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The parental challenge: knowledge, attitudes, and practices on iron deficiency anemia in Tabuk

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Abstarct
Iron deficiency anemia (IDA) is common in children worldwide and has been recognized as a major challenge to the health of children and society. Adequate knowledge of IDA is necessary for effective prevention and treatment. This study aimed to assess parental awareness of IDA and to identify factors that influence their level of knowledge. This cross-sectional survey study was carried out in Tabuk City, Saudi Arabia. The study enrolled 403 parents aged 18 years or older. A link to the electronic survey was sent *via* social media platforms to collect data. Descriptive and inferential statistics were performed.
Most participants were female and aged 36 years or older (72.5% and 75.2%, respectively). The level of parental knowledge regarding IDA varied between good (60.0%), moderate (29.0%), and poor (11.0%). Multivariable binary logistic regression revealed that young parents aged 18-25 had more than threefold increased odds [adjusted odds ratio (AOR): 3.475] of having a low to moderate level of knowledge. In addition, males were more significantly associated with an increased risk of low knowledge compared to females (AOR: 1.945). Parents with less than a university education were more than twice as likely to have poor to moderate knowledge (AOR: 2.157). According to the study's findings, 60% of parents in Tabuk City, Saudi Arabia, were well-informed about all aspects of IDA. The two main areas with the least amount of knowledge were signs and symptoms and understanding the meaning of anemia. Young parents (18-25 years old), men, and parents with less than a university degree are risk factors associated with a higher likelihood of low knowledge.

Introduction

Anemia is a hematologic disorder characterized by low hemoglobin concentration. The World Health Organization defines anemia as having a hemoglobin level below 11 g/dL for children; however, functional and clinically relevant outcomes should be used to guide hemoglobin cutoffs that define anemia and its severity.[1]

The most prevalent cause of anemia globally is iron deficiency anemia (IDA), which manifests as microcytic and hypochromic red blood cells on the peripheral smear.[2] Hemoglobin synthesis requires iron, which is an essential micronutrient. Blood loss, decreased intake, impaired absorption, or increased demand can lead to depletion of iron stores. Occult gastrointestinal bleeding can also lead to IDA.[3]

IDA remains a substantial public health issue, particularly in developing countries, due to the increased growth requirements, diet, low iron bioavailability, and high helminthic infestations.[4] It is the most frequent hematologic disease in children, which affects 20 % of children aged 0-4 and 5.9% of children aged 5-14 in industrialized nations. These figures rise to 39% and 48 %, respectively, in developing countries.[5]

Fatigue, pale complexion, brittle nails, and a desire for non-food substances like dirt, clay, and ice are the primary manifestations of IDA. However, most children with anemia do not exhibit any symptoms, and the illness is identified by screening laboratory testing for high-risk children.[6]

Patients with IDA often have poor general health, a low quality of life, mood and psychological disturbances, poor academic achievement, and developmental delay in children. Furthermore, IDA is associated with immune system disorders, an increase in the incidence of viral infections, as well as a protracted and complicated course of bacterial infections.[7] Even in the absence of anemia, iron deficiency can be debilitating and worsen other chronic health conditions with substantial morbidity and mortality.[8] There is evidence to support the high prevalence of iron-deficiency anemia among hospitalized patients, and it is associated with longer hospital stays and worse outcomes.[9]

Awareness among parents and caregivers is crucial for the prevention and management of IDA. Studies have shown that parents who are knowledgeable about IDA are more likely to engage in preventive measures, such as providing iron-rich foods and ensuring regular medical check-ups.[10,11]

Parental knowledge of IDA in children has been assessed previously. Studies conducted both internationally and in Saudi Arabia have shown suboptimal and inconsistent levels of knowledge, often related to educational and socioeconomic characteristics.[12-14] Hence, there is a need for more targeted research in specific regions to help develop tailored awareness programs that address the unique needs of different communities.

This study aimed to assess the knowledge, attitudes, and practices of parents in Tabuk City, Saudi Arabia, regarding IDA in children and to identify factors influencing the level of knowledge to develop effective awareness and prevention strategies.

Materials and Methods

Ethical considerations

This study obtained ethical approval from the Research Ethics Committee of the University of Tabuk, Saudi Arabia. Subjects who chose to complete the questionnaire were asked to give their consent to participate in the study. We informed participants of the study objectives, methodology, risks, and benefits. We also explained that we would use their data anonymously for research purposes only and that we would maintain their confidentiality.

Study design, setting, and duration

This cross-sectional survey study was carried out in Tabuk City, Saudi Arabia, from the start of September 2024 to the end of October 2024.

Sample size

The sample size was calculated with an online sample size calculator (Raosoft sample size calculator, http://www.raosoft.com/samplesize.html) using a 5% margin of error, a confidence interval of 95%, assuming an average response for most of the questions of 50% and depending on a total population of 624,000 in Tabuk City (Saudi Census). The minimum required sample size was 385 subjects.

Eligibility criteria

Parents aged 18 years or older residing in Tabuk City were invited to participate in the study. Participants declined to provide consent, and those with incomplete data were excluded.

Data collection

After obtaining the ethical approval, we collected the participants' data using an online, self-administered questionnaire. The electronic survey was created using Google Forms. A link to the survey was sent *via* social media platforms.

The survey was conducted in Arabic, and the questionnaire used in this study was adapted from Hehata *et al.* (2020), which was originally developed to assess general population awareness regarding IDA and its relation to nutrition and dietary habits. Modifications were made to tailor the questionnaire to the specific objectives of the current study.[12] The questionnaire consisted of 18 closed-ended multiple-choice questions in the form of three parts. The first part included questions about demographics (age, gender), marital status, number of children, level of education, family income, and family history of anemia. The second part included inquiries about awareness of IDA, such as definition, causes, symptoms and signs, effects, iron-rich diets, and factors that hinder iron absorption. The third part was concerned with attitudes and practices regarding IDA, such as the frequency of visiting doctors and specialists for check-up, the need for getting more information about IDA, and their source of knowledge.

Scoring system

We assessed knowledge using a 9-item second part of the survey. We provided 1 point for each right answer and 0 points for each wrong answer. The maximum possible score was 9 points with a range from 0 to 9 points. The overall level of knowledge was classified as poor (0-4 points, <50% right answer), moderate (5-7 points, 50-79% right answer), and good (8-9 points, 80-100% right answer). For the logistic regression analysis purposes, knowledge was recoded into two groups, good versus moderate to poor.

Statistical analysis

All data were tabulated and analyzed by the statistical package for the social sciences software program, IBM SPSS Statistics for Windows, version 27 (IBM Corp., Armonk, N.Y., USA). We presented categorical data as frequencies and percentages and analyzed the possible associations between categorical variables using Pearson's Chi-square test. A multivariable binary logistic regression (forward method) was performed to determine significant factors associated with a poor to moderate level of knowledge about IDA. Variables that showed significant associations ($p<0.05$) with poor to moderate knowledge in the bivariate analyses were entered as covariates in the regression analysis. Results were displayed as odds ratios and their 95% confidence intervals. A p-value <0.05 was considered statistically significant.

Results

The study included 403 parents living in Tabuk City, Saudi Arabia. Most participants were female and aged 36 years or older (72.5% and 75.2%, respectively). The currently married participants accounted for 91.3%. The number of children ranged from 1-3 (38.7%) to more than 5 (27.0%). Approximately

two-thirds (65.5%) attended university and received a bachelor's degree. Few participants (8.2%) reported a family income of less than SR 3000; otherwise, income varied from SR 3000-10,000 (29.3%) to more than SR 15,000 (34.2%). Family history of anemia was reported by 21.1% only (Table 1).

Table 2 shows that most of the participants (80.6%) had heard about IDA, about two-thirds (66.7%) recorded decreased hemoglobin as the correct definition of anemia, high percentages selected iron as the deficient nutrient in IDA (86.1%), and knew that worm infestation, poor diet, and excessive bleeding are among the causes of IDA (82.4%). More than half (54.3%) recognized tiredness, weakness, shortness of breath, and impaired learning process as signs and symptoms of IDA. However, a large number (80.1%) realized the effects of IDA in terms of impaired growth and development, learning difficulties, and reduced work capacity. Among the participating parents, 369 (91.6%) stated that eating a diet with good sources of iron and taking iron-folic acid tablets can prevent IDA. They also identified green leafy vegetables, meat, and poultry as foods rich in iron (92.3%). Finally, they distinguished tea and coffee as factors that inhibit iron absorption (84.9%).

The level of parental knowledge regarding IDA varied between good (60.0%), moderate (29.0%), and poor (11.0%) (Figure 1). There was a significant association between the level of knowledge and gender ($p=0.001$). The number of males with poor to moderate knowledge was higher than those with good knowledge (36.3% *vs*. 21.8%). Parental age also showed a significant association with knowledge level ($p=0.002$). Young parents aged 18-25 years showed a high frequency of low knowledge (12.5%) compared to good knowledge (4.1%). Similarly, parents with less than a university education and those with an income of 10,000 or less had a significantly high frequency of poor/moderate knowledge (43.8% each, $p<0.05$). A family history of anemia was significantly associated with higher levels of good knowledge (25.9% *vs*. 13.8%, $p=0.012$) (Table 3).

Multivariable binary logistic regression revealed that young parents aged 18-25 years had a more than threefold increased odds [adjusted odds ratio (AOR): 3.475] of having a low to moderate level of knowledge. In addition, males were more significantly associated with an increased risk of low knowledge compared to females (AOR: 1.945). Parents with less than a university education were more than twice as likely to have poor to moderate knowledge (AOR: 2.157) (Table 4).

Table 5 demonstrates the attitudes and practices of the study participants regarding IDA. About one-third (34.5%) visited a specialist for a check-up every 1-6 months, and about one-fourth (23.3%) never did so. Annual visits and visits every 2 to 3 years were reported by 21.3% and 20.8%, respectively. About 82.0% were motivated to learn more about IDA. Media was the source of knowledge for 99 (24.6%) subjects, and medical staff accounted for 22.1%.

Discussion

IDA is the most common worldwide nutritional problem affecting both developing and developed countries, with major implications for human health as well as social and economic development. Lack of awareness of good dietary practices habits is one of the main reasons for the high prevalence of IDA in developing countries.[15]

IDA prevention in children requires good parental practices, such as using iron-fortified formulas, starting iron supplements in breastfed infants between 4 and 6 months of age, consuming foods with adequate amounts of iron, in addition to taking the necessary measures to treat the child if IDA has occurred.[7] In this context, Ibrahim *et al*. reported a significant positive correlation between the mothers' practices regarding IDA and their level of knowledge.[13] Therefore, this study was concerned with exploring the level of knowledge about IDA among parents living in Tabuk City, Saudi Arabia, and the factors associated with poor knowledge, with the aim of designing effective awareness programs.

In this study, the level of parental knowledge regarding IDA was not optimal. About 60% showed good knowledge, while 29% and 11% exhibited a moderate or poor level, respectively. The primary domains that showed the lowest level of knowledge were the signs and symptoms (54.3%) and the correct

definition of IDA (66.7%). Awareness of long-term effects (80%), causes of IDA (82%), and prevention by eating a diet rich in iron sources and taking iron-folic acid tablets (91.6%) were satisfactory.

Previous studies in Saudi Arabia revealed inconsistent findings. Shehata *et al*. reported a deficient level of awareness among the Aseer region population;[12] about half (52.1%) expressed a good level of total awareness regarding IDA. In comparison with our study, 69.1% of their respondents reported anemia as decreased hemoglobin level, and 78.6% identified iron as the nutrient deficient in anemia. However, higher levels of awareness were recorded for the causes as well as signs and symptoms of anemia (86.2%). Furthermore, Algarni *et al.* found that 73% of parents living in the western region of Saudi Arabia have awareness of IDA in children.[16] Whereas, an earlier study conducted in the Qassim region by Waggiallah detected a satisfactory general awareness of anemia among the general population (89.2%), with deficient knowledge (50.5%, average, and 29.0% poor) about the causes of anemia.[17]

Studies conducted in other countries likewise revealed a range of awareness levels. More than half of Pakistani women in the reproductive age range are adequately informed about symptoms, iron-rich foods, problems, and therapies, according to Shahzad *et al.*[18] The researchers credited reading about health care issues and having a positive experience with their sufficient knowledge. Alternatively, a study in Egypt revealed a high prevalence (56.1%) of poor knowledge among mothers regarding IDA in children. Only 13.2% of the studied mothers expressed good knowledge regarding the meaning of anemia, signs and symptoms, complications and treatment.[13] Furthermore, assessment of nutritional knowledge, attitude, and practices regarding IDA among female adolescents in Gaza, Palestine, by Jalambo *et al*. showed high prevalence (91.6% and 81.3%, respectively) of poor awareness regarding the causes and consequences of IDA.[19]

The current study also explored the characteristics of participants significantly associated with poor to moderate knowledge. The risk of having poor to moderate knowledge was detected among young parents aged 18-25 years (AOR: 3.475), males (AOR: 1.945), and parents with less than a university education (AOR: 2.157) compared to their counterparts. This is in line with Algarni *et al*., who declared a significant contribution of education level to the level of awareness of the parents.[16] Respondents holding a bachelor's degree showed better awareness about IDA. The role of education as a determinant of the level of awareness has also been reported by El Hioui *et al*. in Morocco,[20] Al-Zain in Palestine,[21] Haidar and Pobocik in Ethiopia,[22] Osazuwa and Ehigie, and Bello-Manga *et al*. in Nigeria.[23,24]

The study conducted by Shehata *et al*. partially agrees with our findings, as they concluded that young age, high education, and female gender are significant predictors of participants' good knowledge.[12] The present study showed that young, aged parents between 18 and 25 years had a more than threefold increased odds of having a low level of knowledge. This result confirms earlier findings by Patel *et al.* that showed young college girls knew relatively little (13.2%) about the criteria and the importance of a balanced, nutritious diet.[25]

Moreover, the present work showed a significant association between high monthly income and good levels of knowledge. This observation was also mentioned by Algarni *et al.*, who reported significantly higher knowledge of IDA among Saudi parents with higher income.[16] A previous study in Egypt also attributed poor awareness of IDA to the intermediate level of education and the insufficient income of the family.[13]

In the current study, the frequency of specialist check-ups ranged from never (23.3%) to every 1-6 months (34.5%). Medical personnel accounted for 22.1% of the subjects' knowledge, whereas 24.6% attained knowledge from the media. A high percentage of participants (82.0%) expressed a desire to learn more about iron-deficient anemia.

Limitations

The study has some limitations, including that the sample was drawn through social media on the Internet, which may not be fully representative of the study population and may affect how broadly the findings can be applied. In addition, the cross-sectional design limits cause-and-effect relationships.

Conclusions

In conclusion, the study revealed that 60% of the parents in Tabuk City, Saudi Arabia, had a good awareness level for all aspects of IDA. The signs and symptoms (54.3%) and recognition of the meaning of anemia (66.7%) were the two key areas with the lowest degree of knowledge. Risk factors associated with an increased likelihood of a low level of knowledge include young parents between the ages of 18 and 25, men, and parents with an education below a university degree. Improving awareness and practices about iron-deficient anemia requires targeted, effective awareness campaigns and interventions. This can be achieved through mass media and social media, as they are efficient sources of knowledge. Further work should also be done to create a community-based survey on a bigger scale that includes those who are not able to participate in electronic surveys.

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Table 1. Sociodemographic characteristics of the study participants (n=403).

		n	%
Age, years	18-25	30	7.4
	26-36	70	17.4
	37-46	122	30.3
	>46	181	44.9
Gender	Female	292	72.5
	Male	111	27.5
Marital status	Widow	16	4.0
	Married	368	91.3
	Divorced	19	4.7
Number of children	1-3	156	38.7
	4-5	138	34,3
	>5	109	27.0
Level of parental education	Illiterate	11	2.7
	Primary school	26	6.5
	Intermediate	23	5.7
	Secondary school	79	19.6
	Bachelor	264	65.5
Income level, SR	<3000	33	8.2
	3000-10,000	118	29.3
	>10,000-15,000	114	28.3
	>15,000	138	34.2
Family history of anemia	No	266	66.0
	I don't know	52	12.9
	Yes	85	21.1

Table 2. The frequency of correct and incorrect answers of inquiries about iron deficiency anemia (n=403).

Knowledge questions		n	%
Are you heard about iron deficiency anemia?	Incorrect answer	78	19.4
	Correct answer	325	80.6
What is iron deficiency anemia?	Incorrect answer	134	33.3
	Correct answer	269	66.7
What is the nutrient deficient in anemia?	Incorrect answer	56	13.9
	Correct answer	347	86.1
What are the signs and symptoms of iron deficiency anemia?	Incorrect answer	184	45.7
	Correct answer	219	54.3
What is the cause of iron deficiency anemia?	Incorrect answer	71	17.6
	Correct answer	332	82.4
What are the effects of iron deficiency anemia?	Incorrect answer	80	19.9
	Correct answer	323	80.1
What are the ways to prevent anemia caused by iron deficiency?	Incorrect answer	34	8.4
	Correct answer	369	91.6
What is the food that's rich in iron?	Incorrect answer	31	7.7
	Correct answer	372	92.3
What are the factors inhibiting iron absorption?	Incorrect answer	61	15.1
	Correct answer	342	84.9

Table 3. Associations between sociodemographic factors and the level of knowledge about iron deficiency anemia (n=403).

		Poor to moderate knowledge (n=160, 39.7%)	Good knowledge (n=243, 60.3%)	p
		n	%	
Gender	**Male**	58	36.3	0.001*
	Female	102	63.7	
Age, years	>25	140	87.5	0.002*
	18-25	20	12.5	
Marital status	Widow	4	2.5	0.208
	Married	151	94.4	
	Divorced	5	3.1	
Number of children	1-5	119	74.4	0.602
	>5	41	25.6	
Education level	University	90	56.3	0.002*
	Below university	70	43.8	
Income, SR	>10.000	90	56.3	0.035*
	≤10.000	70	43.8	
Family history of anemia	No	114	71.3	0.012*
	I don't know	24	15.0	
	Yes	22	13.8	

*Significant at p<0.05

Table 4. Factors associated with a poor-to-moderate level of knowledge about iron deficiency anemia.

Predictors	AOR	95% CI	p	HL test	accuracy %	p
Male sex	1.945	1.231-3.075	0.004*	0.886	65.5	<0.001*
Age, years (18-25)	3.475	1.542-7.834	0.003*			
Below university education	2.157	1.400-3.323	<0.001*			

*Significant at p<0.05; AOR, adjusted odds ratio; CI, confidence interval; HL, Hosmer-Lemeshow test.

Table 5. Attitude and practices of the study participants regarding iron deficiency anemia (n=403).

		n	%
Frequency of visiting doctor and specialists for check-up	Never	94	23.3
	Every 1-6 month	139	34.5
	Annually	86	21.3
	Every 2-3 year	84	20.8
Would you like to get more information about iron deficiency anemia?	No	74	18.4
	Yes	329	81.6
Source of knowledge regarding iron deficiency anemia	Family	50	12.4
	Media	99	24.6
	Own study	52	12.9
	Medical staff	89	22.1
	One or more of the above sources	113	28.0

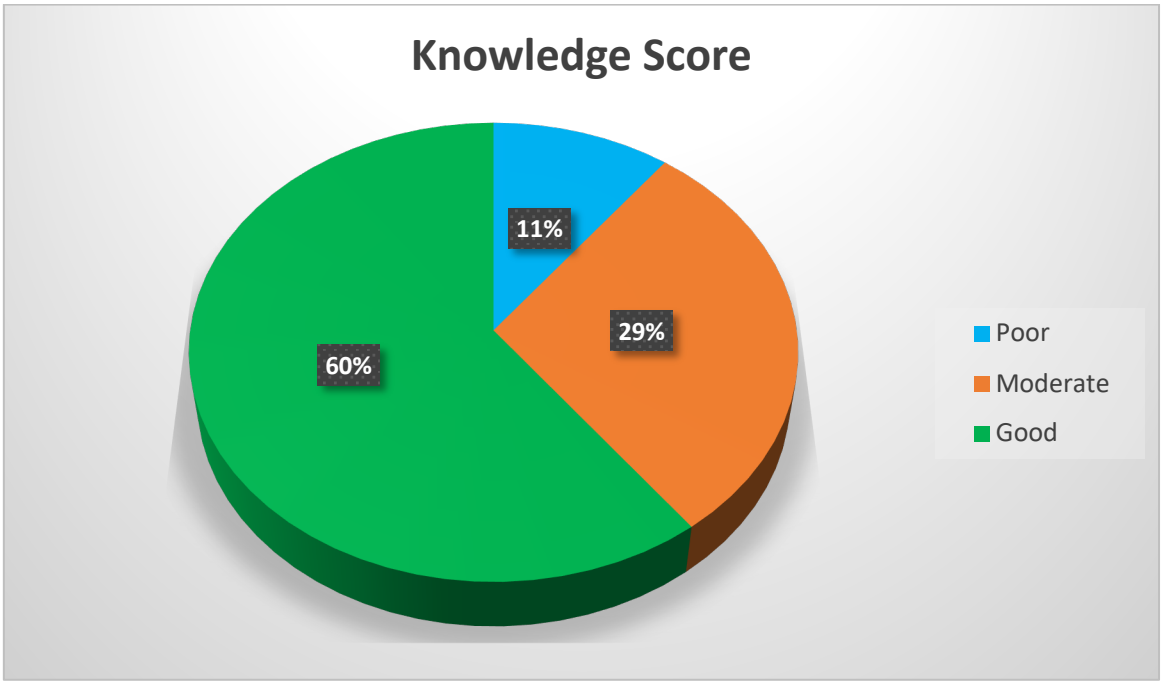

Figure 1. Levels of knowledge among the study participants.