficient knowledge is  $\leq 60\%$ .

**Tool III: Mothers' attitude towards neonatal screening tests** was created by the researchers following revision of relevant literature

(Kasem A. et al., 2022). It contained 8 questions such as the attitude of mothers towards the benefits of the test, its ability to prevent diseases, and readiness to perform the test even it causes pain.

#### **Scoring system:**

The questions were answered using a five-point Likert scale ranging from 1 strongly disagree, 2 disagree, 3 neutral, 4 agree, 5 strongly agree.

The total attitude score was classified as the following:

- Positive attitude, when the total score was more than or equal to 60%.
- Negative attitude, when the total score was less than 60%.

#### **Method**

**The following procedures were used to complete the study:**

#### **The administrative workflow:**

- Approval from the Scientific Research Ethics Committee of the Faculty of Nursing at Tanta University was obtained with code number (225-3-2023)
- Official permission to initiate the study was gained from the director of Tanta University Hospital, El-Menshawy Hospital, and El-Mabara Hospital.

**Ethical and legal considerations:** The researchers clarified the objectives of the study after that, mothers, approval was obtained before

they participated in the study. Confidentiality of data was maintained. The nature of the study didn't cause any harm to mothers. Mothers were informed that they could choose to participate or not in the study and they had the right to withdraw from the study at any time.

**Tools development:** Data were gathered using three tools. (I, II, and III).

**Content validity:** was determined by a panel of five Pediatric Nursing specialists. Adjustments were made by them. Index of content validity =94%.

**Reliability of tools :** Using Cronbach's alpha, which was assessed to be 0.89 for tool II and 0.86 for tool III, the internal consistency was measured to determine the degree to which the tool items measure the same concepts and correlate with one another.

**A pilot study:** The research was conducted in the previously mentioned settings on 150 mothers (10%) which were excluded from the actual study sample to assess the feasibility of the study as well as the applicability and clarity of the included tools. Estimating how long it will take from each participant to complete the questionnaire has also been done through the pilot study.

The collection of data consumed 7 months from April till October 2023 through the following steps:

The researchers review the relevant literature to prepare the tools for the study.

The researchers conducted one-to-one interviews with each mother, outlining the purpose of the research and obtaining informed consent before initiating data collection procedure. To make the sheet understandable to the mothers, it was developed in basic Arabic language.

The researchers attended to the predetermined settings five days a week. Mothers' sociodemographic characteristics, their general and specific knowledge about neonatal screening (metabolic disorders and hearing defects) were obtained.

Furthermore, Mothers' attitude towards neonatal screening tests was assessed. The researchers spent about 20 to 30 minutes with each mother to obtain the necessary information.

Mothers who participated in the study were 1065 mother from Tanta Main University Hospital, 250 mother from El-Menshawy Hospital, and 185 mother from El-Mabara Hospital.

### Analysing statistical data:

Data were fed to the computer and analyzed using IBM SPSS software package version 20.0. (Armonk, NY: IBM Corp) Qualitative data were described using numbers and percentages. The Kolmogorov-Smirnov test was used to verify the normality of distribution Quantitative data were described using range (minimum and maximum), mean, standard deviation, and median. The significance of the obtained results was judged at the 5% level.

The used tests were the Chi-square test. For categorical variables, to compare between different groups. Student t-test. For normally distributed quantitative variables, to compare between two studied categories. F-test (ANOVA). For normally distributed quantitative variables, to compare between more than two categories. Pearson coefficient, to correlate between two normally distributed quantitative variables **Kasem A. et al., (2022)**.

### Results

**Table (1)** presents the percentage distribution of the studied mothers regarding their sociodemographic characteristics. The table revealed that nearly two-thirds of mothers (62%) were from 18 to less than 25 years old. Regarding education, one-third of mothers (33.3%) had a diploma. Concerning occupation, it was observed that more than two-thirds of mothers (69%) were housewives and more than three-quarters of them

(78%) were from rural areas. However, nearly three-quarters of mothers (70%) have no consanguinity with their husbands. The majority of them (95%) had no family history of diseases included in neonatal screening tests.

**Table (2)** shows the percentage distribution of the studied mothers regarding their source of information about neonatal screening tests. It was found that more than three quarters of mothers (77%) heard about congenital hypothyroidism screening tests and more than one half of them (54.6%) gain their information from relatives. Most mothers (89%) didn't hear about other neonatal screening tests and nearly three quarters of them (72.8%) gain their information from the internet.

**Table (3)** displays the percentage and mean scores of the studied mothers regarding their specific knowledge about congenital hypothyroidism, G6PD deficiency, hearing loss, and phenylketonuria. It was found that approximately two-thirds of mothers (64.9%) had sufficient specific knowledge about congenital hypothyroidism with a mean  $\pm$  SD of  $11.09 \pm 2.63$ . Additionally, the table shows that 92.7%, 77%, and 100% of them had insufficient specific knowledge about G6PD deficiency, hearing loss, and phenylketonuria respectively .

**Table (4)** shows the percentage and mean scores of the studied mothers regarding their total general and specific knowledge about screening tests. The table revealed that 65.4% of the studied

mothers showed a sufficient level of general knowledge about screening tests, However, almost all of the participants (92.7%) possessed insufficient level of total specific knowledge about screening tests.

**Table (5)** shows the total percentage and mean scores of the studied mothers regarding their attitude towards screening tests. The table revealed that more than three-quarters of mothers (82.0%) showed a positive attitude regarding neonatal screening tests while only 18.0% had a negative attitude with a mean  $\pm$  SD is  $22.40 \pm 3.09$ .

**Table (6)** represents the relation between mothers' attitude and their total general and specific knowledge about screening tests. The table reveals that 68.5% of mothers with sufficient general knowledge about neonatal screening tests had a positive attitude with a statistically significant difference as p-value  $<0.001$ . However, the majority of mothers (94.8%) with insufficient specific knowledge about neonatal screening tests had a positive attitude, this difference was statistically significant (p-value  $<0.001$ ).

**Table (7)** shows the relation between mothers' knowledge, attitude, and their sociodemographic characteristics. It was found that general and specific knowledge about screening tests increased in mothers between 18 to less than 25 years old with mean  $\pm$  SD is  $0.58 \pm 0.13$  and

$0.47 \pm 0.20$  respectively, while mothers' attitude about screening tests increased with age with mean  $\pm$  SD is  $2.99 \pm 0.07$  with a statistically significant difference as P value  $>0.001$ . The table also reveals that general, specific knowledge and attitude about screening tests increased in mothers with university education with mean  $\pm$  SD is  $0.60 \pm 0.06$  and  $0.58 \pm 0.28$  and  $2.98 \pm 0.06$  respectively.

In addition, general, specific knowledge, and attitude about screening tests increased in mothers from urban areas. The table also reveals that general, specific knowledge and attitude about screening tests increased in mothers who had three children with mean  $\pm$  SD  $0.57 \pm 0.15$  and  $0.55 \pm 0.33$  and  $3.0 \pm 0.0$  respectively. It was found that mothers with a family history of diseases had high mean scores of general, specific knowledge and attitude about screening tests with mean  $\pm$  SD  $0.61 \pm 0.01$ ,  $0.71 \pm 0.27$ , and  $2.95 \pm 0.14$  respectively.

**Table (8)** shows correlation between mothers' attitude and their total general and specific knowledge about screening tests. This table demonstrated a significant positive correlation between mothers' attitude regarding screening tests and their total level of general knowledge (p-value = 0.001). While there was a significant negative correlation between mothers' total specific knowledge, and their attitude about screening tests (as p value  $<0.001$ ).

**Table (1): Percentage distribution of the studied mothers regarding their sociodemographic characteristics (n = 1500)**

<b>Mothers' sociodemographic characteristics</b>	<b>No.</b>	<b>%</b>
<b>Age of mother (years)</b>		
18 – <25	930	62.0
25 – <35	525	35.0
35 – <40	45	3.0
<b>Educational status</b>		
Illiterate	63	4.2
Can read and write	184	12.3
Primary school	195	13.0
Secondary school	300	20.0
Diploma( technical education)	499	33.3
University degree/ above	259	17.2
<b>Occupation</b>		
House wife	1035	69.0
Employed	465	31.0
<b>Residence</b>		
Rural	1170	78.0
Urban	330	22.0
<b>Number of children</b>		
1	765	51.0
2	600	40.0
3	135	9.0
<b>Consanguinity</b>		
No	1050	70.0
Yes	450	30.0
<b>Family history of diseases included in neonatal screening tests:</b>		
No	1425	95.0
<b>Yes</b>	<b>75</b>	<b>5.0</b>
<b>If yes mention the disease (n=75)</b>		
No history	0	0.0
Hypothyroidism	30	40.0
Hearing problems	30	40.0
G6PD	15	20.0

**Table (2): Percentage distribution of the studied mothers regarding their source of information about neonatal screening tests (n = 1500)**

Mothers' source of information about neonatal screening tests	Congenital hypothyroidism screening test		Other neonatal screening tests	
	No.	%	No.	%
<b>Have you ever heard about neonatal screening tests?</b>				
No	345	23.0	1335	89.0
Yes	<b>1155</b>	<b>77.0</b>	<b>165</b>	<b>11.0</b>
<b>What is the source of information?</b>				
Radio/TV	60	5.1	0	0.0
Internet	135	11.7	120	72.8
Relatives	630	54.6	45	27.2
Doctors/ Nurses	150	13.0	0	0.0
Health sessions	180	15.6	0	0.0

**Table (3): Percentage and mean scores of the studied mothers regarding their specific knowledge about congenital hypothyroidism, G6PD deficiency, hearing loss, and phenylketonuria (n=1500)**

Mothers' specific knowledge	Insufficient ( $\leq 60\%$ )		Sufficient ( $>60\%$ )	
	No.	%	No.	%
1. Knowledge of mothers about congenital hypothyroidism	<b>526</b>	<b>35.1</b>	<b>974</b>	<b>64.9</b>
Mean $\pm$ SD.	11.09 $\pm$ 2.63			
2. Knowledge of mothers about G6PD deficiency:	<b>1391</b>	<b>92.7</b>	<b>109</b>	<b>7.3</b>
Mean $\pm$ SD.	1.0 $\pm$ 3.10			
3. Knowledge of mothers about hearing loss:	<b>1155</b>	<b>77.0</b>	<b>345</b>	<b>23.0</b>
Mean $\pm$ SD.	4.49 $\pm$ 4.40			
4. Knowledge of mothers about phenylketonuria	<b>1500</b>	<b>100.0</b>	<b>0</b>	<b>0.0</b>
Mean $\pm$ SD.	0.0 $\pm$ 0.0			

**Table (4): Percentage and mean scores of the studied mothers regarding their total general and specific knowledge about screening tests (n = 1500)**

Mothers' knowledge	Insufficient ( $\leq 60\%$ )		Sufficient ( $>60\%$ )		Total Score		
	No.	%	No.	%			
Mothers' general knowledge about screening tests	519	34.6	981	65.4			
Mean $\pm$ SD.	5.80 $\pm$ 3.28						
Mothers' specific knowledge about screening tests	1391	92.7	109	7.3			
Mean $\pm$ SD.	16.58 $\pm$ 8.30						

SD: Standard deviation

**Table (5): Total percentage and mean scores of the studied mothers regarding their attitude towards screening tests (n = 1500)**

Mothers' attitude towards screening tests	No.	%
Negative attitude $< 60\%$	270	18.0
Positive attitude $\geq 60\%$	1230	82.0
Total score (8 – 24)		
Mean $\pm$ SD.	22.40 $\pm$ 3.09	

SD: Standard deviation

**Table (6): Relation between mothers' attitude and their total general and specific knowledge about screening tests (n = 1500)**

Total general and specific knowledge about screening tests	Mothers' attitude				X <sup>2</sup>	p
	Negative (n = 270)		Positive (n = 1230)			
	No.	%	No.	%		
<b>I: Mothers' general knowledge about screening tests:</b>						
Insufficient ( $\leq 60\%$ )	131	48.5	388	31.5	28.189*	$<0.001^*$
Sufficient ( $>60\%$ )	139	51.5	842	68.5		
<b>II: Mothers' specific knowledge about screening tests</b>						
Insufficient ( $\leq 60\%$ )	225	83.3	1166	94.8	43.175*	$<0.001^*$
Sufficient ( $>60\%$ )	45	16.7	64	5.2		

X<sup>2</sup>: Chi-square test\* Statistically significant at  $p \leq 0.05$

Table (7): Relation between mothers' knowledge, attitude and their sociodemographic characteristics.

Mothers' sociodemographic characteristics	N	Knowledge		Attitude
		General knowledge	Specific knowledge	
		Mean ± SD.	Mean ± SD.	Mean ± SD.
<b>Age of mother (years)</b>				
18 – <25	<b>930</b>	0.58 ±0.13	0.47 ±0.20	2.75 ±0.42
25 – <35	<b>525</b>	0.23 ±0.25	0.46 ±0.28	2.87 ±0.32
35 – <40	<b>45</b>	0.27 ±0.31	0.31 ±0.0	2.99 ±0.07
<b>F (p)</b>		<b>586.668* (&lt;0.001*)</b>	<b>10.612* (&lt;0.001*)</b>	<b>21.709* (&lt;0.001*)</b>
<b>Educational status</b>				
Illiterate	<b>63</b>	0.23 ± 0.25	0.43 ± 0.16	1.99 ± 0.04
Can read and write	<b>184</b>	0.43 ± 0.25	0.54 ± 0.34	2.03 ± 0.16
Primary school	<b>195</b>	0.35 ± 0.29	0.39 ± 0.22	2.90 ± 0.25
Secondary school	<b>300</b>	0.56 ± 0.17	0.38 ± 0.04	2.96 ± 0.16
Diploma (Technical education)	<b>499</b>	0.37 ± 0.27	0.45 ± 0.19	2.95 ± 0.18
University degree/ above	<b>259</b>	0.60 ± 0.06	0.58 ± 0.28	2.98 ± 0.06
<b>F (p)</b>		<b>66.755* (&lt;0.001*)</b>	<b>34.415* (&lt;0.001*)</b>	<b>1272.658* (&lt;0.001*)</b>
<b>Occupation</b>				
House wife	<b>1035</b>	0.54 ±0.18	0.46 ±0.19	2.77 ±0.40
Employed	<b>465</b>	0.24 ±0.26	0.45 ±0.30	2.86 ±0.34
<b>t (p)</b>		<b>22.352* (&lt;0.001*)</b>	<b>0.672(0.502)</b>	<b>4.264* (&lt;0.001*)</b>
<b>Residence</b>				
Rural	<b>1170</b>	0.40 ±0.27	0.41 ±0.20	2.75 ±0.42
Urban	<b>330</b>	0.61 ±0.01	0.63 ±0.25	2.96 ±0.12
<b>t (p)</b>		<b>27.444* (&lt;0.001*)</b>	<b>14.519* (&lt;0.001*)</b>	<b>14.538* (&lt;0.001*)</b>
<b>Number of children</b>				
1	<b>765</b>	0.52 ± 0.21	0.47 ± 0.20	2.97 ± 0.11
2	<b>600</b>	0.32 ± 0.27	0.43 ± 0.24	2.54 ± 0.49
3	<b>135</b>	0.57 ± 0.15	0.55 ± 0.33	3.0 ± 0.0
<b>F (p)</b>		<b>147.953* (&lt;0.001*)</b>	<b>16.639* (&lt;0.001*)</b>	<b>341.878* (&lt;0.001*)</b>
<b>Consanguinity</b>				
No	<b>1050</b>	0.37 ±0.27	0.41 ±0.21	2.73 ±0.44
Yes	<b>450</b>	0.61 ±0.01	0.57 ±0.24	2.97 ±0.11
<b>t (p)</b>		<b>28.474 (&lt;0.001*)</b>	<b>11.847 (&lt;0.001*)</b>	<b>16.452 (&lt;0.001*)</b>
<b>Family history of diseases included in neonatal screening</b>				
No	<b>1425</b>	0.44 ±0.26	0.45 ±0.22	2.79 ±0.39
Yes	<b>75</b>	0.61 ±0.01	0.71 ±0.27	2.95 ±0.14
<b>t (p)</b>		<b>25.811(&lt;0.001*)</b>	<b>8.244(&lt;0.001*)</b>	<b>8.360(&lt;0.001*)</b>

t: Student t-test

F: F for One way ANOVA test

p: p-value for comparison between the studied categories

\*: Statistically significant at  $p \leq 0.05$

**Table (8): Correlation between mothers' attitude and their total general and specific knowledge about screening tests (n = 1500)**

Mothers' total knowledge	Mothers' attitude	
	R	P
Mothers' general knowledge about screening tests	0.083	0.001*
Mothers' specific knowledge about screening tests	-0.175	<0.001*

**r: Pearson coefficient****\*: Statistically significant at  $p \leq 0.05$** 

## Discussion

In order to ensure long-term management, neonatal screening tests are responsible for the screening and diagnosis of limited disorders. They are crucial because they offer a well-organized, all-inclusive system that includes management, treatment, screening, diagnosis, and follow-up. (AlSulaiman et al., 2015). Several disorders identified by screening can be managed with medication and dietary changes before they cause morbidity and death. (AlFadhel et al., 2017). Thus, the aim of this study was to assess the knowledge and attitude of Egyptian mothers regarding neonatal screening tests for metabolic disorders and hearing loss.

The current study mentioned that there was a sufficient level of general total knowledge of mothers about neonatal screening tests. This might be due to nearly three quarters of mothers were well-educated. This result was confirmed by Alfayez et al., (2018) who stated that mothers are generally aware of neonatal screening.

The present study showed that about two thirds of mothers had a sufficient level of specific knowledge regarding congenital hypothyroidism. According to the researchers, this probably may be

due to congenital hypothyroidism is the oldest and most common neonatal screening test that mother had much knowledge about it. The results of this study were consistent with Neethu et al., (2020) who discovered that over two thirds of participants had an average understanding of congenital hypothyroidism. The findings contradicted with Mahgoub et al., (2022) who reported that inadequate total knowledge scores of congenital hypothyroidism were obtained by three quarters of the mothers.

Regarding phenylketonuria, the majority of mothers in the current study had insufficient level of specific knowledge. This may be due to phenylketonuria was not familiar for most of mothers. This result was consistent with the findings of Elsayed et al., (2020) who found that almost half of mothers know very little about phenylketonuria.

As regards G6PD, there was an insufficient level of knowledge about G6PD deficiency. The present findings aligned with Kasemy et al., (2020) who conducted a cross-sectional study to determine the prevalence of mothers' knowledge, attitudes, and practices regarding glucose-6-phosphate dehydrogenase deficiency. The study

revealed that mothers' perceptions of G6PD deficiency were low.

In the current study, the majority of mothers had inadequate level of specific knowledge about hearing loss. This could be due to hearing loss screening test was recently added to the neonatal screening program. The present findings were in line with **Jatto et al., (2018)** who investigated mothers' perspectives regarding newborn hearing screening programs and found that mothers had insufficient information regarding newborn hearing screening.

Regarding total specific knowledge of the studied mothers about screening tests. The study findings showed that the majority of mothers lacked a sufficient level of comprehensive, targeted knowledge of screening tests. This can be because the majority of screening tests are brand-new and were recently included in neonatal screening program. As most of mothers were from rural areas and have only one child, it's also a possible cause that they were less experienced and unaware of this. The present outcome aligned with the research findings of **Alfayez et al., (2018)**, who studied maternal knowledge and attitudes about neonatal screening programs in the Eastern Region of the Kingdom of Saudi Arabia and found that the majority of women knew very little about the neonatal screening program.

**Ong et al., (2022)** discovered that most postpartum mothers were familiar with newborn screening, which is in contrast to the current study. Additionally, a study conducted by **Davey et al., (2019)** in Western Australia indicated that mothers

had higher knowledge compared to the current study.

Concerning mothers' attitude, it was observed that the mothers in the present study showed a positive attitude regarding neonatal screening tests. This matched the results of **Kasem et al., (2022)** who reported that the majority of mothers had positive attitude regarding neonatal screening.

The results of the current study illustrated that mothers with sufficient general knowledge about screening tests had a positive attitude with a statistically significant difference. On the other hand, the majority of them with insufficient specific knowledge about screening tests, had a positive attitude with statistically significant difference. From the researcher's point of view, despite lack of knowledge about the disorders being tested for through neonatal screening, mothers' internal drive to adopt new, healthy behaviors and modify their attitudes came from their worry about their neonates.

This result was in line with the findings of **Kasem et al., (2022)** who found that the mothers' views and knowledge about newborn screening had a moderately positive but significant association. This, however, was consistent with **Abed, (2016)** who stated that the mother had an inadequate knowledge of concepts about genetic testing and newborn screening procedures. Nonetheless, they tended to have favorable attitude about newborn screening tests.

The current study showed a highly statistically significant relation between mothers'

sociodemographic characteristics, total scores of their knowledge and attitude. This result was in contrast to that of **Bragaa et al., (2020)** who discovered no relation between socioeconomic status and knowledge of congenital hypothyroidism. In addition, the current findings also disagreed with **Elbeltagy et al., (2019)** who found no relationship between parents' socioeconomic characteristics, their knowledge and attitude towards hearing loss.

Mothers' attitude towards screening tests and their level of total specific knowledge were significantly correlated negatively. The results of **Hussein et al., (2022)** study, who examined the effectiveness of the screening toolkit on empowering mothers about neonatal screening tests for metabolic disorders and hearing defects, conflicted with the present study result. The results of their study showed a strong positive correlation between the attitude of mothers and their core knowledge of metabolic diseases and newborn screening tests. The current study showed that there was a positive correlation between total general knowledge and attitude of mothers. This outcome was in agreement with **Bassam & Abdelmageed, (2022)** who revealed a strong positive correlation between general knowledge, attitude and practice.

### **Conclusion:**

Based on the findings of the current study, it can be concluded that mothers had sufficient level of total general knowledge and insufficient level of total specific knowledge with positive attitude about screening tests. There was statistically

significant correlation between mothers' attitude and their total general and specific knowledge about screening tests.

### **Recommendations:**

Based on the findings of the current study, the following recommendations were suggested:

Develop an educational program for mothers regarding neonatal screening at maternity and child health centers.

Primary healthcare providers must provide an oral explanation and manual guidelines, hand outs, modules, or brochures about neonatal screening programs.

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