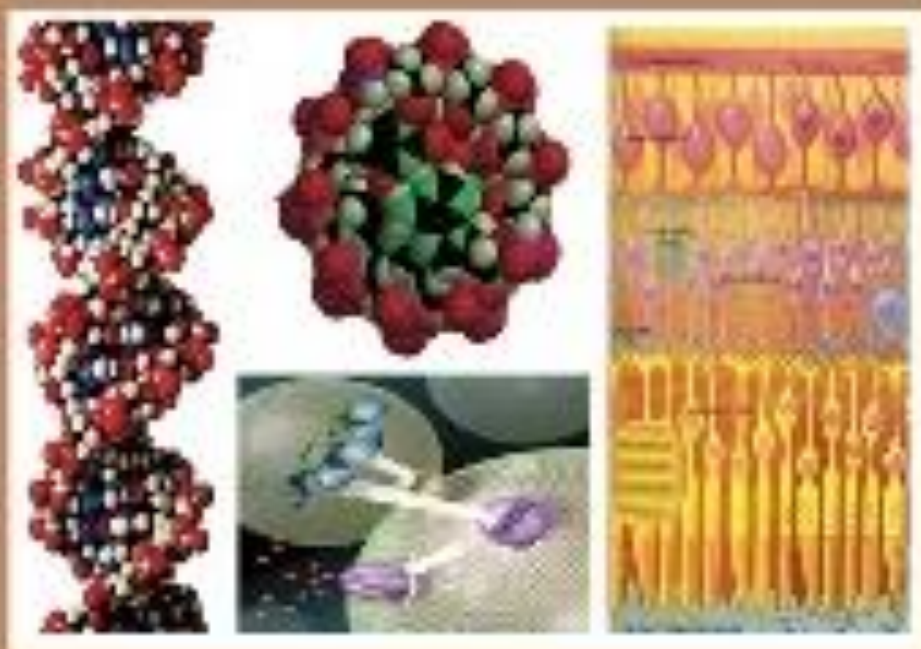




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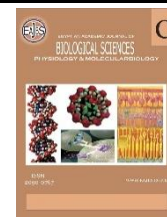
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Knowledge, Attitude, and Practice on Prevention of Iron Deficiency Anaemia among Various Regions in The Kingdom of Saudi Arabia

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ABSTRACT

Background: Iron deficiency anaemia is characterised by the lack of iron storage, which affects the production of haemoglobin and, subsequently, the oxygen carried to the tissue. It is associated with complications during lifetime and morbidity globally. The prevalence of iron deficiency anaemia is about 1.6 billion people, which accounts for around 25% of the world's population, according to the World Health Organization. Whereas, in Saudi Arabia, 30-40% of women of reproductive age and 20-30% of children in the kingdom of Saudi Arabia suffer from iron deficiency anaemia. The assessment of the knowledge, practices, and attitudes towards iron deficiency anaemia in different cities in Saudi Arabia indicates that the Saudi population has poor knowledge, negative attitudes and practices towards iron deficiency anaemia. **Aim:** The study evaluates knowledge, attitudes and practices regarding preventing iron deficiency anaemia among the Saudi population in four regions (south, west, east and Middle). **Methods:** This observational cross-sectional epidemiological study was carried out from June 2023 to August 2024 in various regions in the Kingdom of Saudi Arabia (West, South, East and Middle regions). Data was collected using a structured questionnaire containing socio-demographic, knowledge-related, attitude and practice-related questions on preventing iron deficiency anaemia among the Saudi population. 272 samples were able to be collected and processed for descriptive statistics. **Results:** The statistical analysis revealed that most of the Saudi population had an average knowledge of iron deficiency anaemia, and only 30% had a good knowledge. In addition, participants with a positive attitude towards iron deficiency anaemia were few, around 17.5%. However, participants with poor practice in preventing iron deficiency anaemia were elevated, around 19.5% of total participants. The correlation analysis indicates that a significant correlation was observed between total practice and total attitude. **Conclusion:** The majority of the Saudi population exhibits average knowledge, poor practices, and a negative attitude toward iron deficiency anaemia. Thus, poor practice toward iron deficiency anaemia could be a fundamental factor in the high burden of anaemia in the Kingdom of Saudi Arabia.

INTRODUCTION

Iron deficiency anaemia (IDA) remains a significant global health issue, particularly affecting vulnerable populations such as women of reproductive age, children, and elderly people (Kaealjit Kaur, 2014).

Despite its preventable nature, IDA continues to be a leading cause of morbidity worldwide (Kaealjit Kaur, 2014). IDA is one of the haematological diseases characterised by the lack of iron storage, which leads to the sufficient production of haemoglobin. Subsequently, this decreases the ability to carry oxygen to the tissue, causing complications during the lifetime (Kumar *et al.*, 2022). This deficiency can lead to fatigue, weakness and pale skin, among other symptoms. Left untreated, IDA can impact physical and cognitive function, making early diagnosis and treatment essential for overall health (Alruwaili *et al.*, 2023). The patients with IDA take iron supplements or intravenous iron to improve their physical condition and fatigue. However, in the late stage of IDA, when haemoglobin is decreased, a blood transfusion is the ideal choice of treatment (Ponikowski *et al.*, 2015). According to the World Health Organization (WHO), IDA is the most common nutritional issue worldwide. It affects about 1.6 billion people, which accounts for around 25% of the world's population (Bouree, 2014).

In the Kingdom of Saudi Arabia (KSA), IDA is also a serious public health concern, particularly among women and children. The study estimates that about 30-40% of women of reproductive age and 20-30% of children in KSA suffer from IDA (Al Hassan, 2015). Another study in Jeddah city has reported that 22.5% of 850 students have been diagnosed with IDA (Abalkhail and Shawky, 2002). Furthermore, other studies around KSA have shown that IDA affected 37% of women in Riyadh, 12.7% of female university students at Tabuk and 25% of female university students in four different regions in KSA with poor knowledge and neutral attitudes toward IDA (Alquaiz *et al.*, 2013, Alzaheb and Al-Amer, 2017, Owaidah *et al.*, 2020).

The high prevalence of IDA might be mainly due to dietary habits, rapid growth rates in children, and specific health conditions. National health programs are working to address the issue through

improved nutrition, supplementation, and public health intervention.

Thus, Understanding the knowledge, practices, and attitudes (KAP) towards iron deficiency anaemia is crucial for developing effective public health strategies. Knowledge about IDA's causes, symptoms, and prevention can significantly influence individuals' health behaviours, while positive attitudes and appropriate practices can enhance adherence to preventive measures and treatments.

One study aimed to assess awareness of iron deficiency anaemia among the adult population in Riyadh, KSA. They found that only 27.6% of the participants in this study were considered to have good knowledge about IDA (Alsaab *et al.*, 2023). Another study has investigated the KAP in the general female population toward IDA in Al-Jouf, KSA. They reported that the general female population in the Al-Jouf region in KSA had poor knowledge, and about 76.2% of participants had negative attitudes and poor practices toward IDA (IDA-7). In the study in the Tabuk region, KSA assessed the KAP regarding the prevention of IDA in women, and they found that only 12.0% of participants obtained good knowledge scores, as more than half of women had poor practice (Aboud *et al.*, 2019).

Previous studies offer essential insight into the Saudi population's knowledge, attitude, and practice toward IDA in different cities around KSA. Continued efforts are needed to understand KAP toward IDA around KSA, not only for limited cities.

Therefore, this article explores the interplay between knowledge, practices, and attitudes towards IDA among four regions (South, East, West and Middle) around KSA, including all adult populations. That could shed light on the gaps and challenges that must be addressed to reduce its prevalence.

MATERIALS AND METHODS

This observational cross-sectional epidemiological study was carried out from June 2023 to August 2024 in various regions of KSA (West, South, East, and Middle

regions) to determine the Saudi population's knowledge, attitude, and practice regarding preventing IDA. The research ethical committee of Albaha University in Albaha City, KSA, approved this study.

Inclusion and Exclusion Criteria:

The inclusion criteria of this study comprised all the community (male and female) in KSA and above 18 years old. Exclusion criteria comprised:

People outside KSA and under 18 years old.

Data Collection:

Data was collected using a structured questionnaire containing socio-demographic, knowledge-related, attitude and practice-related questions on preventing IDA among the Saudi population. The tool was prepared in English and translated into Arabic. Questions were adapted from previous studies, and literature was used to assess knowledge, attitudes, and practices regarding IDA (Pareek and Hafiz, 2015, Aboud et al., 2019). We cover all four regions by putting three data collectors in each administrative centre, and most data collectors are healthy individuals. We were able to collect 282 samples.

Statistical Analysis:

The data was cleaned and entered into a statistical package for social science (SPSS Statistics 30.0.0), and consistency and outliers were checked before analysis. Cleaned data (272 samples) was entered into SPSS Statistics 30.0.0, and descriptive

statistics, chi-square test, and regression analysis were conducted. All statistical tests were considered significant at a P-value <0.05 . The data was presented using frequency, percentage and table. Graphs were presented by Prism-GraphPad 10. The knowledge, attitude and practice scores were categorised into (good versus poor knowledge) and practice (Positive versus negative attitude) using the mean score as the cut-off point.

RESULTS

Socio-Demographic Characteristics of The Participants:

Of the study of the Saudi population, 272 participants responded to a survey among different regions in KSA (Table 1). From the total of 272 participants, the majority, 117 (43%) found in the under-age category of >40 years, 66 (24.6%) were 30-40 years, 61 (22.4%) were 20-30 years, and the last >20 years had 28 (10%) participants. The most respondents participants (73.5%) were women. On their education level, the most frequent respondents were bachelor's degrees, 141 (51.8%), following high school graduates and less than 92 (33.8%). In four regions, most of the participants received knowledge about IDA from their self 73 (26.8%) and from the media 62 (22.8%). However, a small population in this study did not hear about IDA 17 (6.3%).

Table 1: Socio-demographic characteristics of the participants.

Characteristics	Number	Percentage
Age		
> 20 years	28	10%
20-30 years	61	22.4%
30-40 years	66	24.6%
> 40 years	117	43%
Mean \pm SD 35 \pm 10.34 years		
Gender		
Male	72	26.5%
Female	200	73.5%
Level of education		
High school graduate and less	92	33.8%
Bachelor's degree	141	51.8%
Post-graduate	39	14.4%
Where did you get most of the knowledge about IDA?		
Myself or people around	73	26.8%
Had anemia	46	16.9%
Media	62	22.8%
Doctor	40	14.7%
Self-interests	34	12.5%
Do not know	17	6.3%

Frequency of Participants Among Four Regions of KSA:

By the end of the survey period, data had been collected from 272 individuals in Saudi Arabia. Most individuals who participated in this study were from the

western region of Saudi Arabia, 97 (35.7%), followed by individuals from the southern region, 63 (23.2%) (Table 2). A minority of participants, 56 (20.2%) of this survey, were in the Middle and East regions (Table 2).

Table 2: Frequency of participants among four regions of KSA.

Region	Frequency	Percentage
West	97	35.7 %
South	63	23.2%
Middle	56	20.2 %
East	56	20.2 %
Total	272	100 %

Knowledge of the Saudi Population Towards Iron Deficiency Anaemia Among Four Regions of KSA:

By investigating knowledge in different regions of Saudi Arabia, close to half of the participants had an average knowledge level (Table 3). However, a small population among the various regions needed better knowledge about IDA, around 8%. From the total number of participants asked for

knowledge related to IDA, we found that 36% of individuals in the West region, 30.2% in the South region, 25% in the Middle region, and 39.3% in the East region had high knowledge. Comparing the knowledge about IDA among the four regions, the knowledge among the different regions of Saudi Arabia remained the same and no significant differences were observed.

Table 3: Knowledge of the Saudi population towards iron deficiency anaemia among four regions of KSA.

	West		South		Middle		East	
	No.	%	No.	%	No.	%	No.	%
Poor knowledge	8	8.4	4	6.3	8	14.3	6	10.7
Average Knowledge	54	55.6	40	63.5	34	60.7	28	50
High knowledge	35	36.0	19	30.2	14	25	22	39.3

The Attitude of The Saudi Population Towards Iron Deficiency Anaemia among Four Regions of KSA:

More than half, 60.8% (west region), 68.2 (South region), 58.9% (Middle) and 58.9% (East region) had neutral attitudes towards IDA (Table 4). The individuals in all

regions of KSA responding to this survey had negative attitudes towards IDA, around 20%. The percentage and frequency of positive attitudes were almost similar to the negative attitude towards IDA: the west region (19.6%), the south region (17.5%), the middle region (16.1%) and the East region (16.1%).

Table 4: Attitude of the Saudi population towards iron deficiency anaemia among four regions of KSA.

	West		South		Middle		East	
	No.	%	No.	%	No.	%	No.	%
Negative attitude	19	19.6	9	14.3	14	25	14	25
Neutral attitude	59	60.8	43	68.2	33	58.9	33	58.9
Positive attitude	19	19.6	11	17.5	9	16.1	9	16.1

Practice of Saudi Population Towards Iron Deficiency Anaemia among Four Regions of KSA:

Regarding the practice of IDA among the Saudi population in different regions, the majority of participants in the

western, south, middle, and eastern regions were in the average category of practice (Table 5). However, the poor practice was mainly reported in individuals in the west and south regions 19 and 20, respectively. The western region reported the lowest percentage

(10.7%) of good practice of IDA, followed by the middle region (12.5%). On the other hand, the south region (15.9%) and west region

(14.4%) had a higher percentage towards a good practice of IDA.

Table 5: Practice of the Saudi population towards iron deficiency anaemia among four regions of KSA.

	West		South		Middle		East	
	No.	%	No.	%	No.	%	No.	%
Poor practice	19	19.6	13	20.6	10	17.9	11	19.7
Average practice	64	66	40	63.5	39	69.6	39	69.6
Good practice	14	14.4	10	15.9	7	12.5	6	10.7

Total knowledge of the Saudi Population Towards Iron Deficiency Anaemia:

Further analyses were conducted to check the total knowledge towards of IDA in

all Saudi populations. The statistical analysis shows that most of the Saudi population had an average knowledge (Fig. 1). However, only 30% had a good knowledge about IDA.

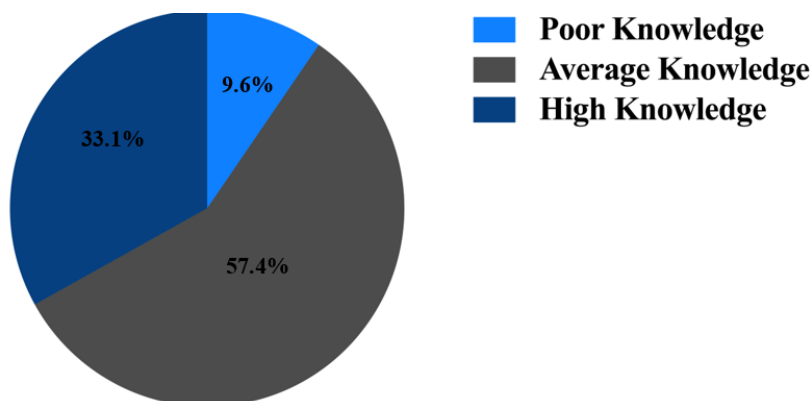


Fig. 1: Shows the percentage of total knowledge among the Saudi population towards IDA

The Total Attitude of the Saudi Population Towards Iron Deficiency Anaemia:

The attitude of the Saudi population towards IDA was generally over 50%, with a

neutral attitude (Fig. 2). Unfortunately, the number of participants who had a positive attitude towards IDA was only around 17.6%.

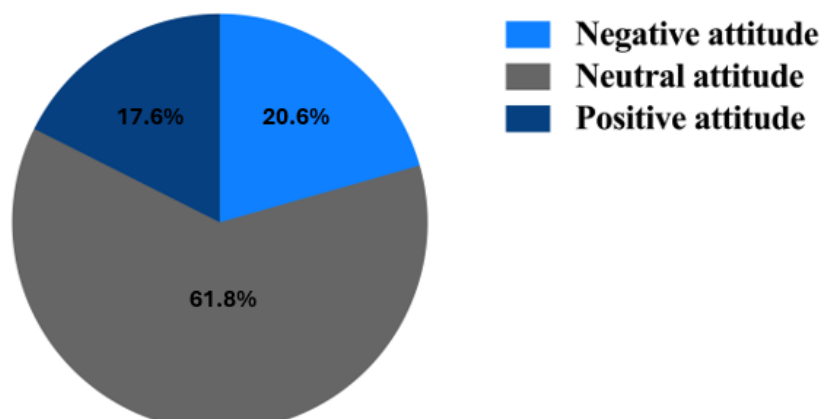


Fig. 2: Shows the percentage of total attitude among the Saudi population toward IDA

Total Practice of the Saudi Population Towards Iron Deficiency Anaemia:

As shown in Figure 3, over half of the Saudi population's practice in preventing IDA was average. However, participants who had poor practice in preventing IDA were elevated around 19.5% of the total participants. Taken together, this result

illustrates that a negative attitude towards IDA could negatively affect the practice and lead to a considerable increase in IDA prevalence.

Overall, these results indicate that the Saudi population had an average knowledge of IDA with a negative attitude and poor practices towards IDA.

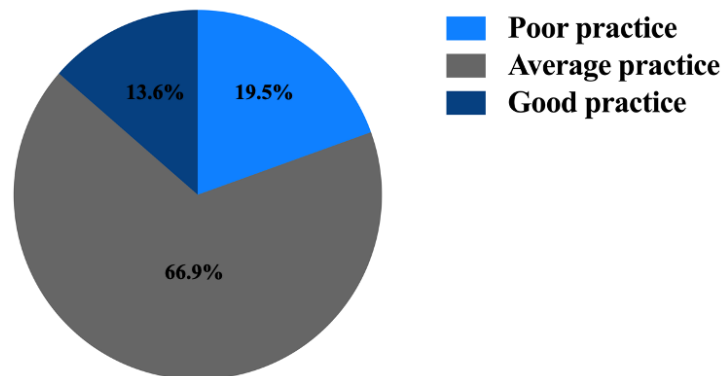


Fig. 3: Shows the percentage of total practice among the Saudi population toward IDA

Correlation of Sociodemographic Data and KAP Data:

Table 5, illustrates Pearson's correlation of parameters used to measure the Saudi population's knowledge, attitude, and practice towards IDA. The result revealed a significant correlation with some parameters. Pearson's Correlation exhibited a significant negative correlation between gender and the source of knowledge and gender with total attitude (-0.164, -0.139), respectively.

Interestingly, a significant correlation between education level and knowledge and attitude was observed in Saudi society. Also, there was a significant correlation between total practice and total attitude.

Together, this correlation proves the previous finding that Saudi residents have negative attitudes and poor practices. This negative attitude can lead to poor practice and increased IDA cases.

Table 5: Pearson's correlation

Pearson Correlation	Gender	Age	Level of education	Source of knowledge	region	Total Knowledge	Total Practice	Total Attitude
Gender	1							
Age	-0.113	1						
Level of education	-0.113	0.150*	1					
Source of knowledge	-0.164**	0.084	0.094	1				
region	0.035	0.078	-0.010	0.024	1			
Total Knowledge	0.291**	-0.117	0.135*	-0.094	-0.020	1		
Total Practice	0.108	0.113	0.052	-0.008	0.008	0.062	1	
Total Attitude	-0.139*	-0.015	0.162**	0.085	-0.079	-0.073	0.236**	1

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

DISCUSSION

This study aims to assess the KAP among the different regions in KSA. The assessment was done using a questionnaire based on Socio-demographic data and questions on IDA knowledge, attitude and practice. The current study was conducted on 272 participants among the Saudi population. Most participants were over 40 years old (43%), and most possessed a bachelor's degree in education (51.8%). Our results agreed with previous findings showing that most participants had high education (Alruwaili *et al.*, 2023, Alsaab *et al.*, 2023, Ahamed *et al.*, 2018). However, the mean age of participants in this study does not support the earlier findings in which they reported that the median age of the study was 25 years. Among the sources of information on IDA reported by respondents were people around them (26.8%) and media (22.8%) (Alruwaili *et al.*, 2023, Alsaab *et al.*, 2023, Ahamed *et al.*, 2018). These sources of information about IDA are contrary to what was reported in the latest studies, in which respondents reported anaemia via electronic media (Pareek and Hafiz, 2015). In this study, 73.5% of participants are typically female, which makes the comparison between gender bias. A possible explanation for the higher response rate from females might be that women tend to be more communicative or have more time for responding.

The first question in this study sought to determine the knowledge of IDA in the Saudi population. Accordingly, different individuals from several regions in KSA have participated in answering the survey to assess their knowledge. The results of this study show that more than half of the participants have an average knowledge of IDA in different regions of KSA, and no significant differences have been noticed between regions (Table 2). In addition, the total knowledge of the Saudi population (Fig. 1) indicates that only about 30% have good knowledge of IDA, and more than half have average knowledge. This finding is consistent with another study in Saudi Arabia (Al-Jouf

City) that found only 23.8% of female participants had good knowledge about the IDA (Alruwaili *et al.*, 2023). In addition, another study conducted in Riyadh found that only 27.6% of the participants in this study were considered to have good knowledge about IDA (Alsaab *et al.*, 2023). A comparison of the knowledge of the Saudi population with that of other countries such as India and Egypt confirms that almost similar findings were achieved (Ahamed *et al.*, 2018, Monika *et al.*, 2019). However, the findings of our study do not support the previous research. For instance, a study among Saudi citizens in the Qassim region found that general anaemia awareness was 89.2% (Waggiallah, 2014).

Furthermore, a study in Ethiopia assessed awareness related to IDA, and they found that the awareness level towards IDA was about 88.1% (Oumer and Hussein, 2019). Additionally, several studies in different countries have reported that more than half of the participants had good knowledge of IDA (Abu-Baker *et al.*, 2021, Shahzad *et al.*, 2017). It was concluded that Saudi citizens in several regions mainly had average knowledge and inadequate knowledge about IDA of the third of participants.

Then, the attitude towards IDA was evaluated in the Saudi population in four different regions. Our results show that over 50% of participants have a neutral attitude with no significant difference between regions. Furthermore, around 20 % (± 2) of participants have negative and positive attitudes among all the KSA regions, indicating the need to sustain campaigns for health education and awareness creation among the population. The possible explanation for this result could be that a diet lacking in iron-rich foods is prevalent in the Saudi population, with a high reliance on refined foods and a lack of emphasis on iron-fortified products.

This result reflects Aboud *et al.*, who also found that only 22% of pregnant women had a positive attitude toward IDA (Aboud *et*

al., 2019). Furthermore, other studies have found undesirable attitudes toward IDA in adolescent girls and pregnant women (Serbesa and Iffa, 2019, Jalambo *et al.*, 2017). In contrast, the study in Pakistan among females of reproductive age reported that more than half of their studied subjects had good knowledge about IDA anaemia, and more than three-quarters of them had positive attitudes toward self-awareness of IDA anaemia as a disease (Shahzad *et al.*, 2017).

After the evaluation attitude, the practice towards IDA has been evaluated, and the result indicates that the majority of participants have average practice. However, good practice has a low percentage for all four regions of KSA. It could be due to poor practice towards iron supplements, a common reluctance to use them due to side effects like gastrointestinal discomfort and a lack of understanding of their importance. Alternatively, due to traditional eating habits in KSA, people consume lots of caffeine after meals. This result agrees with another study in the Tabuk region, KSA, that assessed the KAP regarding the prevention of IDA in women, which found that only 12.0% of participants obtained a good practices score, as more than half of women had poor practices (Aboud *et al.*, 2019). However, the findings of the other study in KSA that studied attitudes and practices towards anaemia among Saudi university students around KSA reported different results. Good attitudes were found among university students towards the anaemia (Al-humaidi, 2017).

Lastly, the correlation between the demographic parameters and KAP has been analysed, and the result shows a significant correlation between the level of education and knowledge and attitude. Furthermore, a significant correlation between total practice and total attitude was observed in this study. According to this data, we can infer that a negative attitude is associated with poor practice toward IDA. This is the first study that used Correlation analyses to investigate KAP towards IDA among the Saudi population.

The differences between our study and other research concerns that our study is the first to evaluate the KAP of IDA among different regions in KSA. In addition, this study has raised our need for health education programs in Saudi Arabia. However, the study is limited by the small sample size among areas.

Conclusion

Overall, the Saudi population exhibits average knowledge, poor practices, and a negative attitude toward IDA. Thus, poor practice toward IDA could be a fundamental factor in KSA's high burden of anaemia. These issues are not unique and are mirrored in various degrees across different countries. However, the difference often lies in access to healthcare, awareness campaigns, and the overall integration of iron supplementation into public health strategies. These findings have significant implications in claiming educational campaigns, public health policies and culturally sensitive interventions that should work together to ensure that people understand the seriousness of IDA and prevent it effectively. In addition, improving education and awareness and addressing barriers like side effects from supplements are vital to enhancing IDA management globally.

Declarations:

Ethical Approval: The study was approved by the Ethical Board of Albaha University in Albah City, KSA (no. 44128214).

Conflict of interests: The authors declare no conflicts of interest.

Funding: This research was self-funded.

Availability of Data and Materials: The data presented in this study are available on request from the corresponding author.

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