Prevalence and Determinants of Anemia during Pregnancy at Hodeida city (Yemen) During the Year 2021

Nabil M. H. Gonaid[1*], Salwa El-Sanousi[2], Hussien Kadi[3]

[1]Community Medicine Department, Hodeida University, Hodeida, Yemen; [2]Community and Family Medicine Department, Gezira University, Gezira, Sudan; [3]Pharmacology and Therapeutics Department, Sana'a University, Sana'a, Yemen

ABSTRACT

Background: Anemia In Pregnancy (AIP) is a global public health problem reaching prevalence as 41.8% globally, and up to 54% in Middle East region. It accounts for 20% of global maternal deaths. In Yemen, prevalence of AIP is 40%. It consists a part of high complicated maternal mortality ratio which reached 164 according last Yemeni demographic health survey reports. The study aimed to assess AIP prevalence and determinants at Hodeida city, Yemen.

Methods: Cross sectional study conducted on 500 pregnant women who were selected from Hodeida health centers, their data collected through structured pretested questionnaire, Hb of study members had been assessed through hemoglobinometer.

Data analysis: Data statistically analyzed through SPSS program (version 22) using descriptive statistics, Chi square test for investigating the association between AIP and the independent factors.

Results: The study revealed AIP prevalence as 55%. It revealed statistically significant determinants of AIP including husband education (P=0.000), mother education (P=0.10), mother concerned health knowledge (P=0.000), suffering from over menses (P=0.000), family socioeconomic level (P=0.000), food sufficiency (P=0.02), food diversity (P=0.087), supplementary feeding support (P=0.05), Khat chewing habit (P=0.094) and post meal tea drinking (P=0.043), while no significant association found for mother age (P=0.144), parity (P=0.690), pregnancy trimester (P=0.414), breastfeeding (P=0.581) and using contraceptives (P=0.208).

Conclusion: Anemia in pregnancy at Hodeida city is a sever public health problem according WHO classification. Socio economic and nutritional factors are representing its roots.

Keywords: Anemia; Pregnancy; Prevalence; Determinants

INTRODUCTION

Yemen is one of the least developed countries in the world, and one of the poorest countries in the middle east with reported food scarcity, high illiteracy especially in females [1]. Differing from Yemeni official figure of 164 as maternal mortality ratio, UNFPA reported it during 2019 as 385 [2].

Yemen is among countries which had negatively affected by Arab spring events of 2011, and had fallen into protracted conflict [3]. The war and siege on Yemen had a devastating impact on the health of women and children [4]. Evidence demonstrated that the health effects of conflict on women and children were neglected [5].

Hodeida is a coastal governorate at the west of Yemen, It is one of the highest population governorates in Yemen, It has around 3 million peoples mostly working in a primitive agriculture and fishing. It has highest poverty and the lowest human development indices. It comprises 26 districts; It has been classified By Ministry Of Public Health and Population (MOPHP) among the most governorates suffering from malnutrition [6].

The global prevalence of AIP is estimated as 41.8%, and in more than 80% of countries in the world, the prevalence of AIP had estimated at 29%. It reaches around 50% in low and middle-income countries including Middle East region [7]. AIP is associated with increased maternal, neonatal and perinatal mortality, low birth weight, premature birth, and delayed child development. Also AIP has a significant effect on nutritional status of young children

leading to stunting and underweight. AIP globally accounts for 12% of Low birth weight, 19% of pre-term birth, and 18% of perinatal mortality [8]. According to study in 29 countries across Latin America, Africa, the Western Pacific, eastern Mediterranean, and Southeast Asia, maternal death in women with severe anemia found to be higher compared with those without severe anemia [9]. Further studies reached a strong association between moderate to severe anemia at 28 weeks of gestation and the severity of intra and postpartum hemorrhage [10]. Iron Deficiency Anemia (IDA), is the main cause of AIP, while intestinal worms infestations; (particularly, hookworm and malaria) worsen the problem of anemia in many areas worldwide [11]. In Yemen prevalence of AIP is 40%. It consisting a significant part of high complicated maternal mortality ratio. Scope of this study is to explore prevalence and determinants of AIP in Hodeida city, Yemen.

METHODOLOGY

A cross-sectional study conducted on pregnant women attending anti natal care clinics at 17 health centers in Hodeida city during the period (mid-November 2020-mid January 2021).

Sampling

Sample size had been calculated using on line computerized soft program estimating number of pregnant women is 27104 (according population projections for the year 2020) and assuming the prevalence of AIP in Hodeida city is going with Yemeni national figure as 40% [12,13]. The total calculated representative sample with 5% error yielded was 379. The sample size was increased to 500 to improve the precision of the study. Sample size had been divided over the three districts of Hodeida city (Al-Hali, Al-Hawak, Al-Miena) according population density, by the ratio (40%,35%,25%) respectively. Health Centers (HCs) from each of the three districts had been selected according to the client attendance rate, thus all high and average attendance rated HCs in the three districts were selected and they reached 17 HCs. The quota of each district of study sample had divided on its selected HCs according health center attendance rate by the ratio (3 for high attendance against 2 for average attendance HC). The study sample per district and health center has revealed in Table 1.

Data collection

Data collected by well-trained health staff according a previously prepared and pre tested data collection tool through interviewing the consenting pregnant women in antenatal care clinics of the slected health centers. Information in the questionnaire included socio demographic characteristics such as age, occupation and educational status, nutritional patterns and habits, mother concerned health knowledge's and behavior. Hb had been tested after completing the interview by hemoglobinometer.

Socioeconomic standards of study members had been scored using modified scoring system after Fahmi and Sherbini [14] as revealed in Tables 2-6, while innovative schemes for scoring other addressed independent factors in this study had been used as revealed in Tables 7-11.

Data entry and analysis

SPSS (version 22) had been used for data entry and analysis.

Table 1: Study sample distribution per HC, district.

District Name	Name of Heath center	Cases	
		No.	%
Al-Hali district	Al-Hali HC	26	5.2%
	Al-Senaeei HC	34	6.8%
	Palestine HC	32	6.4%
	Al-Zaafran HC	30	6%
	Al Salakhanah MCH center	44	8.8%
	Al-Kedf HC	20	4%
	Al-Baida Al-gharbiah HC	17	3.4%
	Al Hali total study cases	203	
Al-Hawak district	Al-Hawk HC	31	6.2%
	Al-Shahariah HC	33	6.6%
	Al- Rabassah HC	33	6.6%
	Al-Thawrah MCH center	45	9%
	Al-Qasr HC	20	4%
	Al Hawak total study cases	162	
Al-Miena district	Al-Zabariah HC	35	7%
	Al-Bostan HC	26	5.2%
	Al-Tahrir HC	37	7.4%
	Al-Ommal HC	25	5%
	Al-Qalaa HC	12	2.4%
	Al Miena total study cases	135	
	Grand total study cases	500	100%

Table 2: Parents education scoring as socio economic parameter.

Education level	Mother	Father
Illiterate	0	0
literacy certificate or read, write	1	1
less than secondary school	2	2
Finishing secondary school	3	3
Bachelor or license degree	3	4
Getting post graduate degree	3	5

Table 3: Parents job scoring as socio economic parameter.

Father/mother job	
No job	0
Reporter, mattress, cleaner.	1+1
Father (soldier, puddler, Barber restaurant worker, motorcycle driver, sales man, Farmer, fisherman)	2
Mother (Nurse Teacher, clerk, semer, sales woman in a shop, sales woman of fabrics and garments)	
Father (Teacher, public or private clerk) Mother (Teacher, physician, lawyer)	3 3

Table 3: Parents job scoring as socio economic parameter.

Father Job	
plumber, joiner, electric, carter mechanical , shopkeeper, transfer, vendor meat, fruit and vegetables seller	4
Import dealer, wholesaler, construction contractors, administrative military and civilian senior managers	5
University teacher, physician Engineer, lawyer.	6

Cronbach Alpha test had been conducted and concluded (as shown in Table 12), that a questionnaire has a high level of internal

Table 4: Scoring of housing conditions as socioeconomic parameter.

	Type of house		House equipment's
4	Own modern house	1	-Refrigerator
2	Rented modern house	1	-Washing Machine
1	Primitively constructed	1	-Cocking oven
	Crowding index (persons per room)	1	-Television
4	1-2 persons	1	-Receiver
2	3-4 persons	1	-Computer
1	5 persons and more	2	-Own car

Table 5: Scoring of housing sanitation and family income as socioeconomic parameter.

Housing and sanitation	
-Availability of safe tape water	2
-Availability of sanitary sewage	2
-Availability of refuse disposal	2
Family income	
- Enough and possible saving	4
- Enough and non-possible saving	2
-Not enough and accumulative loans	1

Table 6: Reaching overall family socioeconomic scoring and its interpretation.

Total score	Interpretation
0-18	Low
19-31	Average
More than 31	High

Table 7: Scheme for scoring breast feeding commitment.

Item	Score
A-**Exclusive breast feeding** period	
-Less than 6 months	2
-6 months	4
B-**Whole period of breast feeding**	
-Up to 6 months	1
-6-12 months	2
-More than 12 months	3
Total scoring	
-Weak	0-4
-Average	5-6
-Good	7

consistency and reliability Descriptive statistics (frequencies, percentages, means and standard deviation) had been used, and Chi square test had been used for investigating the association between initial anemic state and the independent variables of study, given by formula: $\chi2=\sum(Oi – Ei)2/Ei$ Where: O_i=observed value (actual value) and E_i=expected

RESULTS

A Study sample characters (Figures 1-4) majority of study sample (around 86.4%) belonged to the age group (18-35 Years old). Half

Table 8: Scheme for scoring food sufficiency.

Item	Score
A-Number of daily meals	
-1-2 meals per day	1
-3 meals per day	2
-More than 3 meals	3
B -Post meal satisfying	
-Rarely	1
-Some times	2
-Usually	3
C-Peoples sharing meals	
-Her kids	4
-Her husband and kids	3
-Two families members	2
-More than 2 families members	1
Total scoring	
- Poor	0-4
-Average	05-Jul
- Good	08-Oct

Table 9: Scheme for scoring food diversity.

Items	Marks	Items	Marks
A-Meats in meals		C-Fruits and vegetables in meals	
Many times	4		3
Some times Rarely	3	Many times	2
	2	Some times	1
Very rarely	1	Rarely	
		Total scoring	
B - Cereals and Beans in meals	3	Good	8-10
Many times	2	Average	5-7
Some times Rarely	1	Poor	0-4

Table 10: Scheme for scoring khat chewing intensity.

Days of chewing per week	Marks	Hours of chewing per day	Marks	Total marks	Scoring interpretation
1-2 days	1	1-3 hours	1	2	Mild
Most days	2	3-5 hours	2	3-4	Moderate
Every day	3	More than five hours	3	5-6	Intense

Table 11: Scheme for scoring mother concerned health knowledge's.

Mothers knowledge's	Anemia symptoms Marks	Locally available foods rich of iron and vitamin c (marks)	Total marks scoring	
			Total marks	Score
Doesn't know	0	0	0-1	Bad
Knows 1-2 items	1	1	2-3	Average
Knows more than 2 items	2	2	4	Good

Table 12. Cronbach Alpha test out puts.

N	Items	Cronbach Alpha	Stability
500	64	0.71	0.84

Source: SPSS 2021 output base on Survey data
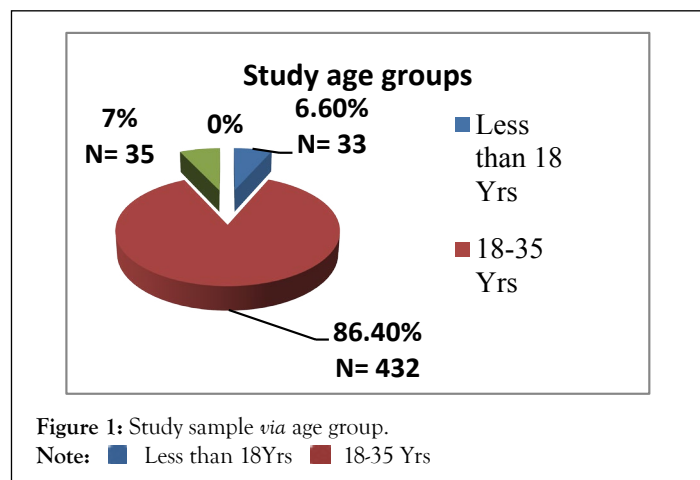

Figure 1: Study sample *via* age group.
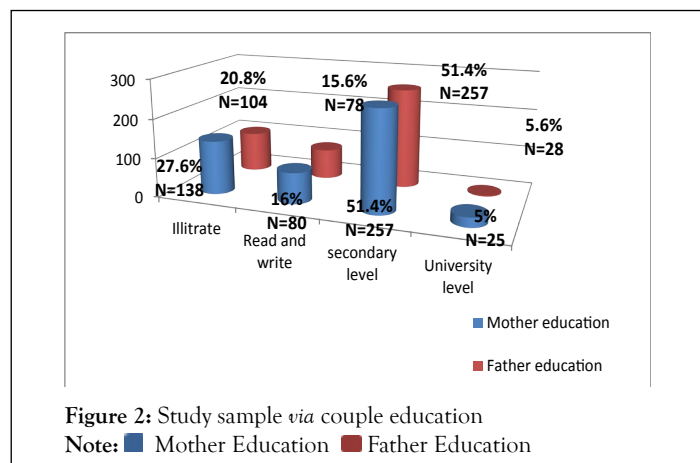**Note:** ■ Less than 18Yrs ■ 18-35 Yrs

Figure 2: Study sample *via* couple education
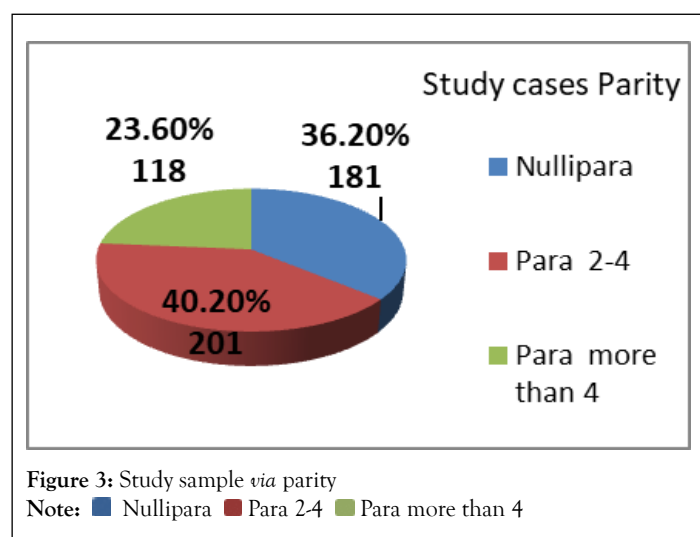**Note:** ■ Mother Education ■ Father Education

Figure 3: Study sample *via* parity
Note: ■ Nullipara ■ Para 2-4 ■ Para more than 4

of study members had secondary education level, and Illiteracy among study member's reached (28%). 52% of study members attained intermediate scores of socio economic level opposite 44% attained low scores. 40% were Para 2-4, 36% were nulliparous and 24% were Para more than 4. B)The study revealed Prevalence of AIP among study sample as 55% (N=275). C) Determinants of anemia in pregnancy has shown in (Table 13). As revealed in Table 13 the study had found:

Table13. Statistical significance of Independent factor.

Independent factor	Chi square	df	P-value
Husband education	15.389a	3	0.000***
Family socio economic level	24.279a	2	0.000***
AIP concerned health knowledge	28.168a	2	0.000***
History of over menses	32.164a	1	0.000***
History of Malaria and Intestinal helminthes	29.616a	6	0.000***
Post meal tea drinking	3.457a	1	0.043**
Food sufficiency	14.972a	6	0.02**
SFP support	2.744a	1	0.05**
Mother education	5.930a	3	0.10*
Khat chewing	6.401a	3	0.094*
Food diversity	4.878a	2	0.087*
Mother age group	.668a	1	0.144
Parity	.743a	2	0.690
Pregnancy trimester	.668a	1	0.414
History of contraception	3.137a	2	0.208
Breastfeeding	1.958a	3	0.581

Note: Source: Researcher own survey data, 2021
*** Significant at 1% level of significance
** Significant at 5% level of significance
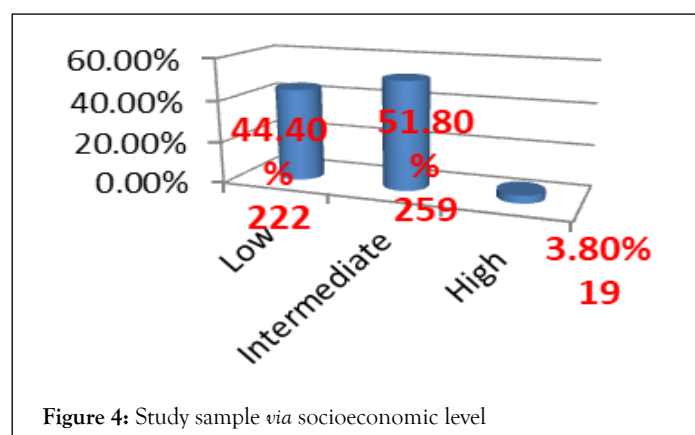* Significant at 10% level of significance

Figure 4: Study sample *via* socioeconomic level

I-Statistically high significant association of AIP (P value=0.00) with husband education, mother AIP concerned health knowledge, family socio economic level, history of over menses, History of parasitic infections and Malaria.

II-Statistically mid significant association of AIP with post meal tea drinking (P value=0.04), Low food sufficiency (P value=0.02), Getting SFP support (P value=0.05)

III-Statically slight significant association of AIP with mother education level (P value=0.1), Low food diversity (P value=0. 09), Khat chewing habit (P value=0.087)

IV-Statically non-significant association of AIP with Age of pregnant woman (P value=0.414), Parity (P value=0. 690), pregnancy trimester (P value=0.427), history of using contraceptive (P value=0. 208), Breastfeeding (P value=0.581).

DISCUSSION

The study sample mainly composed of the age category (18-35 Years old) which is the age category commonly using health centers services. Half of them completed secondary schools while illiteracy

among them reached 28% which is just exceeding the national Yemeni figure for illiteracy among females at urban areas by 4% [13]. Socio economic levels of study members has been scored as intermediate for 52% and low for 44%, and nearly absence of high level (just 4%) which could be attributed to 2 reasons, the 1st is selecting the sample from public health centers which are usually not used by high class peoples who prefer to use private health sector, and 2nd is the decline of high socio economic level category among the Yemeni peoples during last 10 years due to the Arab spring economic effects [3]. Prevalence of AIP concluded by present study is 55% (N=275), is higher than Yemeni national figure by 15% [13], and equaling the prevalence of AIP in Dhamar governorate according recent Yemeni study [15]. The higher AIP prevalence revealed in the present study compared to national figure could be explained by the 11 years deference between the Yemeni DHS (which had conducted during 2010) and the present study (which had been conducted during 2021 and the economic drawback effects occurred during this period in Yemen.

Regarding determinants of AIP according 15 studies conducted in developing countries from 2000 to 2015, factors such as increased maternal age, low education, high parity, poor socio-economic status, and poor nutritional status have been found as important determinants [16]. Also multi-parity had been also concluded in some studies as AIP determinant [17]. In the present study, high statistically significant decrease of AIP had found associating increased husband education; this could be attributed to the dominant role of the husband in decision taking in Yemeni family. Husband education also found to be significantly associating mother adherence to iron and folic acid (IFAS) treatment at Denbiya district health centers, Northwest Ethiopia [18]. In the present study, also high statically significant decreased tendency of AIP found associating increased level of mother concerned health knowledge, same outputs had been reached by many studies such as study conducted in southern region of KSA [19]. Also low maternal concerned health knowledge had been linked with higher prevalence of AIP in study conducted in Harar town, Ethiopia [20].

Present study revealed high statistically significant association of AIP with low family socio economic level, This is going With outputs of a study of determinants of anemia in women of reproductive age which had been conducted in Sudan, a study of determinants of AIP in Nigeria and AIP study conducted in a tertiary care centers in Karachi; Pakistan [21-23].

Iron loss consequent to excessive menstrual discharge is by far the most frequent cause of iron-deficient anemia [24]. The present study revealed high statistically significant association of AIP with history of over menses. This is supported by outputs of a study conducted on Caucasian women's aged 20–45 years [25], and according Saudi study, there was significant increase of AIP prevalence among mothers who suffered from menorrhagia [26].

Malaria is one of the primary causes of anemia globally and intestinal helminthes are among common causes of anemia [27], in the present study high statistically significant association of AIP found with history of malaria and intestinal helminthes. There are many supporting studies of these outputs including Sudanese study, and Ethiopian study [28,29].

The present study also had found mid significant association of AIP with post meal tea drinking, most probably due to the inhibitory

effect of tannin on iron absorption. Tea drinking had been proved in many studies as a significant determinant of anemia, such as Yemeni study conducted among Hodeida university students, and Saudi study conducted among female university students in Tabuk, Saudi Arabia [30,31].

The present study showed mid significant decreased tendency of AIP associating increased food sufficiency, this is supported by evidence from nationally representative surveys of seven south and southeast Asian countries [32], and AIP study conducted in South Africa [33].

The present study also showed mid significant increased tendency of AIP among mothers getting Supplementary Feeding Programs (SFP) support, which could be understood as they were selected to benefit from SFP programs because they were malnourished, so they were suffering also from anemia, this is supported by results of mentioned above south and south eastern Asian survey [32], and Algerian study which reached significant association of AIP with malnutrition in the 3rd trimester of pregnancy [34].

The present study showed slight significant decreased tendency of AIP associating increased mother education level, These significance also revealed in outputs of many studies including a study conducted at Soba University Hospital, Khartoum State Sudan [28], study conducted in Dhaka city Bangladesh [35] and in findings from Ethiopian health and demographic survey [36]. Also the present study shown slight significant decreased tendency of AIP associating increased food diversity score, this output is supported by study on University Students in Hodeida Province, Yemen [30] and a study in rural Ethiopia [37].

Khat is derived from the fresh leaves and buds of Catha edulis which is very popular in some African countries and Yemen. Recently Khat chewing became common among pregnant women in Yemen [38]. The present study showed slight significant association between Khat chewing and AIP. This is supported by above mentioned Yemeni study conducted among Hodeida university students [30].

No significant association reached in the present study between AIP and the age of pregnant woman, as not reached too in Sudanese study conducted during 2018 [39], and study conducted in Libya [40]. All could make impression of the weakness of the role of the age as a determinant of AIP.

Also parity did not proved according the present study as significant determinant as meeting with outputs of studies conducted in Libya [40] and United Arab Emirates [41], all denoting the role of parity as a determinant of AIP might be hidden by other determinants.

Although, many studies revealed significant association of AIP with the advance in pregnancy trimester such a study conducted in Qatar [42], and Jordan [43], the present study and previous study conducted in in Ghana [44] did not reach this significant link. Controversies in out puts of studies her, could be explained as the physiological effect of advance in pregnancy on Hb which had proved as risk factor in some areas of the world might be compensated by other factors at other areas. Also the significant effect of using contraceptives on decreasing anemia prevalence which reached by Saudi study conducted in Alniaryah province [45], a studies conducted in northern Nigeria [46] and Sri Lanka [47], did not reached in the present study might be due to supposed non

enough periods of using contraceptives among users in the present study to protect them against anemia through avoiding monthly blood loss. Also, the present study did not reach significant link for breast feeding with AIP such reported in Iraqi study.

CONCLUSION

The aim of this study was to assess the prevalence and determinants of AIP in Hodeida city, The study revealed AIP prevalence in Hodeida city as 55%, and the study revealed that, (couple education, mother concerned health knowledge, suffering from over menses, family socioeconomic level, food sufficiency and diversity, Malnutrition, Khat chewing habit and post meal tea drinking), all found as statistically significant determinants of AIP, while no significant association found with (mother age and parity, pregnancy trimester, breastfeeding and using contraceptives).

ETHICAL APPROVAL

The proposal for this research was approved by community and family medicine department in Faculty of medicine at Gezira University, Sudan, as a part of proposal for PhD degree. Research had approved by research ethics committee at Yemen University, Yemen.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

REFERENCES

1. UNCDP. United Nations committee for development policy. 2018.

2. UNFPA. Reproductive health equity in the Arab region: Fairness and social success, regional report. 2019.

3. UNDP. Arab human development report. 2016.

4. Charbel EB, Aisha OJ, Michael LC, Farah D, Ali HM. Health in Yemen: Losing ground in war time. Bio Med Central. 2018;14(42):1-2.

5. Kedir H, Berhane Y, Worku A. Khat chewing and restrictive dietary behaviours are associated with anemia among pregnant women in high prevalence rural communities in Eastern Ethiopia. PLoS ONE. 2019;8(11):78601.

6. Yemen NIC. National information center: Governorates section. 2020

7. Fan Y, Liu X, Zha P. Trends in socioeconomic inequalities and prevalence of anemia among children and non-pregnant women in Low-and Middle-Income Countries. JAMA Network Open. 2018; 1(5):e182899.

8. UNICEF. Technical bulletin No 25, Copenhagen. 2018.

9. Daru J, Zamora J, Fernández-Félix BM, Joshua Vogel J, Oladapo OT. Risk of maternal mortality in women with severe anaemia during pregnancy and postpartum: A multilevel analysis. Lancet Glob Health.2018;6(5):548-554.

10. Renzo GCD. Good clinical practice advice: Iron deficiency anemia in pregnancy. Int J Gynecol Obstet. 2019;144:322–324.

11. Titaley CR, Dibley MJ, Roberts CL, Agho K. Combined iron/folic acid supplements and malaria prophylaxis reduce neonatal mortality in 19 sub-Saharan African countries. Am J Clinical Nutrition. 2010;92(1):235-243.

12. YNCB. Yemen DHS 2013: Initial report; Yemeni national centre for biostatistics. 2013.

13. Fahmy SI, El-Sherbini AF. Determining simple parameters for social classification for health research. Bull HIPH. 1983;13:95-107.

14. Fuad YM, Ahmed YAQ, Ahmed GA. Iron deficiency anemia and associated risk factors among pregnant women in Dhamar city, Yemen. J Medi Sci. 2019;1(1):1-11.

15. Sumera Aziz A, Umber K, Anam F. Prevalence and determinants of anemia among women of reproductive age in developing countries. J Coll Physicians Surg Pak. 2020;30(2):177-186.

16. Aisha I, Attia B, Fatima Z, Uzma J, Qaisar M. Maternal anemia and its impact on nutritional status of children under the age of two Years. Biomed J Sci Tech Res. 2018;5(3):4519-4522.

17. Missa T, Mamo W, Azeb A. Antenatal care and mothers education improved iron-folic acid adherence at Denbiya district health centers, Northwest Ethiopia: Using pills count method. Archives of Public Health. 2019;77(1):30.

18. Enas AD. Descriptive study for pregnant women's knowledge, attitude and practices regarding iron deficiency anemia and iron supplements in the Southern Region of KSA. Asian J Clinic Nutrition. 2020;12(1):21-33.

19. Oumer A, Hissien A. Pregnant mothers knowledge, attitude and practice towards preventions of iron deficiency anemia in Harar town Ethiopia. Int J Public Health Sci. 2019;8(2):202-210.

20. Abdelmutalab EK, Ishag A, Mohammed ME. Prevalence and determinants of anemia in women of reproductive age in Sudan: Analysis of a cross-sectional household survey. BMC Public Health. 2020; 20:1125.

21. Ugwu N and Uneke CJ. Iron deficiency anemia in pregnancy in Nigeria-a systematic review. Niger J Clin Pract. 2020;23(7):889-896.

22. Tabassum Z, Alam KR, Farida Q. Anemia in pregnancy: A study of Karachi in a tertiary care centre. American Journal of Phytomedicine and Clinical Therapeutics. 2014;2(10):1224-1233.

23. Guideline: Intermittent iron and folic acid supplementation in menstruating women. Geneva, World Health Organization.2011.

24. Mariasanta N, Alberto D, Giuseppe C. Iron dependent erythropoiesis in women with excessive menstrual blood losses and women with normal menses. Annals Hematology. 2014;93(4):557-563.

25. Asia T, Saira A, Talib L. Iron deficiency anemia in reproductive

age women attending obstetrics and gynecology outpatient of university health center in Al-Asha, Saudia Arabia. Afr J Tradit Complement Altern Med. 2014;11(2):339-342.

26. White NJ. Anaemia and malaria. Malaria Journal. 2018;17:371.

27. Mohamed BNE, Abd-algafor HRH. Prevalence and factors associated with anemia among pregnant women attending ante-natal clinic in the second and third trimesters at Soba University Hospital, Khartoum State, Sudan 2018-2019. Int J Health Sci Res. 2020;10:8.

28. Bolka A, Gebremedhin S. Prevalence of intestinal parasitic infection and its association with anemia among pregnant women in Wondo Genet district, Southern Ethiopia: A cross-sectional study. BMC Infectious Diseases. 2019;19(1):483.

29. Ahmed AA, Salem B, Abdo MM. Prevalence of iron deficiency anemia among University Students in Hodeida province, Yemen. Hindawi Anemia. 2018.

30. Alzaheb RA, Al-Amer O. The prevalence of iron deficiency anemia and its associated risk factors among a sample of female university students in Tabuk, Saudi Arabia. Women's Health J. 2017;10:1-8.

31. Ram S, Singh DR, Chaudhary NK. Prevalence and factors associated with anemia among women of reproductive age in seven South and Southeast Asian countries: Evidence from nationally representative surveys. PLoS ONE. 202015:8.

32. Dorsamy V, Bagwandeen C, Moodley J. The prevalence, risk factors and outcomes of anaemia in South African pregnant women: A protocol for a systematic review and meta- analysis. BMC, Systematic Reviews. 2020;9(209):1.

33. Fouzia T, Hayet O, Abdenacer A. Gestational Anemia: The factors associated and the outcomes in the mother and the infant. Clinics Mother Child Health.2020.

34. Akhter CH, Ahmed Rumana K, Fatema J. Factors associated with maternal anemia among pregnant women in Dhaka city. BMC Women's Health.2015;15:77.

35. Woldegebriel AG, Gebrehiwot GG, Desta AA. Determinants of anemia in pregnancy: findings from the Ethiopian health and demographic survey. Hindawi Anemia. 2020.

36. Zerfu TA, Umeta M, Baye K. Dietary diversity during pregnancy is associated with reduced risk of maternal anemia, preterm delivery, and low birth weight in a prospective cohort study in rural Ethiopia. American J Clinic Nutrtion. 2016;103:1482-1488.

37. Ali A, Roznah S, Sami AD, Sayed, A. Family context and Khat chewing among adult Yemeni women: a cross-sectional study. Biomed Research Int. 2014.

38. Ishaq A, Yassin I, Osama A. Prevalence, types and determinants of anemia in pregnant women in Sudan: A systemic review and meta-analysis. BMC Hematology. 2018;18:31. [CrossRef]

39. Raga AE, Mariam O. Prevalence of anaemia among pregnant women in Derna city, Libya. Int J Community Med Public Health. 2016;3(7):1915-1920.

40. Moyad JS, Nageeb AH, Nada MS. Prevalence of anemia and its associated factors among pregnant women attending anti natal centre in Sharjah, UAE. Int J Pharmaceutical Sci Res. 2019;10(11):5002-5009.

41. Aziz SNA, Mariam AM, Mohammed AK. Assessment of anemia, ida and id among pregnant in qatar: cross sectional survey. J Public Health Epidemiol.2016;2(3):1035.

42. Mohammad AS, Abdullah I. Prevalence of anemia among Jordanian pregnant women and the effect of early pregnancy on alkaline phosphatase activity. Jordan J Biological Sci. 2012;5:(1):65-70.

43. Philip K, Elvis ET, Emmanuel M. Prevalence and associated risk factors of anaemia among women attending antenatal and post-natal clinics at a public health facility in Ghana. BMC Nutrition. 2019;5(40):1-6.

44. Mohammed A, Esmat EA, Sherif HA. Prevalence and epidemiological aspect of Anemia among Pregnant women attending antenatal care centres in alniaryah province eastern Saudi Arabia. Thesis submitted for partial fulfilment of Master degree in Family medicine. 2014.

45. Nwizu EN, Iliyasu Z, Ibrahim SA and Galadanci HS. Socio-demographic and maternal factors in anaemia in pregnancy at booking in kano, Northern Nigeria. African J Reproductive Health.2011;15(4)1.

46. Kalharie P. Cultural factors associated with iron deficiency anemia in pregnancy: A case study of the Kalutara district Sri Lanka. 2nd Global Public Health Conference. 2019;2:62-65.

47. Alaa H, Sha'lan, Ali Saadalddin Hussien AS. The Prevalence of Anemia among Internally Displaced Families residing in well-defined camps in Baghdad City. Nutrition Research Institute Baghdad. 2016.