

Original Research Article

Application of health belief model to assess periodic examination of thyroid functions in children among Saudi mothers

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ABSTRACT

Background: Hypothyroidism is a common concern in the development of physical and cognitive development in children. The health belief model is one of the models that examines the factors behind people's behaviors. Aim was to assess the periodic examination of children among Saudi mothers and its association with different constructs of the health belief model.

Methods: This cross-sectional study was conducted among 385 participants of Saudi mothers for three months from January to April 2024 by using a designed structured questionnaire.

Results: 88.05% of mothers showed poor behavior regarding periodic examinations of thyroid functions for their children. The significant factors that determined this behavior were the older mother's age, working status (mother working), positive family history of hypothyroidism, good perceived benefits, and good cues to action. These factors were statistically significant at p value <0.05.

Conclusions: Most of the mothers who participated in this study showed poor behavior regarding the regular examination of thyroid function tests of their children. Factors such as the older mother's age, working status (working mother), positive family history of thyroid issues, good perceived benefits of the exams, and good cues to action were found to be significantly associated with mothers' behavior towards this regular examination of thyroid function.

Keywords: Acquired hypothyroidism, Behavior, Hypothyroidism, Health belief model, Knowledge, Saudi mothers

INTRODUCTION

Hypothyroidism is the most prevalent thyroid function disorder in children.¹ Hypothyroidism occurs when the thyroid gland is unable to produce adequate amounts of thyroid hormones.² There are two main types of hypothyroidism: congenital hypothyroidism, which is present from birth with an underdeveloped or malfunctioning thyroid gland and is one of the most common preventable causes of intellectual disability, and acquired hypothyroidism also occurs later in life.³ Worldwide, autoimmune thyroiditis is still the leading cause of acquired hypothyroidism in sufficient iodine regions and iodine deficiency in the iodine-deficient regions.² In the United States, 1:2000 to 1:4000 in

newborns have congenital hypothyroidism every year.⁴ The thyroid gland plays a crucial role in children's well-being, influencing both physical growth and development and cognitive function.¹ In fact, hypothyroidism, a condition characterized by an underactive thyroid, is a leading cause of intellectual disability.⁵ Despite its significant health impact, thyroid dysfunction remains a prevalent yet often overlooked and misdiagnosed condition worldwide.⁶ This not only poses a significant burden on individual health but also strains healthcare systems and economies. Early diagnosis and regular screening for hypothyroidism in children are paramount. These measures not only enable the detection of any changes in thyroid function at an early stage, but also provide a valuable tool for monitoring a child's response

and the effectiveness of treatment.^{1,7} This early intervention is crucial to prevent lasting cognitive impairments associated with hypothyroidism. While newborn screening plays a vital role, it may not always identify all cases.⁵ Therefore, mothers' awareness of potential hypothyroidism symptoms in their children and seeking evaluation upon their emergence becomes essential. The purpose of the research is to assess behavior related to periodic examinations for hypothyroidism in children among Saudi mothers and to understand mothers' behaviors and factors influencing them to develop effective strategies for health education and promotion. The health belief model was applied to this study, aim to assess the association between the different constructs of the health belief model and the periodic examination of thyroid functions. Understanding how mothers perceive their child's susceptibility to hypothyroidism, the potential severity of the condition, and the benefits of early detection will inform the development of targeted interventions.

The study aimed to assess the periodic examination of thyroid functions in children among Saudi mothers. It also aimed to assess different constructs of the health belief model regarding perceived susceptibility, perceived severity, perceived barriers, perceived benefit, self-efficacy, and cues to action. Additionally, the study aimed to assess the knowledge of hypothyroidism in children among Saudi mothers and to explore the association between the different constructs of the health belief model and the periodic examination of thyroid functions.

METHODS

Study design, and duration.

A cross-sectional study design was conducted among Saudi mothers. Over 3 months from January to April 2024.

Study population, inclusion, and exclusion criteria.

The target population is Saudi mothers of children aged from 1-12 years, according to the National Institutes of Health.⁸ Exclusion criteria was mothers of children with hypothyroidism.

Sample size and sampling technique.

The participants in the questionnaire were collected online through a convenient sampling technique. The questionnaire was sent to mothers on various social media such as WhatsApp, Twitter, and Telegram. The sample size was calculated using the following equation: $n = Z^2 pq / d^2$.⁹ Assuming that the population was more than 10,000, the prevalence of the factors under the study was 50%, the confidence interval was 95%, and the accuracy degree was 0.05. The sample was calculated from the equation: 385 participants.

Data collection

The questionnaire was designed by researchers, guided by literature.¹⁰ The questionnaire was divided into three sections (social demographic characteristics knowledge-health belief model). The first section covered social demographic characteristics that included 11 close-ended questions, which are age, level of education, occupation status, level of income, place of residence, number of children, family history of hypothyroidism, and health insurance. The second section was about knowledge that included 7 multiple-choice questions regarding hypothyroidism; in this section, correct answers were scored 1, and incorrect answers were scored 0. The total score range was 0-7, with the cut-off point for those it has less than or equal median of 3 having poor knowledge, while those who have more than a median of 3 are considered to have good knowledge. The third section was the constructs of the health belief model, presented answers with a 5-point Likert scale ranging from a score of 5 for "strongly agree" to a score of 1 for "strongly disagree," with the highest score being 5. Perceived susceptibility is 3 items, with a total score ranging from 3 to 15; it was considered that those less than or equal to median 9 have poorly perceived susceptibility, while those who have more than median 9 have well-perceived susceptibility. The perceived severity is 3 items, with the total score ranging from 3 to 15. It was considered that those less than or equal to median 11 have poor perceived severity, while those who have more than median 11 have good perceived severity. Perceived benefits are 3 items, with the total score ranging from 3 to 15. It was considered that those less than or equal median 12 have poor perceived benefits, while those more than the median 12 have good perceived benefits. Perceived barriers are 3 items, with the total score ranging from 3 to 15. It was considered that those less than or equal to median 9 have poor perceived barriers, while those that have more than median 9 have good perceived barriers. Cues to action are 4 items with total scores ranging from 4 to 20. It was considered less than or equal to median 13 have poor cues to action, while those more than median 13 have good cues to action. Self-efficacy is 4 items with total scores ranging from 4 to 20. It was considered those who have less than or equal median of 15 have poor self-efficacy, while those who have more than the median of 15 have good self-efficacy.

Validity and reliability

Validity was tested statistically for all constructs of the health belief model (perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, and self-efficacy) separately. All questions were highly positively correlated with the overall result; r was more than 0.3 for all questions for all constructs of the health belief model, and p values were all less than 0.05. The reliability of the questionnaire was tested by Cronbach's alpha by JMP (17), for all constructs of the health belief model separately.¹¹ For perceived

susceptibility was, the result (0.6); for perceived severity, the result was (0.6); for perceived benefits, the result was (0.7); for perceived barriers, the result was the result (0.6); for cues to action, the result (0.6420); and for self-efficiency was the result (0.8). The results are mostly accepted and good reliability.

Statistical analysis

The data was coded and analysed using John's Macintosh Project JMP software version 17.¹¹ Statistical data in the frequency table were displayed as numbers and percentages by tabulation.

Ethical considerations

The study was conducted with the approval of the institutional review board (IRB) at Princess Nourah Bint

Abdulrahman University, with the IRB log number 24-0035. Information written consent was on the first page of the questionnaire. The participants were assured confidentiality and privacy of any information they provided; they were informed about the purpose of collecting data. The participant had the right to withdraw from the study at any time. And the autonomy of participants was maintained.

RESULTS

Table 1 demonstrates the socio-demographic characteristics of study participants. Most participants were aged more than 40 years. Most 55% have a bachelor's education, and 48.31% of participants have four children or more.

Table 1: Socio-demographic characteristics of study participants (n=385).

Socio-demographic characteristic	Number	Percentage
Age group (years)		
18-23	20	5.19
24-29	39	10.13
30-35	71	18.44
36-40	94	24.42
More than 40	161	41.82
Level of education		
Elementary education	42	10.91
High school education	106	27.53
Bachelor	213	55.32
Postgraduate	24	6.23
Working status		
Not working	208	54.03
Working	177	45.97
Level of income		
4 thousand or less	148	38.44
5-8 thousand	75	19.48
9-12 thousand	74	19.22
13 -16 thousand	47	12.21
17 thousand or more	41	10.65
Place of residence		
Urban	340	88.31
Rural	45	11.69
Number of children		
One child	52	13.51
Two children	65	16.88
Three children	82	21.30
Four children or more	186	48.31

Figure 1 shows distribution of participants based on family history of hypothyroidism. It shows that 54% of participants did not have a family history of hypothyroidism, while it was present in 38% of those with a disorder, and 8% were not sure.

Figure 2 shows description of health insurance availability of the participants. It shows that 41% of the participants had health insurance that covers thyroid function tests in children, while 26% of them did not have health insurance that covers thyroid function tests, and 33% do not have health insurance at all.

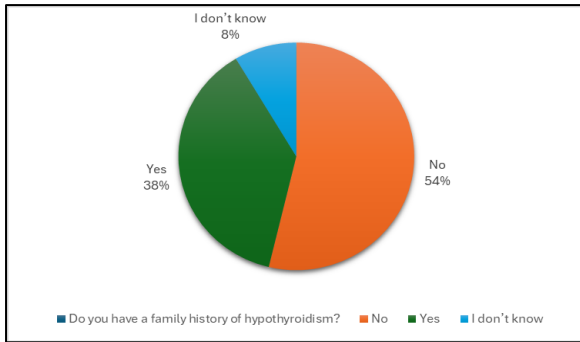


Figure 1: Distribution of participants based on family history of hypothyroidism.

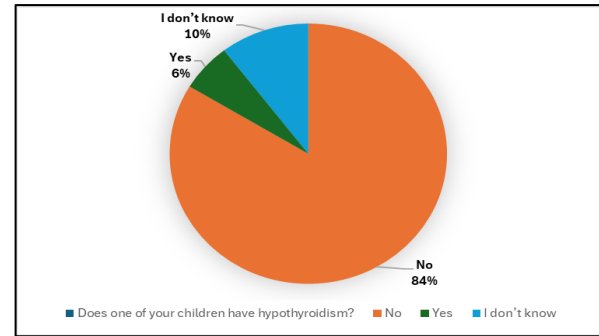


Figure 3: Hypothyroidism in children of our participants.

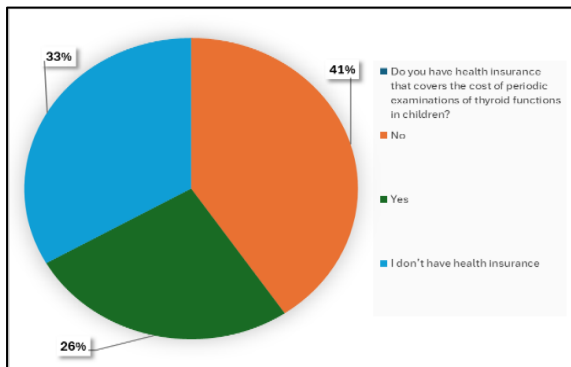


Figure 2: Description of health insurance availability of the participants.

Figure 3 shows the distribution of hypothyroidism in children of our participants. Most participants (84%) did not have a child with hypothyroidism. (16%) did know, and only (6%) have a child with hypothyroidism.

Table 2 constructs of health belief model for hypothyroidism among participants. 147 (38.68%) mothers perceived susceptibility that children with a genetic history of hypothyroidism are more likely to develop hypothyroidism. 41.04% of mothers agreed that the perceived severity of hypothyroidism can have adverse effects on growth. Demonstrates the perceived benefits the majority of mothers 50.91% strongly agree that periodic examinations of thyroid functions help in the early detection and treatment of hypothyroidism. Perceived barriers: 36.62% of participants perceived a neutral viewpoint that the cost of thyroid function examination is extremely high. Cues to the action of hypothyroidism, 44.16% of participants agreed that the child's slow growth may prompt them to seek medical advice. Self-efficacy of hypothyroidism: most participants (46.75%) strongly agreed that if they suspect that their child has hypothyroidism, they will go for the examination without any hindrance (Table 2).

Table 2: Different constructs of health belief model of hypothyroidism among participants.

Constructs of HBM	Strongly agree		Agree		Neutral		Disagree		Strongly disagree	
	N	%	N	%	N	%	N	%	N	%
Perceived susceptibility										
I think that children with a genetic history of hypothyroidism are more likely to develop hypothyroidism	72	18.59	147	38.68	109	28.68	36	9.74	16	4.21
I think my child may be at risk for hypothyroidism	17	4.42	41	10.65	145	37.66	118	30.65	64	16.62
I am very worried about my child developing hypothyroidism	36	9.35	74	19.22	123	31.95	96	24.94	56	14.55
Perceived severity										
I think hypothyroidism can be lived with	68	17.66	173	44.94	101	26.23	25	6.49	18	4.68
I think hypothyroidism in children is a severe problem if left untreated	110	28.57	152	39.48	77	20.00	31	8.05	15	3.90
I think hypothyroidism can have adverse effects on growth	102	26.49	158	41.04	84	21.82	28	7.27	13	3.38
Perceived benefits										
I think control hypothyroidism improves a child's health and growth overall	124	32.21	173	44.94	58	15.06	25	6.49	13	3.38

Continued.

Constructs of HBM	Strongly agree		Agree		Neutral		Disagree		Strongly disagree	
	N	%	N	%	N	%	N	%	N	%
I think a periodic examination of thyroid functions helps in the early detection and treatment of disease	196	50.91	131	34.03	37	9.61	10	2.60	11	2.86
I think a periodic experimentation of thyroid functions can reduce the chance of complications if a child gets hypothyroidism	174	45.19	139	36.10	49	12.73	13	3.38	10	2.60
Perceived barriers										
I think screening centers are very far from my home	47	12.21	90	23.38	112	29.09	103	26.75	33	8.57
I think conducting a thyroid function examination takes a long time	32	8.31	79	20.52	130	33.77	115	29.87	29	7.53
I think the cost of thyroid function examination is very high	67	17.40	103	26.75	141	36.62	55	14.29	19	4.94
Cues to action										
I think I know someone who has hypothyroidism, and that prompts me to examine my child	51	13.25	108	28.05	118	30.65	69	17.92	38	10.13
I think that the child's slow growth may prompts me to seek medical advice	117	30.39	170	44.16	68	17.66	18	4.68	12	3.12
I think I have received recommendations or advice from healthcare professionals regarding symptoms of hypothyroidism that would prompts me to get tested	36	9.35	110	28.57	107	27.79	84	21.82	48	12.47
I think that the signs or symptoms, including the low academic performance that I noticed in my child, make me suspect hypothyroidism	34	8.83	100	25.97	164	42.60	67	17.40	20	5.19
Self-efficacy										
I think that if I suspect that my child has hypothyroidism, I will go for the examination without any hindrance	180	46.75	129	33.51	47	12.21	17	4.42	12	3.12
I think hospital services are available to me to help me check for my child's hypothyroidism	96	24.94	159	41.30	83	21.56	31	8.05	16	4.16
I think I have the skills necessary to navigate the healthcare system and advocate for my child's needs	65	16.88	156	40.52	103	26.75	38	9.87	23	5.97
I think I can recognize possibly symptoms of hypothyroidism in a child	50	12.99	131	34.03	104	27.01	67	17.40	33	8.57

Table 3: Association between behavior and participants level of knowledge and different constructs of health belief model.

Total score of knowledge	Do you regularly check your child's thyroid function?				Chi square test
	Poor		Good		
	N	%	N	%	
Good knowledge	88	25.96	18	39.13	P value =0.0606
Poor knowledge	251	74.04	28	60.87	
Total score of perceived susceptibility					
Poor	213	62.83	19	41.30	P value =0.0051*
Good	126	37.17	27	58.70	
Total score of perceived severity					
Poor	179	52.80	18	39.13	P value =0.0817
Good	160	47.20	28	60.87	

Continued.

Total score of knowledge	Do you regularly check your child's thyroid function?				Chi square test
	Poor		Good		
	N	%	N	%	
Total score of perceived benefits					
Poor	174	51.33	23	50.00	P value =0.8658
Good	165	48.67	23	50.00	
Total score of perceived barriers					
Poor	189	55.75	28	60.87	P value =0.5114
Good	150	44.25	18	39.13	
Total score of cues to action					
Poor	185	54.57	13	28.26	P value =0.0008*
Good	154	45.43	33	71.74	
Total score of self-efficacy					
Poor	193	56.93	15	32.61	P value =0.0019*
Good	146	43.07	31	67.39	

*p value<0.05.

Table 3 demonstrates the association between participants' level of knowledge and periodic examination of thyroid functions, as well as between behavior and different constructs of the health belief model. It was found that most participants do not periodically screen for thyroid functions because of their poor level of knowledge. Also, there was a statistically significant association between the behavior of regular screening of thyroid function in children and three constructs of the health belief model: total perceived susceptibility, total cues to action, and total self-efficacy (p value <0.05).

Table 4 demonstrate the behavior of periodic examination of thyroid functions in children among mothers. Unfortunately, 88.05% of mothers never regularly check their child's thyroid function. Only 11.95% had good behavior towards periodic examinations.

Table 4: Periodic examination of thyroid functions in children among mothers.

Good		Poor	
N	Percentage	N	Percentage
46	11.95	339	88.05

Table 5: Mutually nominal logistics regression regarding regular examination of thyroid function among participants.

Likelihood ratio tests				
Effect	Model fitting criteria		Likelihood ratio tests	
	-2 log likelihood of reduced model		Chi-square	Df Sig.
Intercept	201.372 ^a		0.000	0 .
Age group	213.287		11.915	4 0.018*
Level of education	205.744		4.372	3 0.224
Working status	207.710		6.338	1 0.012*
Income level	210.519		9.147	4 0.058
Place of residence	202.570		1.198	1 0.274
Family history	209.267		7.895	2 0.019*
Number of children	204.671		3.299	3 0.348
Insurance	202.712		1.340	2 0.512
Knowledge	202.974		1.602	1 0.206
Perceived susceptibility	202.622		1.250	1 0.264
Perceived severity	201.747		0.375	1 0.540
Perceived benefits	205.572		4.200	1 0.040*
Perceived barriers	202.328		0.956	1 0.328
Cues to action	207.576		6.204	1 0.013*
Self-efficacy	204.155		2.783	1 0.095

The chi-square statistic is the difference in -2 log-likelihoods between the final model and a reduced model. The reduced model is formed by omitting an effect from the final model. The null hypothesis is that all parameters of that effect are 0. ^aThis reduced model is equivalent to the final model because omitting the effect does not increase the degrees of freedom. *p value <0.05.

Table 5 demonstrates the regression test revealed a significant association between certain variables and behavior. These variables include regular thyroid function examinations in children, as well as age, work status, history of diseases, perceived benefits, and cause of action (p value <0.05).

DISCUSSION

The current research aimed to assess knowledge about hypothyroidism and assessed the periodic examination of thyroid functions. also assessed different constructs of the health belief model regarding perceived susceptibility, perceived severity, perceived barriers, perceived benefit, self-efficacy, and cues to action. Additionally, assessed the association between the different constructs of the health belief model and the periodic examination of thyroid functions in children among Saudi mothers. In the current study, it was found that more than half of the participants had poor knowledge of hypothyroidism. This result is consistent with a study conducted in 2023 among Saudis that showed almost all participants had poor knowledge regarding hypothyroidism.¹² The level of knowledge with current research was better than theirs; in this study, approximately less than five percent of the sample knew methods of diagnosing hypothyroidism; in a contradicted study conducted in Saudi Arabia, most participants had good knowledge about the diagnosis of hypothyroidism.¹² Also, more than half of the participants correctly identified that hypothyroidism is not contagious; this outcome is consistent with a study in Riyadh to assess awareness of thyroid disorders, more than half of the participants answered that hypothyroidism is not an infectious disease.¹³ Moreover, in the current research, less than ten percent of the participants correctly identified that weight gain is an early sign of hypothyroidism in a child. In contrast, in another study conducted to assess the knowledge regarding the difference between thyroid disorders, more than half of participants answered that weight gain that occurs suddenly is a sign of hypothyroidism.¹⁴ This study found they only one-third of our participants knew that hypothyroidism is a hereditary disease. Another study conducted in Saudi Arabia to assess knowledge regarding thyroid disorders showed that almost all of their participants knew that thyroid dysfunction is genetics.¹⁵ Regarding to behavior of periodic examination, in the current research, it was found that nearly almost of mothers had poor behavior of periodic examinations of thyroid function tests. Another study conducted in Makkah among hypothyroidism patients showed that more than half of patients do not check-up regularly their TSH levels, which may be attributed to age as a significant factor older than 45 years.¹⁶ Regarding perceived susceptibility to hypothyroidism, more than one-third of participants believed their children were more likely to acquire hypothyroidism if their family had a genetic history of the condition. This is due to when asked if hypothyroidism is a hereditary disease, more than half of the sample answered incorrectly, indicating a lack of knowledge of hypothyroidism. Another study was

conducted to evaluate the level of knowledge of hypothyroidism among the Saudis. When asked whether a positive family history increases the risk of developing hypothyroidism, more than half of the participants answered correctly. This could be explained by the fact that over half of the participants either had a family member with a thyroid disease or had received a thyroid disorder diagnosis in the past.¹² Regarding perceived severity, half of the mothers in the sample had a poor perception of the severity of hypothyroidism. Despite this, the percentages of good and poor perceived severity in the sample were similar. When it came to individual states, more than half of the sample agreed that untreated hypothyroidism can be detrimental. This belief could be attributed to the fact that less than five percent of women have a child with hypothyroidism, while one-third of the sample have a family history of the illness. These mothers are certainly aware that therapy can control the symptoms of hypothyroidism. According to research on children with hypothyroidism, treatment for acquired primary hypothyroidism, which is levothyroxine seeks to promote normal growth and development while also obtaining optimal cognitive results. Thyroid hormone treatment reduces goitre development and, in most instances, relieves hypothyroidism symptoms.¹⁷ Regarding perceived benefits of hypothyroidism the total score, more than half of the participants have poor perceived benefits. Half of mothers strongly agree that periodic examinations of thyroid functions help in the early detection and treatment of hypothyroidism. The reason for this might be that more than half of mothers have a bachelor's degree, demonstrating their elevated level of education and enabling them to understand the perceived benefits of regularly checking children's thyroid function to ensure their safety. Regarding perceived barriers, this study found that over half of the sample had poor perceived barriers, and this aligns with findings from a study on the assessment of knowledge and awareness regarding thyroid disorders among women in India, which found that participants who believe that the reason for not taking a thyroid test is that they have no idea about the test itself are accounted more than half of the sample.¹⁸ Regarding cues to actions, the results of this study revealed that the quarter of the sample agreed that "I think a slow child's development may prompt me to seek medical advice" due to mothers' keenness to detect hypothyroidism in their children. Less than three-quarters of participants have high action signals, compared to a regular screening of their children's thyroid functions. The quality of life of children is a large concern for mothers. In a study at the University of Nebraska Medical Centre, it is indicated that mothers could do what they can to receive the necessary care and provide the best care for their children.¹⁹ Regarding self-efficacy the level of self-efficacy less than half of the sample agreed that if they suspected their child had hypothyroidism, they would go for unobstructed testing. This indicates a low level of self-efficacy in more than half of the participants. This study showed that performing regular hypothyroidism screening for children was poor for most people who had poor self-efficacy, and it could be linked that most

participants did not have sufficient ability to regularly screen for hypothyroidism in their children due to perceived barriers or cues to action.

CONCLUSION

Most of the mothers who participated in this study showed poor behavior regarding regular examination of thyroid function tests of their children. Factors such as the mother's age, working status, family history of thyroid issues, perceived benefits of the exams, and cues to action were found to be significantly associated with mothers' behavior towards this regular examination of thyroid function.

Recommendations

Intervention studies are recommended to assess the impact of health education campaigns on the knowledge and behavior of mothers regarding hypothyroidism. Continuous health education campaigns targeting knowledge about hypothyroidism and its susceptibility are recommended. Integrating hypothyroidism into high school curricula will help students to advocate for their health and raise awareness within their families.

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