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Prevalence and Risk Factors of Iron Deficiency Anemia in Saudi Arabia: A Systematic Review

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Abstract

***Objectives*:** To evaluate the prevalence and associated risk factors of iron deficiency anemia (IDA)in Saudi Arabia. ***Methods*:** A thorough search of pertinent databases was done in order to find studies that satisfied the requirements for inclusion. A thorough search of PubMed, Web of Science, SCOPUS, and Science Direct was conducted to find pertinent literature. ***Results*:** Nineteen studies, including a total of 20,929 participants and 18,236 (87.1%) of them were females, were included in our data. The prevalence of IDA in the total population ranged from 9.8% in preschool children and 75.3% in pregnant women, and the pooled prevalence was 7043 (33.7%). Regarding pregnant women and women in the childbearing period, the incidence of IDA was significantly correlated with increased gravidity, parity, use of tea and coffee, primiparas, younger moms, those without prenatal care or iron supplements, menorrhagia, antacid or nonsteroidal antidepressant use histories, family and personal history of IDA, occasional meat consumption, and inadequate iron and vitamin C intakes. The improved socioeconomic position of Saudi Arabian children did not affect the prevalence of IDA. Obesity, supplement consumption, and a positive family history of IDA were significantly associated with the increased prevalence of IDA. ***Conclusion*:** The prevalence among pregnant women, women in the childbearing period, children, and adolescents in Saudi Arabia is still high. The study's conclusions emphasize the need to increase public knowledge of the value of a balanced diet and the regular inclusion of foods high in iron in daily meals. The findings of this study provide valuable insights into the risk variables that raise the prevalence of IDA in the study area and serve as a roadmap for future research endeavors addressing IDA.

Keywords: Iron deficiency anemia; Prevalence; Risk factors; Saudi Arabia; Systematic review.

INTRODUCTION

IDA, which affects 30% of the world's population, has been recognized by the WHO as the most prevalent nutritional deficit worldwide [1]. Although IDA is more common in children and women, adult men may also be at risk based on their financial situation and overall health [2]. Reduced dietary iron intake and absorption are also contributing factors to IDA, even though gastrointestinal (GI) hemorrhage and menstruation in women are the most common causes [3].

Numerous cellular processes, such as enzymatic activities, DNA synthesis, oxygen transport, and mitochondrial energy production, depend on iron [4, 5]. As a result, there is a broad variation in the symptoms of IDA. Low blood oxygen levels can cause angina, exhaustion, palpitations, tachycardia, and shortness of breath. The ensuing compensatory reduction in intestinal blood flow brought on by this resulting hypoxemia may result in motility issues, malabsorption, nausea, weight loss, and abdominal pain. In addition to cognitive impairment, central hypoxia can produce headaches, vertigo, and tiredness. However, after anemia returns to normal, multiple investigations have shown that cognitive skills improve [6–9]. It is commonly known that IDA has a substantial negative impact on quality of life (QoL) [9], and new research indicates that treating IDA enhances QoL irrespective of the underlying cause of anemia [8, 10].

According to data from the World Health Organization (WHO), anemia affects almost two billion people globally, with IDA accounting for 50% of cases of anemia [11]. Typically, ID appears gradually and doesn't show symptoms until the anemia gets really bad

[12]. Epidemiological investigations have not been able to determine the general incidence of IDA in Saudi Arabia; nonetheless, numerous reports from individual institutions and for specific age or sex populations have reported prevalences ranging from 10 to 60% [13-15]. The WHO discovered that most data on the frequency of IDA in Saudi Arabia's country profile focused on anemia in general and lacked a precise definition of the disease.

This systematic review aims to thoroughly evaluate the prevalence and associated risk factors of IDA in Saudi Arabia by synthesizing current literature, identifying knowledge gaps, and offering insights for future research and clinical practice.

METHODS

We followed the recommendations in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) [16] for this systematic review. An electronic search was performed on databases like PubMed, Web of Science, SCOPUS, and Science Direct in order to find English-language research that looked at the prevalence and risk factors of IDA. Relevant keywords were included in the search strategy for these situations. Independently, reviewers went through the search results, chose pertinent papers, collected data, and used the right assessment methods to determine how good the included research was.

Eligibility Criteria:

Inclusion Criteria:

1. Studies published in the English language.
2. Studies reported the prevalence of IDA.
3. Studies reporting relevant outcomes such as risk factors and clinical course.
4. Studies conducted in Saudi Arabia
5. Studies involving human participants.
6. Randomized controlled trials, cohort studies, case-control studies, and cross-sectional studies.

Exclusion Criteria:

1. Studies not published in English.
2. Animal studies, in vitro studies, and review articles without original data.
3. Studies with insufficient data or unclear methodology.
4. Case reports and case series with fewer than five participants.
5. Studies with overlapping data or duplicate publications.

Data Extraction

Rayyan (QCRI) was used to validate the search results in order to guarantee accuracy [17]. The inclusion and exclusion criteria were used to determine the relevancy of the titles and abstracts that the search produced. Papers that satisfied the inclusion requirements were carefully examined by the study team. Consensus was used to settle disagreements. Using a predetermined data extraction form, key study data, such as titles, authors, publication year, study location, gender distribution, participant demographics, prevalence of IDA, type of population, and risk factors, were documented. To evaluate the possibility of bias, an impartial assessment instrument was created.

Data Synthesis Strategy

Summaries of the research findings and elements were created utilizing information taken from pertinent studies in order to offer a qualitative assessment. The best method for making use of the data from the studies that were included was decided upon after the data collection for the systematic review was finished.

Risk of Bias Assessment

The Joanna Briggs Institute (JBI) [18] critical assessment criteria for studies reporting prevalence data were utilized to assess the study's quality. This tool had nine questions. A score of one was given for a positive response, while a score of zero was given for a negative, ambiguous, or irrelevant response. The following scores will be categorized as low, moderate, and high quality, respectively: below 4, between 5 and 7, and above 8. The quality of the studies was evaluated by researchers independently, and differences were settled through discussion.

RESULTS

Systematic Search Outcomes

After 402 duplicates were removed, a total of 916 study papers were found through a systematic search. After 514 studies had their titles and abstracts evaluated, 398 papers were discarded. Merely four articles were not located out of the 116 reports that were required to be retrieved. 114 articles passed the screening process for full-text evaluation; 66 were rejected due to incorrect study results, 23 due to incorrect population type, 2 articles were editor's letters, and 2 were abstracts. Nineteen research publications in this systematic review satisfied the requirements for eligibility. An overview of the procedure used to choose the research is illustrated in Figure 1.

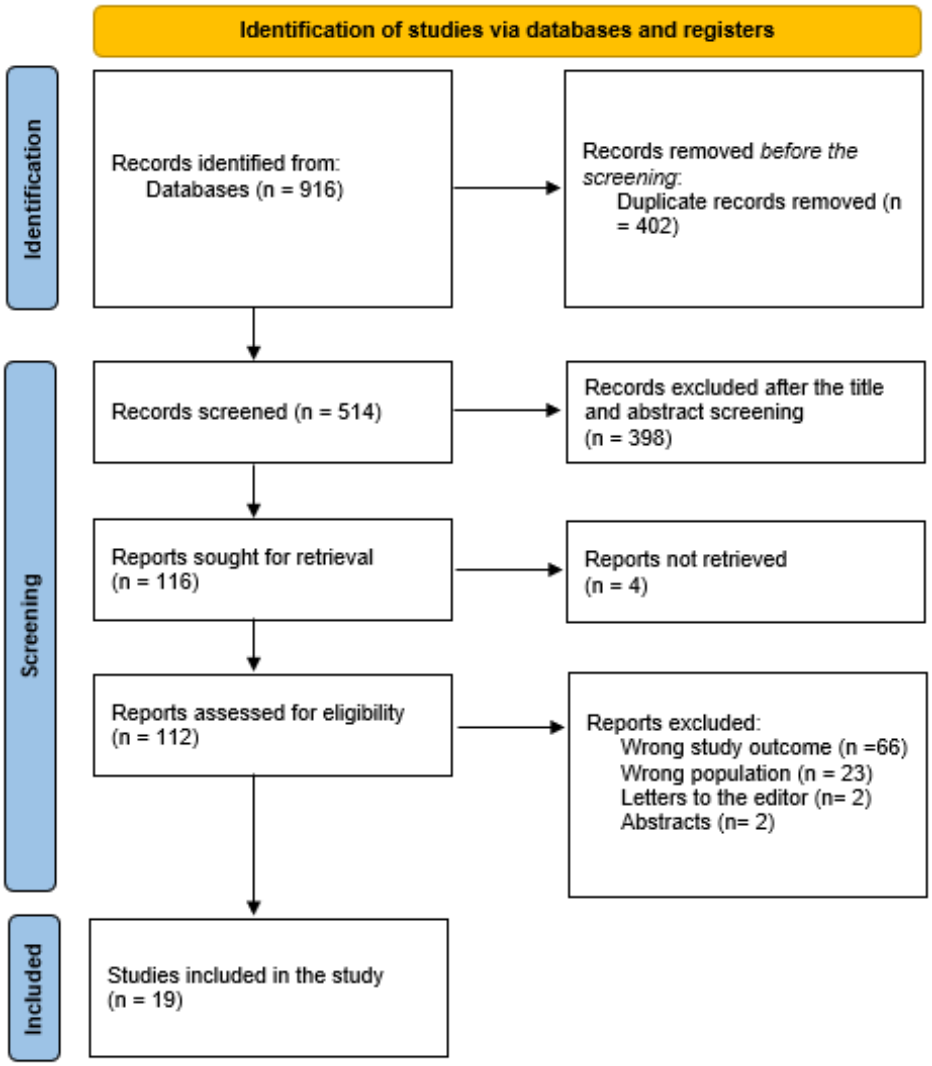

Figure 1: Study decision is summed up in a PRISMA diagram

Sociodemographic features of the comprised studies

The research publications' sociodemographic information is displayed in Table 1. Nineteen studies, including a total of 20,929 participants and 18,236 (87.1%) of them were females, were included in our data. Thirteen studies were cross-sectional [20, 23-31, 33, 34, 37], three were retrospective cohorts [21, 32, 35], one was prospective cohort [19], one was case-control [22], and one was an observational study [36]. The earliest study was conducted in 2001 [22] and the latest in 2022 [21, 36].

Clinical Outcomes

The clinical features are displayed in Table (2). This study included variable populations including pregnant women [19, 20, 21], women in childbearing period [22-29], children and adolescents [30-34], and the general population [35-37]. The prevalence of IDA in the total population ranged from 9.8% in preschool children [34] and 75.3% in pregnant women [20], and the pooled prevalence was 7043 (33.7%).

Regarding pregnant women, the incidence of IDA was significantly correlated with increased gravidity [19], parity [19], use of tea and coffee [20], primiparas [21], younger moms [21], and those without prenatal care or iron supplements [21].

IDA was prevalent among women in the childbearing period. Dietary practices [22, 27], menorrhagia [22, 26], antacid or nonsteroidal antidepressant use histories [22], family history of IDA [23, 24, 26, 29], occasional meat consumption [23, 25, 26, 29], personal history of IDA [25, 26, 29], frequent tea use [25], and inadequate iron and vitamin C intakes [25, 26].

The improved socioeconomic position of Saudi Arabian children did not affect the prevalence of IDA [32]. Obesity [33], supplement consumption [34], and a positive family history of IDA [34] were significantly associated with the increased prevalence of IDA.

Table 1: The sociodemographic attributes of the participating populations

Study	Study design	City	Participants	Mean age/ range	Females (%)
Baradwan *et al*., 2018 [19]	Prospective cohort	Riyadh	1579	NM	1579 (100%)
Ali *et al*., 2021 [20]	Cross-sectional	Rafha	235	15-70	235 (100%)
Wahabi *et al*., 2022 [21]	Retrospective cohort	Riyadh	10,600	30.2 ± 5.9	10600 (100%)
AlQuaiz & AlJohara, 2001 [22]	Case-control	Riyadh	325	12 - 50	325 (100%)
AlQuaiz *et al*., 2013 [23]	Cross-sectional	Riyadh	969	29.1 ± 10.1	969 (100%)
Al-Jamea *et al*., 2019 [24]	Cross-sectional	Dhahran	201	18-25	201 (100%)
Alzaheb *et al*., 2017 [25]	Cross-sectional	Tabuk	200	19-25	200 (100%)
Alswailem *et al*., 2018 [26]	Cross-sectional	Riyadh	683	18-40	683 (100%)
Al Hassan *et al*., 2015 [27]	Cross-sectional	Almadinah	268	20-31	268 (100%)
AlSheikh *et al*., 2018 [28]	Cross-sectional	Riyadh	120	18-24	120 (100%)
Alkhaldy *et al*., 2020 [29]	Cross-sectional	Southern regions	200	19-27	200 (100%)
Al Hawsawi *et al*., 2015 [30]	Cross-sectional	Northwestern region	500	15.4 ± 6.5 (months)	370 (47%)
Aedh *et al*., 2019 [31]	Cross-sectional	Najran	240	13-19	240 (100%)
Alqahtani *et al*., 2019 [32]	Retrospective cohort	Abha	2,415	6 – 59 (months)	969 (40.1%)
Aloufi *et al*., 2018 [33]	Cross-sectional	Taif	200	5 - 12	112 (56%)
Wali *et al*., 2021 [34]	Cross-sectional	The Western region	286	3.6 ± 0.9	144 (50.3%)
Alobidan *et al*., 2021 [35]	Retrospective cohort	Riyadh	244	30 to >86	0
Belali, 2022 [36]	observational	Asir	683	NM	514 (75.2%)
Owaidah *et al*., 2020 [37]	Cross-sectional	Riyadh, Medina, Makkah, and Dammam	981	17.3–25.8	507 (51.6%)

Table 2: Clinical features and results of the included research

Study ID	Population type	Prevalence of IDA (%)	Risk factors	JBI
Baradwan *et al*., 2018 [19]	Pregnant women	702 (44.5%)	A significant correlation was found between increased gravidity and parity and anemia in general, and microcytic hypochromic anemia in particular.	Moderate
Ali *et al*., 2021 [20]	Pregnant women	177 (75.3%)	The individuals exhibited a range of risk indicators, particularly increased use of tea and coffee, which may ultimately result in anemia.	High
Wahabi *et al*., 2022 [21]	Pregnant women	3261 (30.8%)	Primiparas, younger moms, and those without prenatal care or iron supplements had higher odds of anemia.	Moderate
AlQuaiz & AlJohara, 2001 [22]	Women in childbearing period	122 (37.5%)	The three most significant risk variables among Saudi women of reproductive age were dietary practices, menorrhagia, and antacid or nonsteroidal antidepressant use histories.	Moderate
AlQuaiz *et al*., 2013 [23]	Women in childbearing period	390 (40%)	Increased body mass index was linked to a lower risk of anemia, while a family history of IDA and occasional meat consumption was linked to an increased risk of anemia.	Moderate
Al-Jamea *et al*., 2019 [24]	Female undergraduate students	71 (35.3%)	The clinical features and dietary patterns showed that physical activity and a family history of inherited diseases had a major impact on the development of IDA.	Moderate

Study ID	Population type	Prevalence of IDA (%)	Risk factors	JBI
Alzaheb *et al.*, 2017 [25]	Female undergraduate students	25 (12.5%)	A prior personal history of IDA, frequent tea use, infrequent red meat consumption, and inadequate iron and vitamin C intakes were the key risk factors for developing anemia.	Moderate
Alswailem *et al.*, 2018 [26]	Women in childbearing period	284 (41.6%)	A number of factors were found to be significantly linked to an increased risk of developing IDA, including insufficient intake of iron and vitamin C, infrequent consumption of red meat and fish, menstruation disorders such as those that occur twice a month, last longer than eight days, cause blood clotting and heavy blood flow, require previous blood transfusions, and have a personal or family history of IDA.	High
Al Hassan *et al.*, 2015 [27]	Female undergraduate students	171 (64%)	The increased frequency of IDA in the current study may be linked to the food and lifestyle choices made by female students.	Moderate
AlSheikh *et al.*, 2018 [28]	Female medical students	46 (38.33%)	IDA did not show any statistically significant link (P > 0.05) with the anemic participants' background, gynecological history, or dietary habits.	Moderate
Alkhaldy *et al.*, 2020 [29]	Female undergraduate students	126 (63%)	The existence of iron deficiency status was positively connected with inadequate animal product-containing meals and a personal or family history of anemia.	
Al Hawsawi *et al.*, 2015 [30]	Infants	246 (49%)	NM	
Aedh *et al.*, 2019 [31]	Female teenagers	54 (22.5%)	NM	
Alqahtani *et al.*, 2019 [32]	School children	638 (26.4%)	Although the socioeconomic position of Saudi Arabian preschoolers has improved, anemia remains a public health concern.	
Aloufi *et al.*, 2018 [33]	Obese children	112 (56%)	Obesity may account for the correlation between low iron status and obesity. Hepcidin plays a major role in the anemia of chronic disease and Hepcidin overproduction even in mild inflammatory disorders. The axis that associates obesity, inflammation, and low hepcidin levels with low iron status may include IL6 and leptin.	
Wali *et al.*, 2021 [34]	Preschool children	28 (9.8%)	Only supplement consumption and a positive family history were statistically significant factors linked to anemia.	
Alobidan *et al.*, 2021 [35]	Male patients underwent GI endoscopy	155 (63.5%)	IDA is significantly associated, either directly or indirectly, with gastrointestinal malignancies, including gastric, sigmoid, colon, and rectal cancers. In spite of this, no relationship was found.	
Belali, 2022 [36]	General population	398 (58.3%)	Those with low levels of schooling and those with similar forebears also had high rates of IDA. One of the main risk factors for anemia is inadequate iron consumption. The rise in ID was partly caused by low eating of meat and redfish.	
Owaidah *et al.*, 2020 [37]	General population	37 (33.9%)	NM	

*NM=Not-mentioned

DISCUSSION

This comprehensive review reported that the prevalence of IDA in the total population ranged from 9.8% in preschool children [34] and 75.3% in pregnant women [20], and the pooled prevalence was 7043 (33.7%) in the Saudi population. Regarding pregnant women, the incidence of IDA was significantly correlated with increased gravidity [19], parity [19], use of tea and coffee [20], primiparas [21], younger moms

[21], and those without prenatal care or iron supplements [21]. Ugwu and Uneke, reported that there is a high prevalence of IDA among Nigerian pregnant women. They also reported that pregnancy in the third trimester, multiparity, and low socioeconomic position (low educational attainment, no occupation, poor living conditions) are risk factors linked to IDA [38]. In Malaysia, Abd Rahman *et al.,* reported that due to the detrimental consequences on both the mother and the fetus, anemia, and iron deficiency are significant public health issues that are prevalent among pregnant women. Extremes of reproductive age, grandmultiparity, unmarried teenage motherhood, Indian ancestry, low educational attainment, low socioeconomic status, late prenatal booking, rural residency (and urban impoverished), and non-compliance with iron tablet usage were risk factors for anemia during pregnancy in Malaysia [39].

Iron shortage can arise from having too many pregnancies too soon because pregnancy uses a lot of iron [40]. Three to four times as much iron is needed during gestation as non-pregnant women need [41]. Women generally are reported to have low iron stores, most likely because of the monthly blood loss during menstruation, even though it can be mobilized from the maternal stores to meet this demand [42]. The mother will experience iron insufficiency once these stores are exhausted [43]. IDA can arise from a decrease in the rate of hemoglobin synthesis brought on by an iron deficiency [44]. IDA in women can be controlled in part by lowering the overall number of pregnancies and lengthening the period between pregnancies. By reducing a woman's iron demand, family planning, and child spacing can help prevent IDA and its associated problems.

We also found that IDA was prevalent among women in the childbearing period. Dietary practices [22, 27], menorrhagia [22, 26], antacid or nonsteroidal antidepressant use histories [22], family history of IDA [23, 24, 26, 29], occasional meat consumption [23, 25, 26, 29], personal history of IDA [25, 26, 29], frequent tea use [25], and inadequate iron and vitamin C intakes [25, 26]. Due to their regular menstrual cycles, which result in blood loss, female athletes are much more susceptible to iron shortage than male sportsmen. Athletes may also be susceptible to iron shortage as a result of insufficient nutritional intake. Recall that the body's absorption of dietary iron is not very efficient. In order to meet their bodies' needs, players—especially menstrual female endurance competitors—must pay close attention to how much iron they consume. A rigorous vegetarian or vegan diet can increase the risk of iron insufficiency because nonheme iron, which is abundant in plants and fortified foods, is less absorbed [45]. Alaunyte *et al.* also pointed out that the vast majority of studies back up the idea that dietary iron interventions improve the iron balance in female athletes who are iron-depleted. It's unclear, though, just how this affects female athletes' workout performance. However, there appears to be proof that dietary iron supplements could help female athletes maintain their iron status, particularly during demanding training and competition schedules [46].

This study stated that the improved socioeconomic position of Saudi Arabian children did not affect the prevalence of IDA [32]. Obesity [33], supplement consumption [34], and a positive family history of IDA [34] were significantly associated with the increased prevalence of IDA. Gedfie *et al.,* reported that among children under five, the combined prevalence of IDA and ID was found to be moderate, particularly in developing nations. The conclusion is that among children under the age of five, IDA and ID represent a moderate public health concern. Youngsters under the age of two and those living in large families were more likely to get IDA. Conversely, children of anemic mothers, low birth weight babies, and those who did not consume milk enriched with iron were more likely than their peers to acquire ID [47]. Akbari *et al.,* also found that the frequency of ID and the ensuing anemia is significant even with the Iranian Ministry of Health and Medical Education's efforts to provide free iron supplements for women between the ages of 12 and 18 and for newborns under the age of two [48].

CONCLUSION

The prevalence among pregnant women, women in the childbearing period, children, and adolescents in Saudi Arabia is still high. The study's conclusions emphasize the need to increase public knowledge of the value of a balanced diet and the regular inclusion of foods high in iron in daily meals. The findings of this study provide valuable insights into the risk variables that raise the prevalence of IDA in the study area and serve as a roadmap for future research endeavors addressing IDA.

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