

Assessment Of Prevalence And Factors Associated With Anaemia Among Pregnant Women Attending Antenatal Clinic In The Second And Third Trimesters Maternity Primary Health Care Centers At Makkah Al-Mokarramah, Saudi Arabia 2022

Maram Taher Alghabbashi¹, Ahmed Khaled Shukri², Abdulaziz Kamal Abdulaziz Kordi³, Riyadh Naif Saleh Faydah³, Faisal Ghurmullah Rashed Alzahrani⁴, Rashed Saleh Basha Alharthi⁵, Saad Ibrahim A Flata⁶, Amel Hamed Ail Alkhasem⁶, Awatif Marzouq Al Nadir⁶, Ahmad Hamed Muhammad Al Thaqafi⁷, Ahmad Ali Soliman kariri⁸, Manal Sulaiman Alharbi⁸, Ayman Faisal Omar Bokhari⁹, Turki Saleh Dakil Alah Almehmadi⁹

¹Assistant professor, Faculty of Nursing Umm Alqura University, Makkah, Saudi Arabia.

²Assistant professor of Family Medicine, Consultant Family Medicine, Family medicine and Community Department, Collage of Medicine, University of Jeddah, Jeddah, Kingdom of Saudi Arabia.

³General practitioner, Almansuor PMC, Makkah, Saudi Arabia.

⁴Health Education specialist, MOH Makkah, Saudi Arabia.

⁵Health Education Specialist, Makkah Healthcare cluster, Saudi Arabia.

⁶Nursing technician, Makkah Healthcare Cluster, Saudi Arabia.

⁷Nursing technician, Mortuary, King Abdulaziz Hospital in Makkah, Saudi Arabia.

⁸Nursing Specialist, Primary health care kudi and Al Hijrah, Saudi Arabia.

⁹Nursing Technician, Almansuor PMC, Makkah, Saudi Arabia.

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Abstract

Background.

In Saudi Arabia, prenatal anemia is a major public health problem affecting the health of women and children. The World Health Organization (WHO) recommends frequent prevalence surveys related to prenatal anemia. Although anemia is highly prevalent, anemia often does not receive adequate clinical attention, and the detection, assessment and management of iron deficiency anemia and iron-related erythropoiesis may be an unmet medical need. A multidisciplinary committee of physicians experienced in the management of anemia collected and reviewed recently published data on the prevalence of anemia, its etiology and health effects of anemia, as well as current treatment options and guidelines available on management of anemia in different patient groups, anemia is one of the most common nutritional deficiencies in the world, affecting more than a quarter of the world population.

Aim of the study: To evaluate the prevalence and factors associated with anemia in pregnant women attending antenatal clinic in the second and third trimester of pregnancy. (Al-Ka'akyah) among pregnant women who attend antenatal clinic in the second and third trimester. A questionnaire filled in by the researcher through an interview with the pregnant woman was used to collect the data. **Results.** Most of the participants (44.67%) were in the age group 25-30 years the Marital status the majority of participant Married were (75.33%), educational level the majority of participant are Tertiary education were (41.33%) also regarding Nationality the majority of participant are Saudi were (76.0%), the economic level the majority of participant <10.000 were (42.0%). **Conclusion.** Prenatal anemia among pregnant women attending antenatal clinic in the second and third trimesters has been described as a moderate public health problem. Frequent pregnancies, family size, and water source were factors associated with anemia. Therefore, it is highly recommended to promote family planning and nutrition education and to make clean water accessible to the community.

Introduction.

The management of anemia and its relationship to improving patient outcomes are gaining recognition in the healthcare community [1]. Iron deficiency anemia (IDA) occurs in all population groups and is associated with reduced quality of life, physical and cognitive performance, and poor clinical outcomes [2]. Furthermore, the presence of anemia significantly increases the likelihood of allogeneic blood transfusions in primary care patients and the adverse events and outcomes associated with transfusions [3].

Anemia in pregnancy is defined as Hb <110 g / L in the first and last trimester and Hb <105 g / L in the second trimester. Women with anemia during pregnancy can experience fatigue, low energy levels, decreased mental performance, and in cases of severe anemia, this is associated with preterm delivery, low birth weight, and a small fetus of childbearing age. In the postpartum period, anemia was associated with depression, emotional instability, stress and reduced cognitive performance tests [4]

Anemia, defined when there is a decrease in the level of hemoglobin concentration in the blood, this disease is considered one of the most common nutritional deficiency diseases found in the world and this disease affects more than a quarter of the world population [3].

Statistics show that 41.8% of pregnant women in most of the world suffer from anaemic Statistics show that 57.1% of pregnant women in Africa suffer from anemia [2]. In Saudi Arabia, the prevalence of anemia among pregnant women is 55.1% [4]. When the mean prevalence of anemia among pregnant women is 40.0% or more, it is considered a general health problem and indicates severe rates that need to be addressed to reduce this percentage [4].

A number of percentages have been reached that show indicators of anemia during pregnancy, where the effect is severe when the hemoglobin concentration is below 7.0 g / dl, the effect is moderate when the hemoglobin level is 7, 0 - 9.9 g / dL and the effect is mild when the hemoglobin level is 10.0 - 10.9 g / dL.[5]

Where anemia is a major cause of their disease, especially pregnant women, and this disease increases the mortality of fetuses, babies and children [6]. Anemia during pregnancy contributes to 20% of all maternal deaths [7]

Iron deficiency is one of the most common and widespread eating disorders in the world. There are no current global figures for iron deficiency, but iron deficiency disease is a disease that occurs indirectly due to the rate of anemia. It can be estimated that most preschool children and pregnant women in non-industrialized countries, and at least 30-40% in industrialized countries, suffer from iron deficiency due to the association of this disease with the percentage of women in pregnancy suffering from anemia. It is estimated that nearly half of pregnant women in the world are anemic: 52% in non-industrialized countries, compared to 23% in industrialized countries. [8] According to the WHO report, 32.3% of non-pregnant women of childbearing age are anemic in Saudi Arabia, which is reflected in cases of iron deficiency. [9].

Iron deficiency anemia has several causes.

These causes are divided into two main parts: Increased need for iron and decreased intake and absorption of iron in the body. Increased iron requirements include rapid fetal growth, pregnancy, blood loss due to heavy menstrual periods before pregnancy, frequent blood donations, and certain stomach and intestinal diseases, such as food allergies and hookworms.

On the other hand, low iron intake and absorption include a lack of dietary sources of iron (e.g., vegetarian diets) and a reduced absorption component, such as intake of antacids that exceed the recommended dose or drugs used to treat the disease. ulcer and acid reflux can reduce the amount of iron absorbed from the stomach [10].

Review of literatures

Abboud et al. (2019) conducted a hospital study and found that the percentage of women suffering from anemia is 37% in the city of Riyadh, Saudi Arabia. [eleven]

Medina et al. (2018) conducted a hospital study and found that the percentage of women suffering from anemia is 37% in Riyadh, Saudi Arabia. [12] Several studies support anemia among infants who focus on breastfeeding for a longer period due to the relatively low iron content of breast milk.[13]

One study was conducted by Akhter et al. (2021). A report on the prevalence of iron deficiency anemia has been prepared and this is also evident among primary school students in Northern Jeddah, Saudi Arabia [14] and Baldassarat et al. (2020) showed the prevalence of iron deficiency due to iron deficiency anemia in this study, where it was 23.0%. It turns out that the data showed that most of the anemia cases in this study were normal cell type. Anemia was more prevalent among students aged 10 to 12 than in the younger age group [15].

According to the World Health Organization (WHO), the prevalence of anemia among pregnant women is 41.8% (95% CI: 39.9-43.8) worldwide; there are only a few countries in the world where anemia is a major problem illustrating a small public health problem.

International and local organizations have long recommended a complete diet based on the intake of iron compounds during pregnancy; Folic acid turns out to be one of the important compounds used as a dietary supplement for its additional benefits, as it helps (reduces the risk of severe neural tube defects in the baby) for women of childbearing age.[16]

It is traditionally used to be prescribed to pregnant women as a type where dietary supplements have been prescribed to women as a daily routine or daily habit to maintain during pregnancy. In recent times, a group of intermittent supplements has been proposed, since they exploit the renewal time of the cells of the intestinal mucosa that help regulate iron absorption and are the safest element of the economy from a health point of view. [17].

A study conducted indicated that the eastern province of Saudi Arabia had a prevalence of anemia (41.3%) [18] and in Egypt it was prevalent (43%).[19] However, a very similar prevalence was observed in 12-month-old infants (24.9%), as demonstrated by a study conducted in China [20]. Through this, some recent national studies in Qatar [21] found a prevalence of 23.5% using a hemoglobin cutoff below 11.1 g / dL.

Other studies in a group of Arab countries such as Erbil and Iraq showed that the prevalence of anemia and anemia affecting iron anemia among children aged 12 to 24 months was 53% and 30%, respectively [22].

In Estonia, the prevalence of anemia among children aged 9-12 months was 9.4% using a Hb cutoff value of 10.5 mg / dl [23]. A study conducted in 11 European countries among 12-month-old infants revealed a prevalence of anemia of 9.4% [24]. The difference in anemia rates can be explained in current studies and in others by the difference of social origin and the cultural presence of different societies is evident, the existence of inclusion criteria, as well as the different cut-off levels of Hb% used in several studies. [25]

From this observation it clearly emerges that there is a lack of the vital element iron which is supplied of vegetable origin in food products. It is recommended to investigate the measures in this regard. A variety of iron supplements should be taken, and children should be insured to ensure that pregnant women taking a variety of iron supplements have a higher average muscle size and hemoglobin concentration is good [14] relative to social factors influencing this element, as the mother's smoking habit was an important factor in the development of anemia in pregnant women. Numerous other studies have been cited [15] and this has led to a negative effect of maternal smoking on iron in the body of infants.

Furthermore, some researchers such as Salami et al. (2018) report that the problem of not quitting for the mother during pregnancy can lead to intrauterine growth restriction and thus affect the reduction of iron accumulation within the maternal body. This affects birth order, as first-order babies were less likely to develop anemia than others. This correlates with published work and any other specifications from their colleagues [25] Pregnant women with a history of inherited blood disorders or congenital hemoglobin disorders were more likely to develop anemia. This is what Gosh and colleagues reported [26].

Rationale

In developing countries, the problem of anemia has different causes during pregnancy and multifactorial, as it includes the problem of nutritional deficiency and the lack of good food sources that affect the iron factor, deficiency and deficiency of folic acid vitamin B12, as well as due to parasitic diseases such as malaria and hookworm. These diseases lead to iron deficiency which is the cause of 75% of cases of anemia in women during pregnancy. HIV infection due to malnutrition and dirty water sources is also due to a significantly higher prevalence of anemia in sub-Saharan Africa. Where the disease of anemia caused by iron deficiency leads to the

lack of development of the nation due to the lack of cognitive and motor development of children and the productivity of adults. Despite its known impact on the population, data on the determinants of anemia during pregnancy in Saudi Arabia are available.

Aim of the study:

The prevalence of anemia-specific factors among pregnant women attending antenatal clinics in the second and third trimester of pregnancy is being developed and evaluated in primary health care centers in Makkah, Saudi Arabia 2022.

Materials and Methods

Study Design.

This cross-sectional study was conducted at Al-Ka'akyah PHCCs, Makkah Al-Mokarramah, chosen through simple random sampling using random number generator.

Study setting:

Three primary health care centers (Al-Kaaki, KDI, Al-Eskan) were selected by the researcher from 85 primary health care centers within Mecca Al-Mukarramah (Al-Masdar, Ministry of Health) and is a random sample from each center was selected. Where the number of primary health care centers was 85, and these have a number of facilities available and able to measure the percentage of hemoglobin in the blood to find out if mothers have anemia, and this was done in period from December to November 2022.

The vaccination was in one of the forms of health centers existing at the Ministry of Health known as (MOH) and these centers function to provide primary health care services among other clinics located in the western region.

Study Population.

Pregnant Women Attending Antenatal Clinic in the Second and Third Trimesters who are visiting Al-Khaldyah and Al-Ka'akyah PHCCs for routine follow-up in the PHC clinic were selected through convenience sampling technique. Pregnant Women Attending Antenatal Clinic in the Second and Third Trimesters period ranges from 150 participant

Sample Size

The sample size was estimated at (150). using the Raosoft calculator, according to the standard confidence level of 95% and a margin of error of 5%, assuming from the literature that the prevalence of anemia among pregnant women attending the antenatal clinic in Saudi Arabia is 24.9% know that the primary health care clinic covers about 150. outpatient clinics for pregnant women in the second and third trimester of the month.

Sampling Techniques

City of Mecca Regarding the selection of health centers, there are three health sectors within Mecca which are Al Kakiyah, Al Zahir and Al Adl. Using a simple random sampling technique (using randomizer.org), the healthcare sector was selected. Health sector numbered 1 to 12. Again, using the simple random sampling technique, the primary health care center was selected (using the website randomizer.org). The Healthy Child Clinic is one of the modalities of the health centers of the Ministry of Health that provide primary health care services, among other similar clinics in the western region. The primary health care clinic operates throughout the week with a target audience of around 150 pregnant women attending the antenatal clinic. To collect sample size data, the investigator needs approximately 20 patients per day to collect the required sample size. The investigator selected one in four patients to cover the sample size during the data collection period.

Inclusion Criteria

All healthy pregnant women who attended antenatal clinic in the second and third trimester of the visit to the Khalidiya and Kakia clinic were considered for vaccination or regular follow-up as a comprehensive measure.

Exclusion Criteria .

Pregnant women who attended antenatal clinic in the second and third trimester of pregnancy with chronic or acute illnesses were identified as exclusion criteria.

Data Collection Tools and Techniques .

The study involved the use of a questionnaire that the researcher filled out through an interview with pregnant women in the antenatal clinic in the second and third trimester. After the researcher was prepared and edited by the supervisor, the questionnaire was tested for correctness and reliability and a match result greater than 80% was accepted. Also, the hemoglobin result in the form was attached weekly. The questionnaire was written in English and specifically translated into Arabic from the following sections: demographics, determinants of anemia, social aspect, nutrition and hemoglobin level in children. For the collection part, the researcher handed over to the director of each health center the official document of acceptance of health matters. The researcher completed the questionnaire as part of the interview with the pregnant woman in the antenatal clinic in the second and third trimester on working days.

Data Entry and Analysis .

The data was collected manually and then encoded before being entered. Subsequently, the data was entered using Statistical Product and Service Solutions (SPSS version 24). The analysis was carried out by descriptive and percentage. The result of the haematological parameters of the neonates was classified by the investigator as anemia at the level of HB <10.5 mg / dL).

Pilot Study/Pretesting.

A pilot study was conducted at the Kakiya Primary Health Care Center, taking into account 10% of the sample volume. 10% of the total sample was selected and 150 were not included in the main study. This was done to verify the formulation of the questionnaire and the feasibility of the methodology.

Ethical Consideration .

The authorization was obtained from the Joint Family Medicine Program of Mecca and the Health Affairs Directorate of the Holy Capital for primary health care. All information has been kept confidential and the results will be presented to the department as feedback.

Budget : Self-funded.

Results

Table 1. Distribution of the Socio-demographic and economic characteristics of respondents .

	N	%
Age		
18-24	32	21.33
25-30	67	44.67
>31	51	34.00
Marital status		
Married	113	75.33
Single	19	12.67
Divorced	18	12.00
Level of education		
Primary	55	36.67
Secondary	33	22.00
Tertiary	62	41.33
Nationality		
Saudi	114	76.00
Non-Saudi	36	24.00
Occupation		
Self-employed (business)	32	21.33
Government/private employed	51	34.00
Housewife	67	44.67
Economic level		
<10,000	63	42.00
10,000 to 30,000	43	28.67
>31,000	44	29.33

Table 1 shows that most of the participants (44.67%) were in the age group 25-30 years follow by the (34.0%) were the age group >31 years, Regarding the Marital status the majority of participant Married were (75.33%) while single were(12.0%). Regarding Educational level the majority of participant are Tertiary education were(41.33%) while primary were(36.67%), also regarding Nationality the majority of participant are Saudi were(76.0%) while Non- Saudi were(24.0%). Regarding the Occupation the majority of participant Housewife were (44.67%) while Government/private employed were(34.0%). Regarding the Economic level the majority of participant <10.000 were (42.0%) while >31.000 were(29.33%)

Table 2 . Distribution of the obstetric history of the participants .

Obstetric history of the participants	N	%
Number of pregnancy (gravida)		
Frist pregnancy	29	19.33
Second pregnancy	42	28.00

Third pregnancy	16	10.67
Fourth and above pregnancy	63	42.00
Gestational age (trimester)		
Second trimester	51	34.00
Third trimester	99	66.00
Number of children		
One child	82	54.67
Two children	47	31.33
Three and above	21	14.00
Inter-pregnancy interval		
<2 years	53	35.33
>2 years	97	64.67

Table (2) show the regarding obstetric history of the participants, regarding the Number of pregnancy (gravid a) the majority of participant have second pregnancy were(28.0%) followed by first pregnancy were (19.33) while regarding the Gestational age (trimester) the majority of participant third trimester were(66.0%), followed by second trimester were (34.0%) , regarding the number of children the majority of participant One child were (54.67%)followed Two children were (31.33%), regarding Inter-pregnancy interval the majority of participant >2 years were (64.67%) followed by <2 years were (35.33%)

Table 3. Distribution of the ante natal clinic attendance and taking IFAS

Ante natal clinic attendance and taking IFAS	N	%
Gestational age at first ANC visit		
<12 weeks	48	32.00
12 - 18 weeks	38	25.33
19 - 24 weeks	18	12.00
25 - 32 weeks	46	30.67
Frequency of ANC visits		
Once	31	20.67
Twice	33	22.00
Thrice	51	34.00
4 times and above	35	23.33
Number of children		
One child	35	23.33
Two children	40	26.67
Three and above	75	50.00
Iron/folic acid supplementation		
Yes	108	72.00
No	42	28.00
Gestational age when the women started taking IFAs		

<12 weeks	35	23.33
12 - 18 weeks	36	24.00
19 - 24 weeks	63	42.00
25 - 32 weeks	16	10.67
Anthropometric measurements		
Body Mass Index (BMI)		
<18.5	38	25.33
18.5 - 24.9	48	32.00
>24.9	64	42.67
MUAC		
<23 cm	68	45.33
≥23 cm	82	54.67

Table (3) show regarding the ante natal clinic attendance and taking IFAS, regarding the Gestational age at first ANC visit the majority of participant heave <12 weeks were(32.0%) followed by 25 - 32 weeks were (30.67) while regarding Frequency of ANC visits the majority of participant third were(34.0%), followed by 4 times and above were (23.33%) , regarding the number of children the majority of participant Three and above were (50.00%)followed Two children were (26.67%), regarding Inter-pregnancy interval the majority of participant >2 years were (64.67%) followed by <2 years were (35.33%), regarding the Iron/folic acid supplementation the majority of participant heave 19 - 24 weeks were(42.0%) followed by 12 - 18 weeks were (24.0)

Table (3) also show regarding anthropometric measurements, regarding Body Mass Index (BMI) the majority of participant >24.9 were(42.67%), followed by 18.5 - 24.9 were (32.0%) , regarding the MUAC the majority of participant ≥23 cm were (54.67%) followed <23 cm were (45.33%),

Table 4. Distribution of the health conditions of the women during the current pregnancy.

Health conditions of the women during the current pregnancy	N	%
Any health problems during the current pregnancy		
Yes	48	32.00
No	102	68.00
Occurrence of diarrhea for the last one month preceding the study		
Yes	126	84.00
No	24	16.00
Occurrence of febrile illnesses for the last one month preceding the study		
Yes	67.5	45.00
No	82.5	55.00
Treating for worms in the last 6 month preceding the study		
Yes	99	66.00
No	51	34.00

Treating for malaria in the last 6 month preceding the study		
Yes	15	10.00
No	135	90.00
HIV status of the women		
Sero-positive	18	12.00
Sero-negative	132	88.00

Table (4) show the health conditions of the women during the current pregnancy regarding any health problems during the current pregnancy the majority of participant answer No were(68.0%) followed by Yes were (32.22) while regarding Occurrence of diarrhea for the last one month preceding the study the majority of participant answer Yes were(84.0%), followed by No were (16.0%) , regarding Occurrence of febrile illnesses for the last one month preceding the study the majority of participant No were (55.00%) followed Yes were (45.0%), regarding Treating for worms in the last 6 month preceding the study the majority of participant Yes were (66.0%) followed by No were (34.0%), regarding the Treating for malaria in the last 6 month preceding the study the majority of participant No were (90.0%) followed by Yes were (10.0), regarding HIV status of the women the majority of participant Sero-negative were(88.0%), followed by Sero-positive were (12.0%).

Table 5. Distribution of the Life style habits of participants.

Life style habits of participants	N	%
Whether the women had taken beverages (tea, cocoa, or coffee)		
Yes	68	45.33
No	82	54.67
Time when the women had taken these beverages		
<20 min before/after meals	53	35.33
≥20 min before/after meals	18	12.00
Not applicable	79	52.67
Number of meals per day		
Twice	119	79.33
Thrice	18	12.00
Four or more times	13	8.67
Foods avoided during the current pregnancy		
Yes	129	86.00
No	21	14.00
Reasons for avoiding the foods		
Heart burn	63	42.00
Vomiting	78	52.00
Loss of appetite	49	32.67
Don't know	23	15.33
Craving for non-food substances		
Yes	99	66.00

No	51	34.00
Type of craving		
Stones	36	24.00
Charcoal	51	34.00
Soil	30	20.00
Tooth paste	33	22.00

Table (5) show the Life style habits of participants regarding Whether the women had taken beverages (tea, cocoa, or coffee) the majority of participant answer No were(54.67%) followed by Yes were (45.33), while regarding Time when the women had taken these beverages the majority of participant Not applicable were(52.67%), followed by <20 min before/after meals were (35.33%) , regarding Number of meals per day the majority of participant Twice were (79.0%) followed Thrice were (12.0%), regarding Foods avoided during the current pregnancy the majority of participant answer Yes were (86.0%) followed by answer No were (14.0%), regarding the reasons for avoiding the foods the majority of participant Vomiting were (52.0%) followed by Heart burn were (42.0) but the Loss of appetite were (42.0), regarding Craving for non-food substances the majority of participant answer Yes were(66.0%), followed by answer No were (34.0%) , Regarding Type of craving the majority of participant Charcoal were (34.0%) followed Stones were (24.0%),

Discussion

Although anemia in pregnant women nationwide in Saudi Arabia (40.0% prevalence) is classified by the World Health Organization as an acute public health problem [5], the prevalence estimated in our study suggests that the problem in urban Mecca is a moderate public problem. Importance for health based on the same classification of the World Health Organization [10]. This prevalence is also lower than that of the global Mediterranean (38.2%) and Eastern Mediterranean (38.9%) countries [27]. Compared to the prevalence reported in other areas of Saudi Arabia, the estimated urban prevalence of hail is slightly higher than that reported in the Asir region (31.9%) [4, 28], but lower than the prevalence reported in Mecca (39 , 0%) [10], Khobar (41.3%) [23] and significantly lower than the reported prevalence of Al-Ahsa (73.3%) [14].

The present study showed that the prevalence of anemia among pregnant women was high according to the World Health Organization classification of the importance of anemia for public health, it is a serious public health problem [29] . This result is slightly higher than the prevalence of anemia during pregnancy in Kenya at 55.1%. It is also significantly higher than the study conducted in Kakamega County, Kenya, which reported 40% [30] and unpublished results from Nairobi Mbagati District Hospital at 36.2%. [31] This difference may be due to the fact that participants in this study did not include pregnant women in the first trimester because anemia is more common in the second and third trimesters. However, this figure is relatively comparable to other studies conducted in African countries such as Nigeria with 54.5% and Ethiopia with 56.8% [32]. But it falls short of Uganda's results at 63.1% [18] and Egypt's 62.2% [19] and above Tanzania's scores at 47.4% [20].

Our study highlighted the importance of dietary factors as important risk factors associated with anemia during pregnancy. The consumption of tea, cocoa or coffee was one of the factors that showed a significant association with anemia during pregnancy. Pregnant women who ate less than once a day were more likely to develop anemia than pregnant women who ate foods avoided during their current pregnancy one or more times per week. This finding is consistent with other studies which have shown that pregnant women who frequently ate red meat had higher hemoglobin concentrations [16, 20].

Red meat is an important dietary source of heme iron [23]. Pregnant women aged 31 years and older were significantly more anemic than mothers aged 18 to 24 years. This finding is consistent with previous studies conducted in the Kisumu region of Kenya [31], Ethiopia [31], Tanzania [30] and Egypt [19] which found that late pregnancy significantly increased the risk of anemia. In general, anemia during pregnancy is thought to increase with increasing equivalence and maternal age. In addition to the general weakening of the body as the mother

ages, older women are expected to be dredged several times. Multigravida can cause anemia by depleting the mother's iron stores with each pregnancy and causing blood loss with each delivery [31].

Relatively higher prevalence was reported in relation to the current study prior to a study conducted in the eastern province of Saudi Arabia (41.3%) [26]. and in Egypt (43%) [19]. However, a fairly similar prevalence (24.9%) was observed in 12-month-old infants in a study from China [9]. Similar to our results, a recent national study in Qatar [8] showed a prevalence of 23.5% using a hemoglobin cutoff of less than 11.1 g / dL. Other studies conducted in Arab countries such as Erbil and Iraq have shown that the prevalence of iron deficiency anemia and anemia among children aged 12 to 24 months was 53% and 30%, respectively [11]. In Estonia, the prevalence of anemia among children aged 9-12 months was 9.4% using an Hb cutoff value of 10.5 mg / dL [20]. A study of 12-month-old infants in 11 European countries revealed that the prevalence of anemia was 9.4% [21]. The difference in anemia rates in current and other studies can be explained by the difference in the sociocultural background of the different communities, the inclusion criteria and the different Hb% cut-off levels used in the different studies.

Regarding socio-demographic characteristics, childhood anemia was found to be more pronounced among mothers with no previous maternity leave after childbirth. A study in China also reported that the history of postpartum anemia among mothers was significantly associated with anemia among infants aged 6 to 12 months [22]. On the other hand, the current study describes that children with a history of chronic, hospitalized, or acute disease in the past two weeks are more likely to develop anemia. Constantiner and colleagues observed the same in Brazil [23] and Simba and colleagues in Indonesia [24]. Weiss and Goodnough [25] reported that fever, which is a common symptom of acute and chronic infectious diseases, has been associated with low Hb levels. When evaluating factors related to infants and anemia, the weight growth rate based on the Saudi Arabian weight growth chart was significantly associated with anemia, as it was reported more among infants below the 3%. This finding contradicts what was observed in two American studies [26], pointing out that overweight infants and children (1-3 years old) were more likely to develop iron deficiency anemia because this disease is mainly associated with imbalance. between iron requirements and dietary sources of iron, not their relationship to infant nutrition or body mass index. However, there was no association between anemia and childhood BMI based on a study conducted in Qatar [11].

Conclusions

“In Makkah Al-Mokarramah region, Saudi Arabia, anemia among pregnant women was a moderate public health problem. Low income, bigger family size, higher parity, longer menstrual cycle > 5 days, bleeding during pregnancy, infrequent intake of meat, the habit of drinking tea just after meals, past history of anemia, and the sign of clinical anemia (pallor), were found to be significantly associated with anemia. These findings give insight to healthcare providers about the importance of early detection and management of anemia in early pregnancy. Further research utilizing of Prevalence and Factors Associated with Anaemia among Pregnant Women Attending Antenatal Clinic in the Second and Third Trimesters Maternity primary health care centers at Makkah ”

References

1. Woldie, M., Feyissa, G. T., Admasu, B., Hassen, K., Mitchell, K., Mayhew, S., ... & Balabanova, D. (2018). Community health volunteers could help improve access to and use of essential health services by communities in LMICs: an umbrella review. *Health Policy and Planning*, 33(10), 1128-1143.
2. Cappellini, M. D., Musallam, K. M., & Taher, A. T. (2020). Iron deficiency anaemia revisited. *Journal of internal medicine*, 287(2), 153-170.
3. Fernandez-Jimenez, M. C., Moreno, G., Wright, I., Shih, P. C., Vaquero, M. P., & Remacha, A. F. (2020). Iron deficiency in menstruating adult women: Much more than anemia. *Women's Health Reports*, 1(1), 26-35.
4. Alreshidi, M. A., & Haridi, H. K. (2021). Prevalence of anemia and associated risk factors among pregnant women in an urban community at the North of Saudi Arabia. *Journal of Preventive Medicine and Hygiene*, 62(3), E653.
5. AlFaris, N., ALTamimi, J., AlKehayez, N., AlMushawah, F., AlNaeem, A., AlAmri, N., ... & Alotibi, H. (2021). Prevalence of anemia and associated risk factors among non-pregnant women in Riyadh, Saudi Arabia: a cross-sectional study. *International journal of general medicine*, 14, 765.
6. Owaidah, T., Al-Numair, N., Al-Suliman, A., Zolaly, M., Hasanato, R., Al Zahrani, F., ... & Sajid, M. R. (2020). Iron deficiency and iron deficiency anemia are common epidemiological conditions in Saudi Arabia: report of the national epidemiological survey. *Anemia*, 2020.

7. Alam, S., Fahim, S. M., Rajamani, A. S., Rammohan, A., Sai, V. R., Rela, M., ... & Dhawan, A. (2021). *WJH. World*, 13(10), 1203-1458
8. Noronha, J. A., Al Khasawneh, E., Seshan, V., Ramasubramaniam, S., & Raman, S. (2012). Anemia in pregnancy-consequences and challenges: a review of literature. *Journal of South Asian Federation of Obstetrics and Gynecology*, 4(1), 64-70.
9. Sundararajan, S., & Rabe, H. (2021). Prevention of iron deficiency anemia in infants and toddlers. *Pediatric Research*, 89(1), 63-73.
10. Sabbagh, H. J., Al-Jabri, B. A., Alsulami, M. A., Hashem, L. A., Aljubour, A. A., & Alamoudi, R. A. (2021). Prevalence and characteristics of autistic children attending autism centres in 2 major cities in Saudi Arabia: A cross-sectional study. *Saudi medical journal*, 42(4), 419.
11. Aboud, S. A. E. H., El Sayed, H. A. E., & Ibrahim, H. A. F. (2019). Knowledge, Attitude and Practice Regarding Prevention of Iron Deficiency Anemia among Pregnant Women in Tabuk Region. *International Journal of Pharmaceutical Research & Allied Sciences*, 8(2).
12. MADINAH, K. (2018). *PHARMACEUTICAL SCIENCES. hospital*, 30, 7.
13. Hamodi, L. E., Naji, A. S., & Ismael, S. H. (2022). FACTORS ASSOCIATED WITH ANEMIA IN WOMEN OF REPRODUCTIVE AGE IN IRAQI FEMALES SAMPLE. *Age*, 14(19), 20-29.
14. Akhter, M. S., Hamali, H. A., Iqbal, J., Mobarki, A. A., Rashid, H., Dobie, G., ... & Laghbi, O. S. (2021). Iron Deficiency Anemia as a Factor in Male Infertility: Awareness in Health College Students in the Jazan Region of Saudi Arabia. *International Journal of Environmental Research and Public Health*, 18(24), 12866.
15. Baldassarre, M. E., Panza, R., Farella, I., Posa, D., Capozza, M., Mauro, A. D., & Laforgia, N. (2020). Vegetarian and vegan weaning of the infant: how common and how evidence-based? A population-based survey and narrative review. *International Journal of Environmental Research and Public Health*, 17(13), 4835.
16. Gökteş, P. (2020). Development of an Experimental Image Processing Tool and Flow-Cytometry Based Electromagnetic Scattering Analysis for Medical Diagnosis of Red Blood Cell Pathology (Doctoral dissertation, Bilkent Üniversitesi (Turkey)).
17. Li, H., Xiao, J., Liao, M., Huang, G., Zheng, J., Wang, H., ... & Wang, A. (2020). Anemia prevalence, severity and associated factors among children aged 6–71 months in rural Hunan Province, China: a community-based cross-sectional study. *BMC public health*, 20(1), 1-13.
18. Elshebiny, A. M., Alali, H. A., Alamer, Z. M., Alsultan, Y. K., Alkhalaf, H. E., Alkishi, A. M., & Alsawaylih, M. A. (2021). The incidence of hypoglycemia and its risk factors among diabetic patients in the Eastern Province of Saudi Arabia. *Int J Med Dev Ctries*, 614-21.
19. AlZaben, F. N., Sehlo, M. G., Alghamdi, W. A., Tayeb, H. O., Khalifa, D. A., Mira, A. T., ... & Koenig, H. G. (2018). Prevalence of attention deficit hyperactivity disorder and comorbid psychiatric and behavioral problems among primary school students in western Saudi Arabia. *Saudi medical journal*, 39(1), 52.
20. Guo, Y., Ke, H. J., Liu, Y., Fu, M., Ning, J., Yu, L., ... & Wu, J. L. (2018). Prevalence of vitamin D insufficiency among children in southern china: A cross-sectional survey. *Medicine*, 97(25).
21. Veettil, S. T., & Alnuaimi, A. S. (2019). Association between body mass index (BMI) percentile and asthma in children of 5–12 years old: A case–control study using electronic medical records in Primary Health Care Corporation, Qatar 2016–2017. *QScience Connect*, 2019(1), 6.
22. Allahyani, S. S. S. A., Sembawah, W. M. S., Alzahrani, A. A., Almalki, M. M., Magrabi, H. M. A., Alharbi, A. A. D., ... & Alshaikhi13, A. M. A. (2021). Assessment of Prevalence and Determinants of Anaemia among Infants attending well-baby clinic at Primary Health Care Centers, Makkah Al-Mokarramah, 2021. *European Journal of Molecular & Clinical Medicine*, 8(04).
23. Preka, E., Bonthuis, M., Harambat, J., Jager, K. J., Groothoff, J. W., Baiko, S., ... & Bakkaloglu, S. A. (2019). Association between timing of dialysis initiation and clinical outcomes in the paediatric population: an ESPN/ERA-EDTA registry study. *Nephrology Dialysis Transplantation*, 34(11), 1932-1940.
24. Salami, A., Bahmad, H. F., Ghssein, G., Salloum, L., & Fakh, H. (2018). Prevalence of anemia among Lebanese hospitalized children: Risk and protective factors. *PLoS One*, 13(8), e0201806.
25. Zainel, A. J. A. L., Osman, S. R. O., Al-Kohji, S. M. S., & Selim, N. A. (2018). Iron deficiency, its epidemiological features and feeding practices among infants aged 12 months in Qatar: a cross-sectional study. *BMJ open*, 8(5), e020271.
26. Antsaklis, P., Papamichail, M., Daskalakis, G. J., & Antsaklis, A. J. (2021). Haemoglobinopathies in Pregnancy. *The EBCOG Postgraduate Textbook of Obstetrics & Gynaecology: Obstetrics & Maternal-Fetal Medicine*, 1, 252.
27. Turk-Adawi, K., Sarrafzadegan, N., Fadhil, I., Taubert, K., Sadeghi, M., Wenger, N. K., ... & Grace, S. L. (2018). Cardiovascular disease in the Eastern Mediterranean region: epidemiology and risk factor burden. *Nature Reviews Cardiology*, 15(2), 106-119.
28. Alslamah, T., ALSOFAYAN, Y. M., Almazroa, M. A., MOUSA, S., ALANNAZ, A. A., Shaik, R. A., ... & ALMUTAIRI, W. K. Z. A. (2021). Descriptive mapping of road traffic accidents reported to Red Crescent, Saudi Arabia. *Pak J Med Health Sci*, 15(9), 3009-3012.
29. Kounnavong, S., Vonglokhom, M., Kounnavong, T., Kwadwo, D. D., & Essink, D. R. (2020). Anaemia among adolescents: assessing a public health concern in Lao PDR. *Global Health Action*, 13(sup2), 1786997.
30. Miller, J. D., Collins, S. M., Omotayo, M., Martin, S. L., Dickin, K. L., & Young, S. L. (2018). Geophagic earths consumed by women in western Kenya contain dangerous levels of lead, arsenic, and iron. *American Journal of Human Biology*, 30(4), e23130.
31. Wambui, A., Odhiambo, A., Achieng, L., Otieno, C. F., & Bhatt, S. M. (2018). Prevalence Of Vitamin D Deficiency In Adult Human Immunodeficiency Virus Infected Persons At District Hospital In Nairobi, Kenya.
32. Diana, R., Khomsan, A., Anwar, F., Christianti, D. F., Kusuma, R., & Rachmayanti, R. D. (2019). Research Article Dietary Quantity and Diversity among Anemic Pregnant Women in Madura Island, Indonesia.