PREVALENCE OF ANEMIA DURING PREGNANCY IN PAKISTAN: META-ANALYSIS

Bismillah Sehar[1], Muhammad Moazzam[2]*, Mousa Jawasreh [1]

1. Tutor, Health and Social Care Department - University of Bedfordshire,
2. Research Assistant, Biomedical Engineering, School of Engineering and Digital Sciences, . Nazarbayev University, Kabanbay batyra 53, Astana 010000, Republic of Kazakhstan.

ARTICLE INFO

Key words:
Anemia, Pregnant Women, Pregnancy, Pakistan, Prevalence, Hb Level

Corresponding Author:
Muhammad Moazzam
Email:
muhammad.moazzam@alumni.nu.edu.kz

Vol 01 Issue 03
JULY-SEP 2023

ISSN Online: 2960-2599
ISSN Print: 2960-2580

META-ANALYSIS

ABSTRACT

Background: In the 21st century, anemia is the most common nutritional deficiency globally reported. Anemia affects both genders, male and female, and all age groups. But the main problem is more prevalent among women, which makes it common medical condition in pregnancy. **Objective:** This study was designed to find the pooled prevalence of anemia during Pregnancy in Pakistan using meta-analysis. **Methodology:** Studies were searched out using different key words like "Anemia", "Pregnant women", "anemia and Pregnant women", "Anemia during pregnancy", "Anemia and Pakistan", "Pregnant women and Pakistan" and "Hb level". The related studies were found by using different search databases, Google Scholar, PubMed, and Scopus. Studies were included if articles had anemia in their title and had full text available. We excluded review articles and copyright or where permission was required. The pooled prevalence of anemia was found by fixed effect and random effect, forest plot and Funnel plots. Other tests were applied to find heterogeneity and publication bias. We considered I^2 > 75% to be high heterogeneity. The P-value less or equal 0.05 was considered significant. **Results:** The results showed the pooled prevalence of anemia among pregnant women was 54.901% using the fixed effect, 62.888% using the random effect. The I^2 (inconsistency) was found as 99.67%, and Cochran's Q value was significant (p-value < 0.01) in the heterogeneity test, which showed huge heterogeneity among these studies. In publication bias, significant levels were reported: P = 0.2510 for Egger's test and P = 0.4480 for Begg's test. **Conclusion:** This meta-analysis found the highest pooled prevalence of anemia (54.901%) among pregnant women in Pakistan. The health department, policymakers, nutritionists, family doctors, and gynecologists should put a serious focus on reducing anemia among pregnant women.

Introduction:

In 21th Century, Anemia is most known common nutritional deficiency diseases globally reported. The World Health Organization (WHO) defined the anemia in pregnancy as hemoglobin levels less than 11.0 g/dl.[1] Anemia affects both gender male and female, and all age groups. But main problem is more prevalent among women that is it common medical condition in pregnancy.[2, 3] It increases in maternal mortality and morbidity, also do low birth weight. Although folic acid, vitamins A, C, and B12, as well as vitamins from the B-complex group, such as Vitamin B, proteins, and amino acids, are crucial in maintaining the haemoglobin level, iron deficiency is the major cause of anaemia.[4] Anemia affects over two-thirds of women in underdeveloped nations, according to estimates. However, it affects

pregnant women more frequently.[5] Poor foetal iron storage caused by anemia in late pregnancy are considered to permanently change the iron content of the brain and the neurotransmitters in foetuses and newborns.[6] In developing countries, the main cause of anemia among pregnant women is multifactorial and geographic region it varies.[7] According to a global prevalence research, 41% of pregnant women were afflicted, compared to 30.2% of non-pregnant women, 25.4% of school-age children, 23.9% of the elderly, and 12.7% of males.[8,9]

The prevalence of anemia in Pakistan for pregnant women living in urban areas is 29% to 50 % visiting antenatal clinics in a tertiary hospital in Karachi, among ever-married women aged from 15 to 44 years is showed 47% in rural areas and 26% in urban areas.[10] Globally, during anemia during pregnancy understood factors are iron deficiency, socioeconomic and cultural, hookworm and malaria like parasitic disease, and women immune deficiency virus infection. Other contributing factors like family history and poor hygiene may lead to infections.[11]

According to WHO, in 2011, the prevalence of maternal anemia was 38.2% in worldwide. In North America is its prevalence reported less than 20%.Different continents showed different prevalence of anemia like Europe (24.5%), Asia (39.3%), Latin America & Caribbean region (28.3%), Oceania (29%), and Africa (44.6%).[12] Currently, most of pregnant women are suffering from anemia. Anemia not only affects mother's health but also produce defects during child growth. The anemic mother and child care is more difficult than other disease. In this study, we did a systematic review and meta-analysis on Prevalence of Anemia in Pregnant women in Pakistan.

Materials and Methods

Reporting:

This study was designed according to PRISMA guidelines for reporting systematic reviews and meta-analysis (Figure 1).

Search Strategies:

Studies were searched out with using different key words "Anemia'', "Pregnant women'', " Anemia and Pregnant women'', "Anemia during pregnancy'', "Anemia and Pakistan'', "Hb level'', and "Pregnant women and Pakistan''. The related studies were found by using different search databases, Google Scholar, PubMed, and Scopus

Selection criteria:

Studies were included if: (1) prevalence of Anemia in pregnancy in their title, (2) the full-text was available (3) Anemia diagnosis by Healthcare professional supervision .We excluded studies review articles and copyright or permission issues.

Data extraction:

A pre-designed data extraction form was used to extract information on the following variables: Author (Publication year), sample size, cases (N), prevalence rate, and city name.

Statistical Analysis:

After literature collection, studies data was entered, managed and analyzed using ''Medcalc''. The application "Meta-Analysis of proportion" was used to conduct whole analysis. The pooled prevalence of anemia was found by fixed effect and random effect along with forest plot and Funnel plots were used. Other tests were applied to find heterogeneity and publications bias. We considered I2 > 75% as high heterogeneity. The P-value ≤ 0.05 was considered as significant.

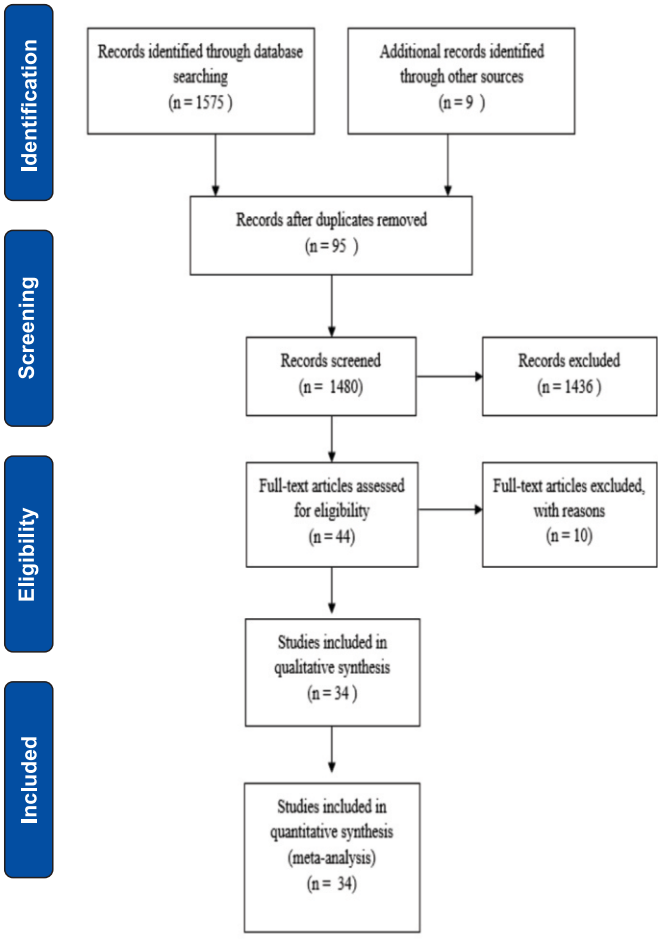

Fig. 1: PIRSMA Diagram for Inclusion of Studies.

Results:

This study selected total 34 researches for analysis. By adding all the sample sizes, total sample of pregnant women was calculated 33918. The maximum sample size was 14800 and minimum sample size was 50 reported. Out of 34 studies, maximum prevalence of anemia was 91 and minimum was 10.5 observed. The pooled anemic pregnant women cases reported 18733(55.23%) out of total studies sample size 33918. After meta-analysis, results showed pooled prevalence of anemia among pregnant women was 54.901% using fixed effect, 62.888% using random effect (Table 2). The I^2 (inconsistency) was reported 99.67% and Cochran's Q value was significant (p-value < 0.01) in heterogeneity test which showed huge heterogeneity among these studies (Table 3). In publication bias, significant levels found in P value- 0.2510 for Egger's test and Begg's test, P = 0.4480 (Table 3).

Table 1: Characteristics of the studies included in the meta-analysis.

Sr. No.	Study name	Total number	N	Prevalence	Trimester
1	Christian al., 2009	6288	663	10.5	3rd
2	Mahmood et al., 2014	100	22	22	All
3	Naz and Begum et al., 2013	810	440	54.3	All
4	Batool et al., 2010	400	170	42.3	All
5	Qureshi et al., 2003	150	68	45	All
6	Nazir et al., 2011	14800	9600	60	All
7	Zaheer et al., 2015	103	64	62.1	3rd
8	Ullah et al., 2013	210	142	67.6	All
9	Umar et al., 2015	132	41	68.33	All
10	Ijz et al., 2016	200	141	70.5	All
11	Shahani et al., 2012	310	220	71	All
12	Rizwan et al., 2010	500	375	75	1st
13	Anjum et al., 2015	100	75	75	All
14	Abbassi et al., 2009	263	208	79.1	All
15	Haq et al., 2014	1000	910	91	All
16	Baig-Ansari et al., 2008	1,366	1236	90.5	All
17	Khan et al., 2020	280	95	33.93	All
18	Nisar et al., 2017	150	112	74.8	All
19	Khalid et al., 2017	196	126	64.3	2nd&3rd
20	Baksh et al., 2019	1250	700	56	All
21	Rehman rt al., 2018	360	187	52	3rd
22	Bibi et al., 2019	625	350	56	All

Table 2: Meta-analysis of the studies included

Study	Sample size	Proportion (%)	95% CI	Weight (%)	
				Fixed	Random
(Christian et al., 2009)	6288	10.544	9.795 to 11.329	18.52	2.97
(Mahmood et al.,2014)	100	22.000	14.330 to 31.392	0.30	2.90
(Naz and Begum, 2013)	810	54.321	50.818 to 57.792	2.39	2.96
(Batool et al, 2010)	400	42.500	37.602 to 47.510	1.18	2.95
(Qureshi et al, 2003)	150	45.333	37.197 to 53.657	0.44	2.92
(Nazir et al., 2011)	14800	64.865	64.090 to 65.634	43.59	2.97
(Zaheer et al.,2015)	103	62.136	52.044 to 71.511	0.31	2.90
(Ullah et al., 2013)	210	67.619	60.836 to 73.896	0.62	2.94
(Umar et al., 2015)	132	31.061	23.298 to 39.696	0.39	2.92
(Ijaz et al., 2016)	200	70.500	63.658 to 76.723	0.59	2.93
(Shahani et al.,2012)	310	70.968	65.570 to 75.960	0.92	2.95
(Rizwan et al., 2010)	500	75.000	70.963 to 78.738	1.48	2.96
(Anjum et al., 2015)	100	75.000	65.345 to 83.122	0.30	2.90
(Abbassi et al., 2009)	263	79.087	73.666 to 83.840	0.78	2.94
(Haq et al, 2014)	1000	91.000	89.053 to 92.701	2.95	2.96
(Baig-Ansari et al., 2008)	1366	90.483	88.802 to 91.988	4.03	2.97
(Khan et al., 2020)	280	33.929	28.401 to 39.801	0.83	2.95
(Nisar et al., 2017)	150	74.667	66.926 to 81.407	0.44	2.92
(Khalid et al., 2017)	196	64.286	57.146 to 70.986	0.58	2.93
(Baksh et al, 2019)	1250	56.000	53.197 to 58.775	3.68	2.97
(Rehman et al., 2018)	360	51.944	46.647 to 57.210	1.06	2.95
(Bibi et al., 2019)	625	56.000	52.008 to 59.935	1.84	2.96
(Anwar et al., 2020)	357	69.468	64.403 to 74.206	1.05	2.95
(Jahan and Siddiq et al, 2017)	405	71.358	66.686 to 75.714	1.20	2.95
(Akram et al., 2017)	200	84.000	78.170 to 88.791	0.59	2.93
(Qamar et al., 2019)	50	86.000	73.260 to 94.181	0.15	2.83
(Balouch et al., 2020)	850	35.294	32.078 to 38.612	2.51	2.96
(Qazi et al., 2020)	300	82.333	77.537 to 86.477	0.89	2.95
(Attaullah et al., 2017)	250	59.200	52.829 to 65.351	0.74	2.94
(Khaskheli et al., 2016)	305	55.738	49.967 to 61.396	0.90	2.95
(Shams et al., 2017)	300	76.667	71.463 to 81.335	0.89	2.95
(Hussain and Younise et al, 2019)	318	58.176	52.542 to 63.656	0.94	2.95
(Saqib et al., 2019)	600	89.167	86.401 to 91.539	1.77	2.96
(Ullah et al., 2019)	390	57.692	52.618 to 62.649	1.15	2.95
Total (fixed effects)	33918	54.901	54.370 to 55.431	100.00	100.00
Total (random effects)	33918	62.888	52.567 to 72.646	100.00	100.00

Table 3: Test for heterogeneity and Publication bias of the studies included

Test for heterogeneity		Publication bias (Egger's test & Begg's test)	
Q	10043.3009	Intercept	5.2056
DF	33	95% CI	-3.8651 to 14.2764
Significance level	P < 0.0001	Significance level	P = 0.2510
I^2 (inconsistency)	99.67%	Kendall's Tau	-0.09123
95% CI for I^2	99.64 to 99.70	Significance level	P = 0.4480

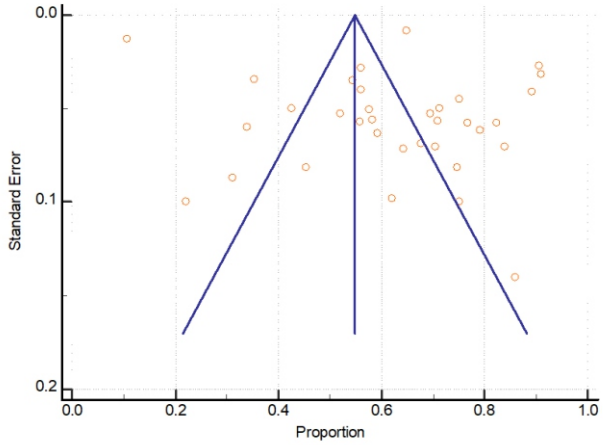

Fig. 2: Funnel Plot for Inclusion of Studies.

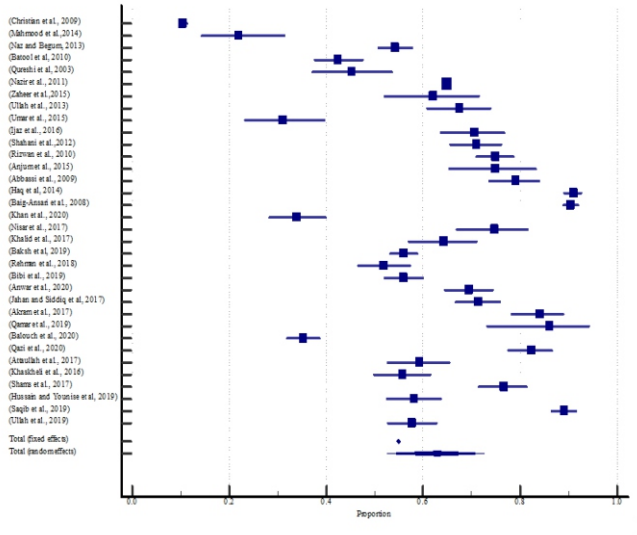

Fig. 3: Forest plot for Inclusion of Studies.

Discussion:

In this study, total 1584 studies were selected. After screening base on inclusion criteria, 34 studies were shortlisted.These studies 2003 from in 2021, 6(17.6%) were from 2017,2019,4(11.7%)were from 2020,3(8.8%) from 2015 and 2(5.8%) from 2009,2010,2013,2014, 2016, 1(2.9%) each from 2003,2008,2011,2012 and 2018 for Prevalence of Anemia in Pregnant women in Pakistan. In 2003, Qureshi et al found the prevalence of Anemia in Pregnant women. They selected 150 pregnant women from 3rd trimester for their study. In their study, 68 out of 150(45%) prevalence were reported. [13] After Baig-Ansari et al in 2008, 1366 huge sample size was taken for the study. In their study, 1236(90.5%) prevalence was found.[14] In 2009, there were two studies Christian et al and Abbassi et al conducted for prevalence of anemia. Their results are for anemia prevalence 10.5% and 79.1% respectively.[15, 16] Next year 2010, Batool et al and Rizwan et al did studies on all trimester pregnant women. Their findings are 42.2% and 75% respectively.[17, 18] In 2011, one study was selected for this study. Nazir et al selected 14800 pregnant women from trimester. They found out (60%) prevalence of anemia among them.[19] Shahani et al (2012) found prevalence of anemia 220(71%) among 310 pregnant women.[20] For 2013 year studies, Naz and Begum et al and Ullah et al did study. They found out 54.3% and 67.6% among all trismester pregnant women.[21, 22] In 2014, Mahmood et al and Haq et al finding were 22% and 91% respectively.[23, 24] There are three studies Zaheer et al, Umar et al and Anjum et al selected for 2015 year. Zaheer el al did study among 3rd trimester pregnant women and remaing two take all trimester pregnant women. For their results, 62.1%, 68.33% and 75% reported respectively.[25-27] In 2016, two researchers did studies for prevalence of anemia among pregnant woman in Pakistan. The Ijaz et al and Khaskheli et al found 70.5% and 55.73% prevalence among all trimester

pregnant women.[28, 29] There are six studies conducted in 2017. The Khalid et al and Akram et al did their study among 2nd & 3rd trimester pregnant women.[30,31] Others Nasir et al, Jahan and Siddiq et al,Akram et al, Attaullah et al and Shams et al take all trimester pregnant women. In their results, Nasir et al (74.8%), Khalid et al (64.3%), Jahan and Siddiq et al (71.35%), Akram et al(84%), Attaullah et al(59.2%) and Shams et al(76.7%) reported.[31-35] In 2018, Rehman et al found 52% prevalance among 3rd trimester.[36] In 2019, six studies included for this study. Ullah et al found prevalance 57.7% among 2nd & 3rd trimesters, Baksh et al (56%), Bibi et al (56%),Qamar et al(86%), Hussain and Younise et al (58.2%) and Saqib et al(89%) reported.[37-42] In 2020, fours studies were reported for prevalance of anemia. They all take sample form all trismester pregnant women. The Khan et al (33.93%), Anwar et al (69.5%), Balouch et al(35.2%) and Qazi et al (82.3%) reported.[43-46] This systematic review and meta-analysis was done to determine the aggregate prevalence of anemia among pregnant women in Pakistan based on previous studies. According to the pooled meta-analysis of this research, anemia was prevalent among pregnant women in Pakistan at a rate of 54.901%. Over the past two decades, the anemia rate has grown, which has raised the morbidity in mother and child health. According to the research, anemia is more prevalent in Pakistan's rural than urban areas. The increasing ratio can be attributed to imbalanced diet and inadequate economic status inequalities. In 2011, WHO issued the prevalence of maternal anemia was 38.2%. By comparing pregnant and non-pregnant women there is anemia difference between them. The worldwide 41% anemia reported in pregnant women and 30.2% anemia reported in non- pregnant women.[47, 48] In 2011, a meta-analysis was conducted to follow the global trend in anemia. Their study showed that 38% pregnant women suffered from anemia. Additionally, according to their meta-analysis, the frequency was 36% in East Africa and 22% in high-income areas. Anemia was present in 31.66% of pregnant women in Ethiopia, according to another meta-analysis. [49] According to their research, anemia affected roughly one third of pregnant women in Ethiopia. They discovered other relationship variables in their meta-analysis, including pregnancy-interval malaria infection, residency throughout pregnancy, and anemia and gravidity. It is important to place special focus on areas where anemia is more common among expectant mothers. To lower the high frequency of anemia among pregnant women, the responsible authority should take action on the variables that have been identified. In Current meta-analysis, we found the pooled prevalence of anemia among pregnant women i.e: 54.901% using fixed effect, 62.888% using random effect, I^2 (inconsistency) 99.67% in heterogeneity test which showed huge heterogeneity among these researches. . For publication bias, significant levels reported in P = 0.2510 for Egger's test and P = 0.4480 for Begg's test reported.

Conclusion:

This meta-analysis found one of highest pooled prevalence 54.901% of anemia among pregnant women in Pakistan. The health department policy makers, nutritionists, family doctors and gynecologists should put a serious focus on reducing anemia among pregnant women. The early screening in unmarried teenagers, nearly married and married women will help to reduce risk factors leading to anemia during pregnancy. By reducing anemia among pregnant women can results in healthy life of mother-child, and significantly reduced mortality and morbidity rates of mother and child in Pakistan.

Acknowledgements:
We would like to acknowledge to authors of studies included in this review.

Funding:
No funding was obtained for this study.
Ethics approval and consent to participate:
Not applicable.
Consent for publication:
Not applicable

AUTHORS CONTRIBUTION

BS: Literature search and write up, **MM:** conceived, designed and did statistical analysis, manuscript writing & editing of the manuscript, **MJ:** Write up

REFERENCES:

1. Smith C, Teng F, Branch E, Chu S, Joseph K. Maternal and perinatal morbidity and mortality associated with anemia in pregnancy. Obstetrics and gynecology. 2019;134(6):1234.

2. Kemper AR, Fan T, Grossman DC, Phipps MG. Gaps in evidence regarding iron deficiency anemia in pregnant women and young children: summary of US Preventive Services Task Force recommendations. The American journal of clinical nutrition. 2017;106 (suppl_6):1555S-8S.

3. Prasad K. Prevalence of anemia among pregnant women-a cross-sectional study. International Journal of Medical Science and Public Health. 2018;7(12):1023-6.

4. Abioye AI, Aboud S, Premji Z, Etheredge AJ, Gunaratna NS, Sudfeld CR, et al. Hemoglobin and hepcidin have good validity and utility for diagnosing iron deficiency anemia among pregnant women. European journal of clinical nutrition. 2020;74(5):708-19.

5. Mengist HM, Zewdie O, Belew A. Intestinal helminthic infection and anemia among pregnant women attending ante-natal care (ANC) in East Wollega, Oromia, Ethiopia. BMC research notes. 2017;10(1):1-9.

6. Adam I, Ibrahim Y, Elhardello O. Prevalence, types and determinants of anemia among pregnant women in Sudan: a systematic review and meta-analysis. BMC hematology. 2018;18(1):1-8.

7. Derso T, Abera Z, Tariku A. Magnitude and associated factors of anemia among pregnant women in Dera District: a cross-sectional study in northwest Ethiopia. BMC research notes. 2017;10(1):1-8.

8. Herzog SA, Leikauf G, Jakse H, Siebenhofer A, Haeusler M, Berghold A. Prevalence of anemia in pregnant women in Styria, Austria—A retrospective analysis of mother-child examinations 2006–2014. Plos one. 2019;14(7):e0219703.

9. Darmawati D, Tahlil T, Siregar TN, Kamil H, Fithria F, Audina M. Antenatal care and iron deficiency anemia among pregnant women. Proceeding of AIC: Health and Life Sciences. 2018;8(1).

10. Masood A, Sulman M, Arshad A, Ashraf F. Symptomatic Complications and Quality of Life in Pakistani Patients with Iron-Deficiency Anemia: Quality of life in Iron-Deficiency Anemia Patients. Proceedings of the Pakistan Academy of Sciences: B Life and Environmental Sciences. 2019;56(1):19–27-19–27.

11. Susheela AK, Kumari C. Addressing anemia in pregnant women and school children through a field tested novel strategy. Annals of the National Academy of Medical Sciences (India). 2020;56(01):15-25.

12. WHO W. The global prevalence of anaemia in

2011. Geneva: World Health Organization. 2015.

13. Qureshi EMA. Study of iron deficiency anaemia among pregnant women attending antenatal clinic of jinnah Hospital, Lahore: AIOU; 2003.

14. Baig-Ansari N, Badruddin SH, Karmaliani R, Harris H, Jehan I, Pasha O, et al. Anemia prevalence and risk factors in pregnant women in an urban area of Pakistan. Food and nutrition bulletin. 2008;29(2):132-9.

15. Christian P, Shahid F, Rizvi A, Klemm RD, Bhutta ZA. Treatment response to standard of care for severe anemia in pregnant women and effect of multivitamins and enhanced anthelminthics. The American journal of clinical nutrition. 2009 Mar 1;89(3):853-61.

16. Abbassi RM, Ansari S, Devrajani B, Abbasi S. The prevalence and risk factors of anemia in pregnant women. Medical Channel. 2009;15(3):70-3.

17. Batool Z, Zafar MI, Maann AA, Ali T. Socio-cultural factors affecting anemia and their effects on mother, and child health in rural areas of District Faisalabad, Punjab, Pakistan. Pak J Agri Sci. 2010;47(1):59-65.

18. Rizwan F, Memon A. Prevalence of anemia in pregnant women and its effects on maternal and fetal morbidity and mortality. Pakistan journal of medical sciences. 2010;26(1).

19. Nazir G, Naz S, Ali S, Aziz S, Malik SA, Qari IH, et al. Anaemia: the neglected female health problem in developing countries. J Ayub Med Coll Abbottabad. 2011;23(2):8-11.

20. Shahani RA, Shahani S, Kazi N. Prevalence of Anemia during pregnancy in rural Sindh. infection. 2012;9:15.

21. Naz H, Begum B. Prevalence and associated risk factors of anaemia in pregnant women in a teaching hospital, Korangi Industrial Area. Pak J Surg. 2013;29(2):131-3.

22. Ullah I, Zahid M, Khan MI, Shah M. Prevalence of anemia in pregnant women in district Karak, Khyber Pakhtunkhwa, Pakistan. International Journal of Bio-sciences. 2013;3:77-83.

23. Mahmood A, Dars S, Memon AR. Anemia in pregnancy: A survey of pregnant women in Hyderabad, Sindh. Rep Opin. 2014;6(5):6-8.

24. Haq H, Asif M. Prevalence of anaemia in pregnant women in Muzaffarabad division of Azad Jammu and Kashmir. Annals of Pakistan Institute of Medical Sciences. 2014;10(1):39-42.

25. Zaheer M, Majid A, Aslam S, Wagan IA. PREVALENCE OF ANAEMIA IN THIRD TRIMESTER OF PREGNANCY. Liver. 2015;39:0.000.

26. Umar Z, Mahmood Rasool MA, Karim S, Malik A, Mushtaq G, Kamal MA, et al. Evaluation of hemoglobin concentration in pregnancy and correlation with different altitude: a study from balochistan plateau of pakistan. The open biochemistry journal. 2015;9:7.

27. Anjum A, Manzoor M, Manzoor N, Shakir HA. Prevalence of anemia during pregnancy in district Faisalabad, Pakistan. Punjab Univ J Zool. 2015;30(1):15-20.

28. Ijaz T, Atif M, Ullah M, Arshad S, Ashraf S, Munir S, et al. Prevalence of Anemia and

thrombocytopenia in pregnant females of Lahore. Life sci-Int J. 2016;10(01):38-42.

29. Khaskheli M-N, Baloch S, Sheeba A, Baloch S, Khaskheli FK. Iron deficiency anaemia is still a major killer of pregnant women. Pakistan journal of medical sciences. 2016;32(3):630.

30. Khalid S, Hafeez A, Mashhadi SF. FREQUENCY OF ANEMIA IN PREGNANCY AND ITS ASSOCIATION WITH SOCIODEMOGRAPHIC FACTORS IN WOMEN VISITING A TERTIARY CARE HOSPITAL IN RAWALPINDI. PAFMJ. 2017;67(1):19-24.

31. Akram MC, Akram H, Mubeen A. Prevalence of Anemia in Pregnant Women in Central Punjab. PAKISTAN JOURNAL OF MEDICAL & HEALTH SCIENCES. 2017;11(4):1374-6.

32. Nisar S, Ullah S, Said M, Khalid M. PREVALENCE OF ANAEMIA IN PREGNANT WOMEN OF DISTRICT MARDAN. Journal of Bacha Khan Medical College. 2017;1(1):5-.

33. Jahan T, Siddiq A. Anemia in pregnant women. The Professional Medical Journal. 2017;24 (05):675-9.

34. Attaullah GNK, Ahmad B, Nasir Iqbal NA. In district Swat Khyber Pakhtunkhwa Pakistan anemia (iron deficiency) in pregnant women of different ages as a public health problem becomes a reality. J Entomol Zool Stud. 2017;5(2):1266-9.

35. Shams S, Ahmad Z, Wadood A. Prevalence of iron deficiency anemia in pregnant women of district Mardan. Pakistan J Preg Child Health. 2017;4(356):2.

36. Rehman A, Malik FR, Jan MA, Zeb M, Sabiha ZUA, Zafar D, et al. FREQUENCY, DISTRIBUTION AND DETERMINANTS OF IRON DEFICIENCY ANEMIA AMONG THIRD TRIMESTER INDOOR PREGNANT WOMEN. Gomal Journal of Medical Sciences. 2018;16(3):79-82.

37. Ullah A, Sohaib M, Saeed F, Iqbal S. Prevalence of anemia and associated risk factors among pregnant women in Lahore, Pakistan. Women & health. 2019;59(6):660-71.

38. Baksh FM. Anemia in Pregnant Women. Journal of Surgery Pakistan. 2019;24(3):144-7.

39. Bibi A, Kakar A, Shahwani F, Iqbal F. 5. Frequency of anemia in pregnant women of different age groups at Quetta: A hospital-based cross sectional study. Pure and Applied Biology (PAB). 2019;8(2):1043-50.

40. Qamar S, Azhar S, Mazhar S, Bakht K, Murtaza G. Iron deficiency anemia and associated factors among pregnant women in a tertiary care hospital, in Sargodha District, Pakistan. Tropical Journal of Pharmaceutical Research. 2019;18(10):2183-7.

41. Hussain NA, Younise MH. Prevalence and severity of anemia among pregnant: cross-sectional study. Nada. 2019;241.

42. Saqib M, Manzoor F, Shahid R, Naz S, Sharif S. Incidence of anemia among pregnant females of rural areas of punjab. S. Asian J Life Sci. 2019;7(2):25-8.

43. Khan AF, Khan S, Ahmad H. Prevalence of Iron Deficiency Anaemia in Pregnant Women & its Associated Risk Factors: A Novel Study from Pakistan. THE STETHO. 2020;1(2).

44. Anwar Z, Abid Z, Ghazenfer T, Usman R,

Naheed R, Kamal A, et al. Biochemical and Hematological Profile of Anemic And Non-Anemic Pregnant Women. Journal of the Dow University of Health Sciences (JDUHS). 2020;14(2):54-9.

45. Balouch AR, Mustafa MA, Chaudhry BR. Prevalence of Anemia among Pregnant Women Living In Bahawalpur. Asian Journal of Multidisciplinary Studies. 2020;8:8.

46. Qazi M, Dayo A, Ghoto MA, Arain MI, Shaikh B, Shaikh AA, et al. Assessment of the Anemic Conditions during Pregnancy: A Study of Sukkur City, Sindh, Pakistan. Journal of Pharmaceutical Research International. 2020:47-53.

47. Akbari M, Moosazadeh M, Tabrizi R, Khatibi SR, Khodadost M, Heydari ST, et al. Estimation of iron deficiency anemia in Iranian children and adolescents: a systematic review and meta-analysis. Hematology. 2017;22(4):231-9.

48. Kang SY, Kim H-B, Sunwoo S. Association between anemia and maternal depression: a systematic review and meta-analysis. Journal of psychiatric research. 2020; 122:88-96.

49. Kassa GM, Muche AA, Berhe AK, Fekadu GA. Prevalence and determinants of anemia among pregnant women in Ethiopia; a systematic review and meta-analysis. BMC hematology. 2017;17(1):1-9.