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Research Article

Short Inter-Pregnancy Interval as a Risk Factor for Anaemia in Pregnancy

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Abstract

Inter-Pregnancy Interval (IPI) less than 2 years was found to be associated with pregnancy anemia. The aim of this study was to assess the relationship between the IPI and the presence of anemia among Saudi pregnant women. A cross-sectional study was done on 202 pregnant females who attended the antenatal care clinics of the Obstetric and Gynecology hospital of Taif city, Saudi Arabia. Demographics data, and data on parity, IPI, having blood transfusion and suffering from anemia in last pregnancy, gestational age, iron intake, and presence of anemia in current pregnancy were collected. The present study showed that 42.6% of participant pregnant females were anemic. Participants with IPI less than 2 years showed a significant higher percent of those having anemia in the current pregnancy. A significant relationship was found between anemia in the current pregnancy and IPI less than 2 years, anemia in the past pregnancy, being in the 3rd trimester, and having a parity ≥ 4 and not taking iron. Participants with IPI less than 2 years showed a significant lower level of both RBCs count and hemoglobin level in the current pregnancy. Health education at the PHC level for all pregnant women should be carried out regarding the relationship between short IPI and anemia, and the importance of iron intake during pregnancy.

Keywords: *Inter-Pregnancy; Interval; Risk; Anemia; Pregnancy; Saudi*

Introduction

The world health organization (WHO) reported that half a billion women in the reproductive age suffer from anemia worldwide, and about 38% of the anemic women were pregnant [1]. It has been also reported that anemia affects almost half of pregnant women globally [2,3]. The prevalence of anemia varied among pregnant women in different continents including; Africa (55.8%), Asia (41.6%), Europe (18.7%) and North America (6.1%) [4]. Adverse pregnancy outcomes due to anemia include; intrauterine growth retardation, preterm delivery, low birth weight [5], increased fetal and neonatal mortality [6].

The (WHO) recommends an inter-pregnancy interval of 2-3 years to decrease infant mortality and to maintain good maternal health [7]. Other organizations as the United States Agency for International Development (USAID recommend a longer interval of 3 - 5 years [7]. An inter-pregnancy (IPI) interval less than 2 years was found to weaken the process of anatomical and physiological recovery after delivery, leading to adverse effects on maternal and neonatal outcome [8] and it can also lead to anemia in the subsequent pregnancies [9,10]. The association between short IPI and present of anemia during pregnancy was proved in other studies [11-19]. In the kingdom of Saudi Arabia (KSA), an old study done in Asir region in 1994 found a prevalence of anemia among pregnant women of (31.9%) [20]. Another study done in 2008 in Al-Khobar city reported a prevalence of (41.3%) of anemia among pregnant women [21].

A study done in Makkah city in 2010 showed a prevalence of (39%), where women in the third trimester, who had short IPI, were multipara, and who had a history of anemia before pregnancy had higher prevalence of anemia in the current pregnancy [22]. Another study was done in Jazan city that the prevalence anemia among 400 pregnant women, found a prevalence of 62% [23]. In Taif city, the only study that assessed the problem of anemia during pregnancy was done in 2005 and mentioned as a reference in the study done in Makkah city, and mentioned that 26.8% of pregnant women who attended the antenatal clinic at AI-Hada Hospital had anemia [24]. A careful literature search found that no other study was done in Taif city since 2005 to assess the problem of anemia among pregnant Saudi females. This study aimed to investigate the relationship between the IPI and the presence of anemia among Saudi pregnant women.

Methods

Study design and time frame

A cross-sectional study was done, including the pregnant females who attended the antenatal care clinics of the obstetrics and gynecology hospital of Taif city, Saudi Arabia. The recruitment process extended from June to August 2018.

Sampling methodology

The inclusion criteria were any Saudi pregnant women who attended the antenatal care clinics of the obstetrics and gynecology hospital of Taif city at the study period and agreed to share in the study. The exclusion criteria were any primipara, other gynecological cases, non-Saudis, and those who refused to share in the study.

Study instrument

A pre-designed questionnaire was used with a first section that included few questions on the demographic data as age, education, residence, and socioeconomic class. The second section included questions on parity, IPI and information about the last pregnancy as having blood transfusion and suffering from anemia. The third section included questions related to the current pregnancy as gestational age, iron intake, and presence of anemia. Information about the patients' RBCs count and hemoglobin level was taken from their medical records. The questionnaire items were derived from similar national and international studies [11-19,21-23].

According to the World Health Organization (WHO), the studied pregnant woman was considered to have anemia when her hemoglobin level is less than 11 g/dL [25]. And according to the USA National Center for Biotechnology, the studied participant was considered to have a normal reference range of RBCs count when her level was (3.5 - 5.5 million/mm^3) [26].

Ethical considerations

The study was reviewed and approved by the Research Ethics Committee of Taif University. Written and verbal consents were obtained from all participants.

Statistical analysis

The data were coded, tabulated, and analyzed using the statistical package for the social sciences (SPSS). Qualitative data were expressed as numbers and percentages, and the Chi-square (χ^2) test was used to test the relationship between variables. Quantitative data were expressed as mean and standard deviation (Mean ± SD), where Mann-Whitney (U) test was used for non-parametric variables. A p-value of < 0.05 was considered statistically significant.

Results

Table 1 shows that in the present work, (57.4%) of the participants were in the age of 25-35 years, (50.5%) were gravida 4 and more, (47%) had school level of education, (91.6%) belonged to the middle socioeconomic class, (12.4%) had blood transfusion in past pregnancy, (44.6%) suffered from anemia in the past pregnancy, (63.7%) reported iron intake in the current pregnancy, (and 47.5%) had an IPI less than 2 years.

Parameter	No. (%)
Age	
< 25 y	26 (12.9)
25-35 y	116(57.4)
> 35 y	60 (29.7)
Education	
Illiterate	15 (7.4)
School	95 (47)
University	92 (45.5)
Residence	
Urban	146 (72.3)
rural	56 (27.7)
Socioeconomic standard	
Poor	7 (3.5)
Middle class	185 (91.6)
Rich	10 (5)
Parity	
Gravida 2	23 (11.4)
Gravida 3	77 (38.1)
Gravida 4 and more	102 (50.5)
IPI/year	
< 2y	96 (47.5)
> 2y	106 (52.5)
IPI/ month	
< 6 months	39 (19.3)
6 - ≤ 12 months	22 (10.9)
12 - ≤ 18 months	22 (10.9)
18 - ≤ 24 months	13 (6.4)
> 2 years	106 (52.5)
Anemia in the past pregnancy	
Present	90 (44.6)
Absent	112 (55.4)
Blood transfusion in past pregnancy	
Yes	25 (12.4)
No	177 (87.6)

Table 1: *Description of the studied participants according to demographic characters and some conditions related to previous pregnancies.*

Table 2 shows that (63.9%) of the participants were in the 3rd trimester, and (42.6%) had anemia in the current pregnancy. According to the anemic grades, (14.9%) had mild anemia, (15.3%) had moderate anemia and (12.4%) had severe anemia, while (57.4%) of the participants were not anemic.

Parameter	No. (%)
Trimester	
1st trimester	37 (18.3)
2nd trimester	71 (35.1)
3rd trimester	94 (46.5)
Iron intake	
Yes	146 (72.3)
No	56 (27.7)
Anemic status	
Anemic	86 (42.6)
Not anemic	116 (57.4)
Grades of anemia:	
Mild	30 (14.9)
Moderate	31 (15.3)
Sever	25 (12.4)
Normal	116 (57.4)
RBCs count (million cells/ul) (Mean ± SD)	3.45± 0.55
Hemoglobin level (Mean ± SD)	11.3 ± 1.54

***Table 2**: Description of the studied participants according to conditions related to current pregnancy.*

Figure 1 shows that participants with IPI less than 2 years showed a significantly higher percentage of those having anemia in the current pregnancy (p-value = 0.02). According to the grades of anemia, participants with IPI less than 2 years showed a significantly higher percentage of those having moderate and severe anemia when compared to participants with IPI more than 2 years.

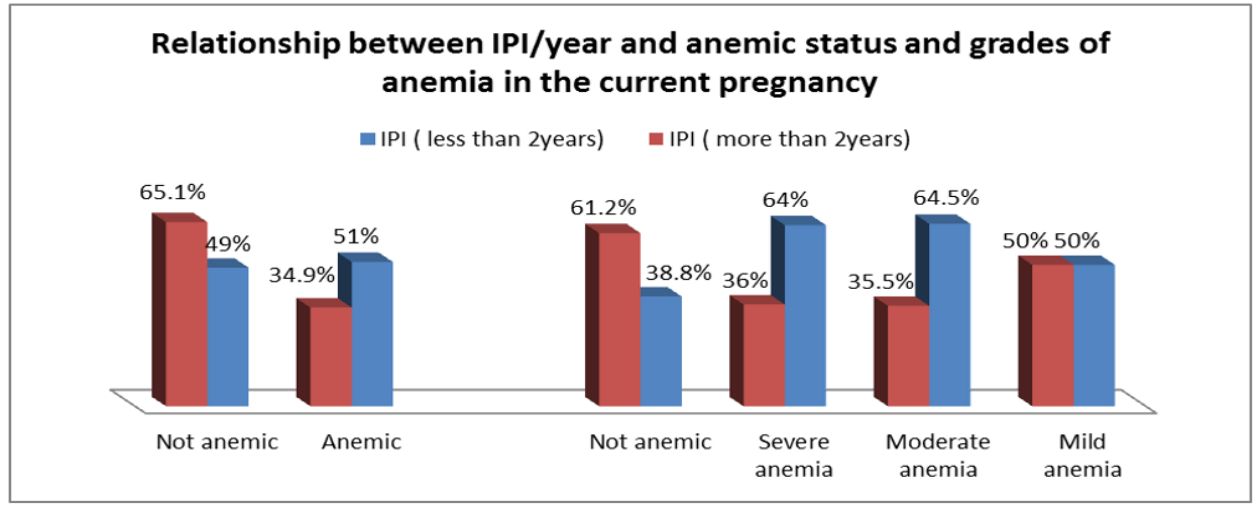

***Figure 1:** Relationship between IPI and anemic status and type of anemia of the participants in current pregnancy.*
(N.B. For relationship between IPI and anemia status: (χ2= 5.36 and p-value = 0.02).
(N.B. For relationship between IPI and types of anemia (χ2= 9.39 and p-value = 0.019).

Table 3 shows that participants with anemia in the current pregnancy showed a significantly higher percentage of those who suffered anemia in the past pregnancy (p-value = < 0.001), those who were in the 3rd trimester, and those who had a parity ≥ 4 ((p-value = < 0.05).

Parameter	Anemic	Not anemic	(χ^2) test	p-value
	No. (%)	No. (%)		
Age				
< 25 y	10 (38.5)	16 (61.5)	0.65	0.71
25-35 y	48 (41.4)	68 (58.6)		
> 35 y	28 (46.7)	32 (53.3)		
Education				
Illiterate	9 (60)	6 (40)	2.4	0.3
School	37 (38.9))	58 (61.1)		
university	40 (43.5)	52 (56.5)		
Residence				
Urban	71 (42.8)	95 (57.2)	0.015	0.9
Rural	15 (41.7)	21 (58.3)		
Socioeconomic standard				
Poor				
Middle class	5 (71.4)	2 (28.6)	3.93	0.14
Rich	75 (40.5)	110 (59.5)		
Parity				
Gravida 2	4 (17.4)	19 (28.6)		
Gravida 3	28 (36.4)	49 (63.6)	11.66	0.003
Gravida 4 and more	54 (52.9)	48 (47.1)		
Anemia in the past pregnancy	(67.8)	29 (32.2)		
Present	25 (22.3)	87 (77.7)	42.17	< 0.001
Absent	6 (60)	4 (40)		
Blood transfusion in past pregnancy				
Yes	12 (48)	13 (52)	0.34	0.55
No	74 (41.8)	103 (58.2)		
Trimester				
1st trimester	7 (18.9)	30 (81.1)	15.31	
2nd trimester	27 (38)	44 (62)		< 0.001
3rd trimester	52 (55.3)	42 (44.7)		
IPI/month				
< 6 months	25 (64.1)	14 (35.9)		
6 - ≤ 12 months	10 (45.5)	12 (54.5)		
12 - ≤ 18 months	11 (50)	11 (50)	11.92	0.018
18 - ≤ 24 months	4 (30.8)	9 (69.2)		
> 2 year	36 (34)	70 (66)		
Iron intake				
Yes	53 (36.3)	93 (63.7)	8.47	0.004
No	33 (58.9)	23 (41.1)		

Table 3: *Relationship between anemic status and some demographic characters, conditions related to previous pregnancies and gestational age and iron intake in current pregnancy.*

On the other hand, a non-significant difference was found between anemic and non-anemic participants according to age, residence, parity, educational level, socioeconomic standard, having a blood transfusion in past pregnancy, and gestational age (p-value= > 0.05). Participants with IPI less than 6 months showed a significantly higher percentage of those having anemia when compared with participants with longer intervals (p-value = < 0.05). Participants who reported not taking iron in the current pregnancy showed a significantly higher percentage of those who have anemia (p-value = < 0.05).

Table 4 shows that participants with IPI less than 2 years showed a significantly lower level of both RBCs count and hemoglobin level in the current pregnancy compared to those with IPI more than 2 years (p-value = < 0.05).

Parameter	IPI (less than 2years)	IPI (more than 2years)	(U test)	p-value
RBCs count (million/mm^3) (Mean ± SD)	3.36 ± 0.51	3.52 ± 0.58	2.09	0.036
Hemoglobin level (Mean ± SD)	10.96 ± 1.58	11.61 ± 1.45	3.01	0.003

Table 4: *Relationship between IPI and RBCs count and Hemoglobin level in current pregnancy.*

Discussion

The present work showed that (42.6%) of the studied participants had anemia in the current pregnancy. This result is somewhat in agreement with that revealed from a recent study done in Makkah city (39%) respectively [22]. It IS also in agreement with a study done in Al-Khobar city that was done in 2008 (41.3%) [21]. On the other hand, this prevalence is much higher than that observed in an old study done in Taif city in 2005, where only (26.8%) of the studied females had anemia [24].

On comparing this result to international studies, the prevalence observed in the present study is much lower than that observed in developing countries done as India (91.3%) [27], Iraq (91%) [28], Rajasthan (69.5%) [29], Nigeria (54.5%) [30], and Malaysia (57.4%) [15]. This observed difference was explained in the previous studies by poor nutrition, short IPI, and the inadequate use of the ante-natal care among the studied women as these studies were done on lower socioeconomic classes pregnant women attended Government Hospitals.

According to the anemic grades observed in the present study, (14.9%) had mild anemia, (15.3%) had moderate anemia and (12.4%) had severe anemia, while (57.4%) of the participants were not anemic. A higher percent of moderate and severe anemia was found in the study done in Iraq where 40% had mild anemia, 40% had moderate anemia and 20% had severe anemia [28]. Better results were observed in the study done in Makkah city, where (89.7%) had mild anemia and (10.3%) had moderate anemia and no one had severe anemia [22]. Different results were also found in the study done in Al-Khobar city; where mild, moderate and severe anemia was present in (25.2%), (15.7%) and (0.4%) women respectively [21].

The present study showed that participants with IPI less than 2 years showed a significantly higher percentage of those having anemia, and those having moderate and severe anemia when compared to participants with IPI more than 2 years. The same result was observed in the study done in Makkah city, where higher prevalence of anemia in the current pregnancy was found among pregnant women who had short IPI [22].

The observed relationship between short IPI and present of anemia during pregnancy was found in other studies [11-19]. The relationship between short IPI and anemia among pregnant mothers was explained biologically by the insufficient time for a pregnant mother to recover from the nutritional burden of the previous pregnancy, Specifically the folate and iron deficiencies [15,18]. These studies found that an IPI less than 2 years was responsible for high prevalence of anemia in pregnancy.

In a study done in Ethiopia, pregnant women with an IPI less than 2 years were found to be more than two times more likely to develop anemia during the current pregnancy when compared to women with an IPI more than 2 years [14]. These studies explained that the effect of short IPI on the overall physiologic status of the mother as she had no enough time to recover from the depleted nutrients [15].

The present study showed that participants with anemia in the current pregnancy had a significantly higher percentage of those who suffered anemia in the past pregnancy. This finding was observed in previous studies which showed the relationship between anemia in the last pregnancy that leads to anemia in the pre-conceptional period, which In turn lead to anemia in the current pregnancy [27].

The present study showed that participants with anemia in the current pregnancy had a significantly higher percentage of those who were in the 3rd trimester. The same was observed in the study done in Makkah city [22] and other international studies [12].

Anemic pregnant women in the present work had a significantly higher percentage of those who had a parity ≥ 4. The same was observed in the study done in Makkah city [22] and other international studies [16,19,27]. A meta-analysis done to assess the effect of birth spacing on maternal nutritional status found that primigravida women were 61% less likely to develop anemia during pregnancy compared to multigravida women. This was explained by the depletion of iron store of a pregnant woman by repeated pregnancy [12,15]. An Ethiopian study has also found that pregnant women with family size greater than five were 2.7 times more anemic than women with family size less than five [31].

The present work showed a non-significant difference between anemic and non-anemic participants according to their age. Different results were present in other studies where anemia was found among pregnant mothers of more than 35 years [27,32]. As regards residence, the present study showed the same non-significant difference, a result that was observed in other studies [27,33]. On the other hand, different results were revealed from studies done in developing countries as Malawy and India [34,35], where pregnant women from the rural areas are more likely to develop anemia than women from the urban area. These studies explained that by the difference in the socioeconomic status and health service access between rural and urban areas in addition to the inadequate counseling by health professionals in correcting the wrong beliefs related to iron supplementation.

A none significant difference was found also between anemic and non-anemic participants according to their educational level. The same was observed in other studies [12]. In contrast, other studies done in developing countries found that low educated pregnant mothers had the highest prevalence of anemia compared to mothers in other educational levels [27]. This was explained by the lack of awareness regarding adequate nutrition and the effect of anemia on pregnancy, in addition to the inadequate use of health services among the less educated women.

In the present study, the none significant difference between anemic and non-anemic participants according to their socioeconomic standard was observed in a systematic analysis of global anemia burden from 1990 to 2010, where a non-significant difference of anemia prevalence during pregnancy was found among mothers belonging to different socioeconomic classes [36]. On the other hand, studies done in developing countries showed a different result, where pregnant mothers belonged to lower socio-economic classes had a higher prevalence of anemia. A matter that was explained by poor nutrition, short IPI, and the inadequate use of antenatal care [12,27].

The non-significant relationship between anemic and non-anemic participants in the present study according to their educational level and socioeconomic standard could also be explained by the better economic standard of Saudi participants, as KSA has an oil-based economy, with a higher Gross National Income (GNI) per capita [37]. It was also reported that iron supplementation during pregnancy increases levels of hemoglobin, serum ferritin, mean cell volume, and serum iron, as it reduces the extent of depletion of iron stores [27]. In the present study, as regards iron intake in the current pregnancy, the present study showed that participants who reported not taking iron had a significantly higher percentage of those who have anemia. Similar results were observed in other studies [12,27,32].

Participants in the present study with an IPI less than 2 years showed a significantly lower level of both RBCs count and hemoglobin level in the current pregnancy compared to those with IPI more than 2 years. The same observed significant difference was reported in a previous study done in Makkah city [22] and in other international studies [11-19].

Limitations

One of the possible limitations of this study was using a self-reported questionnaire that may be prone to recall bias. The use of a cross-sectional study showed the relation between variables without closing a cause-effect relationship.

Conclusion

A significant relationship was found between anemia in the current pregnancy and IPI less than 2 years, anemia in the past pregnancy, being in the 3rd trimester, and having a parity ≥ 4, and not taking iron. Health education at the PHC level for all pregnant women should be carried out to stress on the proper length of IPI, and the proper intake of iron during pregnancy. Moreover, an emphasis on the importance of initiating antenatal care in the 1st trimester for early detection of anemia should be also done.

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Conflicts of Interest

No conflicts related to this work

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Bibliography

1. World Health Organization. "Global Nutrition Targets 2025: Anaemia Policy Brief. (Who/Nmh/Nhd/14.4)". Geneva. WHO (2014).
2. Lee AI and MM Okam. "Anemia in Pregnancy". *Hematology/Oncology Clinics of North America* 25.2 (2011): 241-259.
3. Karaoglu L., *et al*. "The Prevalence of Nutritional Anemia in Pregnancy in an East Anatolian Province, Turkey". *BMC Public Health* 10 (2010): 329.
4. McLean E., *et al*. "Worldwide Prevalence of Anaemia, Who Vitamin and Mineral Nutrition Information System, 1993-2005". *Public Health Nutrition* 12.4 (2009): 444-454.
5. Haider Batool A., *et al*. "Anaemia, Prenatal Iron Use, and Risk of Adverse Pregnancy Outcomes: Systematic Review and Meta-Analysis". *BMJ: British Medical Journal* 346 (2013): f3443.
6. Goonewardene M., *et al*. "Anaemia in Pregnancy". *Best Practice and Research: Clinical Obstetrics and Gynaecology* 26.1 (2012): 3-24.
7. World Health Organization. "Report of a Technical Consultation on Birth Spacing. (Who/Nmh/Nhd/14.4)". Geneva (2005).
8. "Effect of Interpregnancy Interval on Pregnancy Outcome among Pregnant Women Attending Delivery at Belqas Hospital Seham" (2015).
9. Riyanto DL., *et al*. "Short Interpregnancy Interval as a Risk Factor for Anemia in Pregnancy: A Retrospective Cohort Study in Duren Sawit, Jakarta, 2014–2016". *Journal of Computational and Theoretical Nanoscience* 23.7 (2017): 6828-6830.
10. Conde-Agudelo A., *et al*. "Effects of Birth Spacing on Maternal, Perinatal, Infant, and Child Health: A Systematic Review of Causal Mechanisms". *Studies in Family Planning* 43.2 (2012): 93-114.

11. Langare Dr Sanjivani., *et al*. "A Cross Sectional Study to Assess Certain Determinants Co-Related with Anaemia in a Pregnant Women Attending Antenatal Clinic at Rural Health Training Centre in Western Maharashtra". *National Journal of Community Medicine* (2013).

12. Viveki R., *et al*. "Prevalence of Anaemia and Its Epidemiological Determinants in Pregnant Women". *Al Ameen Journal of Medical Sciences* 5 (2012).

13. Noronha Judith Angelitta., *et al*. "Anemia in Pregnancy-Consequences and Challenges: A Review of Literature". *Journal of SAFOG* 4.1 (2012): 64-70.

14. Kassa Getachew Mullu., *et al*. "Prevalence and Determinants of Anemia among Pregnant Women in Ethiopia; a Systematic Review and Meta-Analysis". *BMC Hematology* 17 (2017): 17.

15. Nh Nik Rosmawati., *et al*. "The Rate and Risk Factors for Anemia among Pregnant Mothers in Jerteh Terengganu, Malaysia". *Journal of Community Medicine and Health Education* 2.5 (2012): 150.

16. Stevens GA., *et al*. "Global, Regional, and National Trends in Haemoglobin Concentration and Prevalence of Total and Severe Anaemia in Children and Pregnant and Non-Pregnant Women for 1995-2011: A Systematic Analysis of Population-Representative Data". *Lancet Global Health* 1.1 (2013): e16-e25.

17. Sagili H., *et al*. "Are Teenage Pregnancies at High Risk? A Comparison Study in a Developing Country". *Archives of Gynecology and Obstetrics* 285.3 (2012): 573-577.

18. Howard EJ., *et al*. "The Association between Short Interpregnancy Interval and Preterm Birth in Louisiana: A Comparison of Methods". *Maternal and Child Health Journal* 17.5 (2013): 933-939.

19. Balarajan Y., *et al*. "Anaemia in Low-Income and Middle-Income Countries". *Lancet* 378.9809 (2011): 2123-2135.

20. Mahfouz AA., *et al*. "Anemia among Pregnant Women in the Asir Region, Saudi Arabia: An Epidemiologic Study". *Southeast Asian Journal of Tropical Medicine and Public Health* 25.1 (1994): 84-87.

21. Rasheed Parveen., *et al*. "Anemia in Pregnancy: A Study among Attendees of Primary Health Care Centers". *Annals of Saudi Medicine* 28.6 (2008): 449-452.

22. Mokhtar Amany and Samaa Elsoadaa. "Prevalence and Risk Factors of Anemia among a Sample of Pregnant Females Attending Primary Health Care Centers in Makkah, Saudi Arabia". *Pakistan Journal of Nutrition* 11.12 (2012): 1113-1120.

23. Fathi Rafaa Hassan., *et al*. "Incidence of Anemia among Pregnant Women Attending at Primary Health Care Center in Jazan in 2011-2012". *International Journal of Academic Scientific Research* 4.4 (2016): 124-131.

24. AL Zahrani Saad. "Prevalence of Iron Deficiency Anemia among Pregnant Women Attending Antenatal Clinics at Ai-Hada Hospital". *Saudi Society of Family And Community Medicine* (2009).

25. World Health Organization. "Haemoglobin Concentrations for the Diagnosis of Anaemia and Assessment of Severity. Vitamin and Mineral Nutrition Information System (Vmnis). (Who/Nmh/Nhd/11.1)". WHO (2011).

26. Dean Laura. "Blood Groups and Red Cell Antigens. National Center for Biotechnology Information (Us); Table 1, Complete Blood Count" (2005).

27. Bedi Dr Renu., *et al*. "Maternal Factors of Anemia in 3rd Trimester of Pregnancy and Its Association with Fetal Outcome". *International Multispecialty Journal of Health* 1.7 (2015): 8.

28. Abdul-Fatah BN., *et al*. "Assessment of Iron Deficiency Anemia (Ida) and Dietary Pattern among Pregnant Women in Baghdad City, Iraq". *Journal of Pharmaceutical Sciences and Research* 10.9 (2018): 2279-2284.

29. Bansal Babita., *et al*. "Comparative Study of Prevalence of Anemia in Muslim and Non-Muslim Pregnant Women of Western Rajasthan". *International Journal of Research in Health Sciences (IJRHS)* 1 (2013): 48-52.

30. Olatunbosun OA., *et al*. "Prevalence of Anaemia among Pregnant Women at Booking in the University of Uyo Teaching Hospital, Uyo, Nigeria". *BioMed Research International* (2014): 849080.

31. Obse N., *et al*. "Magnitude of Anemia and Associated Risk Factors among Pregnant Women Attending Antenatal Care in Shalla Woreda, West Arsi Zone, Oromia Region, Ethiopia". *Ethiopian Journal of Health Sciences* 23.2 (2013): 165-173.

32. Zhang Q., *et al*. "Prevalence and Risk Factors for Anaemia in Pregnant Women: A Population-Based Prospective Cohort Study in China". *Paediatric and Perinatal Epidemiology* 23.4 (2009): 282-291.

33. Nadeem Ahmad., *et al*. "The Prevalence of Anaemia and Associated Factors in Pregnant Women in a Rural Indian Community". *Australasian Medical Journal* 3.5 (2010): 276-280.

34. Gowri Dorairajan., *et al*. "Influence of Awareness and Attitude About Anemia and Iron Supplements on Anemic Status of Pregnant Women Attending a Tertiary Care Centre in South India". *Journal of Reproductive Health and Contraception* 2.1 (2017).

35. Adamu Aishatu L., *et al*. "Prevalence and Risk Factors for Anemia Severity and Type in Malawian Men and Women: Urban and Rural Differences". *Population Health Metrics* 15.1 (2017): 12.

36. Kassebaum NJ., *et al*. "A Systematic Analysis of Global Anemia Burden from 1990 to 2010". *Blood* 123.5 (2014): 615-624.

37. "Saudi Arabia Economy - Overview - Economy".

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