Magnitude and Factors Associated with Immediate Postpartum Anemia among Singleton postpartum women at Public Hospitals in Dire Dawa Administration, Eastern Ethiopia

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Abstract

Background: Anemia is the decrease ability of red blood cells to provide adequate oxygen to body tissue. Postpartum period is a critical time where most maternal complications including death occurs and immediate postpartum anemia is one of the risk factors. But it lacks studies both at national level and study area too. Therefore, this study was aimed to assess magnitude and factors associated with immediate postpartum anemia at public hospitals in Dire Dawa administration, Ethiopia.

Methods: Institution-based cross-sectional study was conducted on May 2022 among 476 study participants selected using systematic random sampling technique. Data were collected through face-to-face interview by pre-tested structured questionnaire and medical card review. The data were entered in to EPI DATA (Version 3.1) and analyzed using SPSS (Version 22) software. Both bivariate and multivariate logistic regression, odds ratios with 95% CI also was carried out to see the effect of each independent variable on the dependent variable. A P-value (< 0.25 at bivariate and < 0.05 at multivariable) was considered as statistical significance.

Results: A total of 476 postpartum women were included in the study and the overall magnitude of immediate postpartum anemia was 26.9% (95% CI: 22.9-31.1%).

Immediate postpartum anemia was significantly associated with no formal education (AOR=3.01, 95%CI: 1.12-8.08), unemployment (AOR= 2.72, 95%CI:1.02-7.21), < 4 ANC visits (AOR=2.40,95%CI: 1.32-4.30), instrumental assisted vaginal delivery(IAVD) (AOR=3.70,95%CI: 1.952-6.86), pre-delivery anemia (AOR=2.96,95%CI: 1.48-5.91), GIT parasites (AOR=3.23,95%CI: 1.37-7.59), low dietary diversity (AOR=3.10,95%CI:1.65-5.79) and no IFA supplementation (AOR=2.69,95%CI:1.10-6.58) during pregnancy.

Conclusion: Immediate postpartum anemia is a high public health problem comparing to other previous studies in Ethiopia. Coordinated efforts in promoting antenatal care visits and awareness about risk factors of immediate postpartum anemia were recommended to studied hospitals and other stalk holders.

Introduction

According to the World Health Organization (1) and other studies anemia is defined as a condition in which hemoglobin concentration and/or red blood cell (RBC) numbers are lower than normal and insufficient to meet an individual's physiological needs(2–7). Anemia can exist wherever there is its risk factors regardless of age and sex but common in pregnant women and children (8, 9). Blood loss and loss of excess fluid from body tissues after delivery different in amount among individuals, which have a major effect on maternal hemoglobin(Hgb) concentration (10, 11). As a result, postpartum anemia (PPA) lacks a single consensus definition, but clinically, depending on the duration of postpartum period, PPA can be defined as Hgb < 10 g/dl, Hgb < 11g/dl and Hgb < 12g/dl cut-off values within the first 24-48hrs, at 1week and 6weeks of postpartum duration respectively (12–14). Immediate PPA should be considered if Hgb concentration is < 10g/dl and severe if Hgb < 7 g/dl and it can be confirmed by measurement of Hgb

concentration within the first 24–48 hours of postpartum period (15). However, there is considerable variation in the exact concentration that defines anemia and the time after birth at which it should be measured (10, 16, 17).

Anemia is common during postpartum period characterized by having multifactorial origin(18, 19). Although most maternal and infant deaths occur during this time, it is among neglected period for the provision of quality of maternal care, especially in low resource setting countries (19–22).

Literatures from different part of the world reveal contributing factors of anemia among women like socioeconomic variables (23), age(5, 24), income or family size(25), nutritional status of women(26), diet(23) and dietary diversity(27–29). Besides, comorbid illness like intestinal parasitic infections(30), placental malaria(31) and obstetrics factors like short birth interval(24),peripartum anemia combined with acute bleeding anemia due blood losses at delivery are associated with postpartum anemia(10).

Globally, anemia including PPA affects one third of world's population and over 800 million women and children (32–34). Moreover, severe PPA can increase maternal mortality by three folds during postpartum period (35). Anemia in post-delivery women has complications, decreases work productivity(36), increases risks of postpartum hemorrhage(PPH)(37),renal failure, disseminated intravascular coagulation(9) and maternal death(35). In Ethiopia, the most reported indirect causes of maternal death was anemia (10.39%) (38). Besides, consequences of postpartum anemia is associated with an impaired quality of life, reduced cognitive abilities, emotional instability, and depression which negatively affect mother-infant bonding (10). Moreover, PPA affects newborn development(20), alterations during the child's psycho-neurological development, which can have negative implications for infant development (39–42).

Despite WHO global nutrition target 2 reduction of anemia by 50% among women of reproductive age by 2025, none of the countries were on the track of the target particularly in Africa including Ethiopia (43). Hence, the burden of anemia including PPA remains persistently high in many regions of the world (44). Thus, an increase focus on identifying magnitude and contributing factors of anemia. is needed to know area of intervention.

In Ethiopia few studies conducted on postpartum anemia in different interval of time within 42 days after delivery but they are community-based studies. However, maternity ward is an important window of opportunity for anemia diagnosis and medical intervention for postpartum women(45). Thus, facility-based study of magnitude and associated factors of IPPA in early postpartum period is crucial for correctly identification of associated factors on time, to provide appropriate intervention and anemia prevention before further complications occur and for success of anemia control program. However, little information is available about IPPA in the study area; this study therefore was aimed to identify magnitude and factors associated with IPPA among singleton postpartum women in the public hospitals in the study area.

Methods And Materials

Study setting and Design

A facility-based, cross-sectional study was conducted from May 01 to 30 /2022 in two public hospitals in Dire Dawa administration, eastern Ethiopia, which is located 515 kilometers from Addis Ababa, the capital city of Ethiopia. According to 2020 population projections, 506,000 people live in Dire Dawa Administration (68% estimated to be urban inhabitants) and have 38 rural and 9 urban kebeles (smallest administrative units). This administration has six hospitals, including public and 4 private(46). We included all postpartum women who were admitted at maternity ward within the first 48 hours of delivery. However, women who were delivered by cesarean hysterectomy or laparotomy after uterine rupture, women who were critically ill, known anemia before conception, who had blood transfusion both during intrapartum and postpartum period were excluded to reduce over estimation of IPPA.

Sample Size And Sampling Procedure

The sample size was determined using a single population proportion formula considering the following assumptions: standard normal distribution(z = 1.96), 95% level of significance, 4% margin of error(to obtain the maximum sample), prevalence = 24.3%(21) and 10% non-response rate and the final sample size became 486. A systematic random sampling technique was used to get all 476 study participants. The K^{th} interval for both selected hospitals was ≈ 2 (633/486 = 1.3 ≈ 2). Two public hospitals (Dilchora Referral (DRH) and Sabiyan General (SGH)) were included based on their high number of maternity ward admission services and sample size was proportionately allocated to each after taking consideration of monthly maternity admission average from health management and information system(HMIS) report of each hospital (Fig. 1).

Data Collection Methods

Data were collected using a pre-tested structured questionnaire adapted and modified from different studies to suit local context(19, 21, 47, 48) The questionnaire was translated from English into local languages (Afaan Oromo and Amharic). It was then translated back into English to maintain consistency. The questionnaire contained four main parts, socio-demographic, obstetrics, and dietary-nutrition and comorbid illness characteristics. Data were collected through face-to-face interviews and medical card review with eight trained diploma Nurses and Midwives, and two supervisors checked and monitored the data collection process daily.

Food insecurity status was measured using the Household Food Insecurity Access Scale (HFIAS) recommended by food and nutrition technical assistance (49) to stratify individuals as food secure and food insecure. It consists of nine occurrence questions that represent a generally increasing level of severity of food insecurity (access), and nine “frequency-of occurrence” questions that were asked as a

follow-up to each occurrence question to determine how often the condition occurred. It is valid and reliable in Ethiopia as measured by Cronbach's alpha value of 0.85 for both rural and urban samples (50).

Dietary diversity developed as a proxy indicator to reflect the micronutrient adequacy of women's diets. Ten food groups or foods recommended by USAID-FANTA to classify individuals or households as lower or higher dietary diversity if at least consumed five and less than five of ten food groups. Dietary diversity can act as an alternative indicator of food security (51). Research has shown that a more diversified diet is associated with improved hemoglobin concentrations(52).

Hemoglobin concentration was determined by using automated blood analyzer Cell-Dyne1800 (Abbot Laboratories Diagnostic Division, USA) by laboratory technologist. MUAC was measured via tape measures on non-dominant hand and the result was interpreted to the UNICEF and WHO recommendation cutoff point less than 23cm as undernourished and 23cm or more as well nourished.

Operational Definitions:

Postnatal period

begins immediately after the birth of the baby and extends up to six weeks (42 days) after birth(53).

Immediate postpartum anemia

is usually clinically defined by hemoglobin < 10gm/dl within the first 48 hours of postpartum (14, 54).

Food insecurity is a lack of consistent access to sufficient amount, healthy, nutritious and culturally appropriate food for every person in a household due to lack of money and other resources to live an active, healthy life. It is measured by Household Food Insecurity Access Scale(HFIAS) based on nine occurrence questions which developed by NATA and validated in Ethiopia (55). It categorized as

1. **Food secure** if the women scored two or less affirmative (yes) answers and
2. **Food Insecure** if the women scored more than two affirmative (yes) answers.

Dietary Diversity is the number of different foods and food groups consumed over a given reference period (56). This does not include food group consumed outside the home. It can be classified as:

1. **High food diversity** if the women consumed five or more food groups out of ten food groups within a 24 hours (51).
2. **Low food diversity** if women consumed less than five food groups out of ten food groups within 24 hours (51).

Upper arm circumference (MUAC)

was measured to the nearest 0.1 cm using flexible and non-stretchable measuring tapes following the standard procedures. Pregnant women were considered under-nourished when their MUAC value is less than 23.0 cm and those with MUAC ≥ 23 cm were considered well nourished) (57).

Data Quality Control

Two days of training were provided to all data collectors and supervisors. We conducted a pretest on 5% of the sample size out of the selected hospitals (Hiwot Fana Specialized University hospital, not included in the final sample) before the actual data collection. Based on the findings of the pretest, we made minor modifications to the questionnaire. The data collection process was closely supervised, and the completeness of each questionnaire was checked by the investigators and supervisors daily. During data cleaning, a logical checking technique was used to identify the errors. Finally, double data entry was performed to verify the consistency of the data.

Data Processing And Analysis

The data were coded and entered into Epi Data (Version 3.1) and exported to the Statistical Package for Social Sciences (SPSS) (Version 22) statistical software for analysis. A univariate analysis was used to describe the frequency distribution variables. We coded the outcome variables as “1” for having IPPA, whereas “0” for not having IPP. The association between the outcome and independent variables was analyzed using a logistic regression model. Covariates with a p-value ≤ 0.25 were retained and entered into the multivariable logistic regression analysis using a forward step-wise approach. A multicollinearity test was performed to determine the linear correlation among the independent variables using the variance inflation factor (> 10) and standard error (> 2). The goodness-of-fit test was performed using the Hosmer–Lemeshow test (> 0.05). Adjusted odds ratio (AOR) with 95% CI using a p-value < 0.05 was considered a statistically significant associated with outcome variable(IPPA).

Results

Socio-Demographic Characteristics: a total of 476 study participants were included, yielding a response rate of 97.94%. The age of respondents was ranged from 18 to 40(mean = 28.4 years, SD ± 6.3 years). Majority of the study participants were urban resident (79.4%), merchant (47.3%) and married (92.4%) (Table 1).

Table 1
Distribution of study participants by their socio-demographics, Dire Daw administration, Eastern Ethiopia, 2022 (n = 476)

Variables	Categories	Frequency	Percentage (%)
Age (in completed years)	> 34	75	15.7
	30–34	98	20.6
	25–29	140	29.4
	20–24	97	20.4
	< 20	66	13.9
Current residence	Rural	98	20.6
	Urban	378	79.4
Marital status	Married	440	92.4
	single	18	3.8
	Divorced	10	2.1
	widowed	8	1.7
Level of education(women)	No formal education	75	15.7
	Primary school(1-8th)	65	13.6
	Secondary(9-10th)	135	28.4
	Preparatory(11-12th) and Diploma	106	22.3
	Degree and above	95	20.0
Occupation(husband = 440)	Farmer	78	17.7
	Merchant	144	32.7
	Private employee	142	32.3
	Public employee	76	17.3
Level of education (Husbands, n = 440)	No formal education	33	7.5
	Primary school(1-8th)	94	21.4
	Secondary (9-10th)	122	27.7
	Preparatory(11-12th) and Diploma	98	22.3
	Degree and above	93	21.1

Variables	Categories	Frequency	Percentage (%)
Occupation(women)	Unemployed	80	16.8
	Merchant	225	47.3
	Private employee	107	22.5
	Public employee	64	13.4
Average monthly household income	< 1000	393	82.6
	1000–3000	36	7.6
	3001–5000	29	6.0
	> 5000	18	3.8
Family size	> 4	301	63.2
	≤ 4	175	36.8

Dietary and Micronutrient uptake: More than three-fourth (89.1%) of study participants were not under nutrition (MUAC ≥ 23cm) but only one-fourth (25%) had high dietary diversity. Around three-fourth (75% and 78.4%) had IFA supplementation during their recent pregnancy and less than three times per day consumption of coffee or/and tea respectively (Table 2).

Table 2
Dietary and micronutrient uptake characteristics of postpartum women admitted at maternity ward in public hospitals in Dire Dawa administration, Eastern Ethiopia, 2022(n = 476)

Variables	Categories	Frequency	Percentage (%)
Under nutrition	1.MUAC < 23cm	52	10.9
	2. MUAC ≥ 23 cm	424	89.1
Dietary diversity	1.Low	357	75.0
	2. High	119	25.0
Meal frequency	1.<3 times per day	117	24.6
	2. ≥3 times per day	359	75.4
Food insecurity	1.Yes	38	8
	2.No	438	92
IFA supplementation	1.No	119	25
	2.Yes	357	75
Coffee or/and tea intake	1. >3 cups per day	103	21.6
	2. ≤3 cups per day	373	78.4

Obstetrics: Majority (80.3%) of the participants were multiparous women, had delivery at hospital (89.7%) and had no history of C/S delivery (85.5%) (Table 3).

Table 3
Obstetrics characteristics of postpartum women admitted at maternity ward in public hospitals in Dire Dawa administration, Eastern Ethiopia, 2022(n = 476).

Variables	Categories	Frequency	Percentage (%)
Parity	Nulliparous	65	13.7
	Multiparous	382	80.3
	Grand multiparous	29	6.1
Inter-pregnancy interval(n = 411)	> 2 years	109	26.5
	≤ 2 years	302	73.5
ANC follow up (recent pregnancy)	No	115	24.2
	Yes	361	75.8
Number of ANC visits(n = 361)	< 4 times	244	67.6
	≥4 times	117	32.4
Maternal blood loss (APH, PPH, n = 427)	Yes (APH = 29, PPH = 49)	78	18.3
	No	349	81.7
Gestational age at delivery	< 37weeks	38	8
	37-42weeks	381	80
	> 42weeks	57	12
Weight of newborn	> 4kg	80	16.8
	< 2.5kg	87	18.3
	Normal(2.5-4kg)	309	64.9
Mode of delivery	Instrumental assisted vaginal delivery(IAVD) (forceps (42) and vacuum (138)	180	37.8
	C/S (69 elective type,9 emergency)	78	16.4
	SVD	218	45.8
Pre-delivery anemia(n = 427)	Yes (< 11 g/dl)	190	44.5
	$No(\geq$11 g/dl)	237	55.5
Place of delivery	Home (or during transportation)	49	10.3
	Hospital	427	89.7

Variables	Categories	Frequency	Percentage (%)
History of C/S delivery	Yes	69	14.5
	No	407	85.5
History of abortion	Yes	22	4.6
	No	454	95.4
Prolonged 2nd stage of labour(n = 427)	Yes	42	9.8
	No	385	90.2
Manual removal of placenta	Yes	398	83.6
	No	78	16.4
Lacerations (birth canal and perinea tears)	Yes	82	17.2
	No	394	82.8
Episiotomy	Yes	71	14.9
	No	405	85.1

Comorbid Illnesses: 15.1% study participants had clinically confirmed gastrointestinal parasites during the recent pregnancy. From these, Trichuris trichiura and schistosoma mansoni were the commonest ones (Fig. 2).

Chronic illnesses: Around 5.3% and 2.5% had chronic illnesses, gastritis and chronic hypertension respectively (Table 4).

Table 4
List of clinically confirmed chronic illnesses during pregnancy among postpartum women admitted at maternity ward in public hospitals in Dire Dawa administration, Eastern Ethiopia, 2022(Frequency = 59, valid percent = 12.4%).

Types of chronic illnesses	Frequency	Percentage
Gastritis	25	5.3
Chronic hypertension	12	2.5
TB	10	2.1
HIV	7	1.5
More than one chronic illnesses	5	1.1

Magnitude of Immediate Postpartum Anemia(IPPA): The overall magnitude of IPPA was 26.9% (95% CI: 22.9–31.1%). From this 44(34.4%), 65(50.8%) and 19(14.8%) were sever, moderate and mild anemia respectively.

Factors Associated with Immediate Postpartum Anemia: In the multivariable logistic regression analysis women's level of education, occupation, number of ANC visits, mode of delivery, dietary diversity, IFA supplementation during recent pregnancy, GIT parasites and pre-delivery anemia were significantly associated with IPPA (Table 5).

Table 5
Factors associated with IPPA among postpartum women admitted at maternity ward in public hospitals in Dire Dawa administration, Eastern Ethiopia, 2022

Variables	Category	IPPA		COR (95% CI)	AOR (95% CI)
		Yes	No		
Current residence	Rural	17(13.3%)	81(23.3%)	1.98(1.12–3.50) *	0.95(0.25–3.55)
	Urban	111(86.7%)	267(76.7%)	1	1
Level of education(women's)	No formal education	13(10.2%)	62(17.8%)	2.20(1.052-4.60) *	3.01(1.12–8.08) *
	Primary school(1-8th)	17(13.3%)	48(13.8%)	1.30(0.65–2.36)	1.70(0.70–4.1)
	Secondary(9-10th)	35(27.3%)	100(28.7%)	1.32(0.74–2.35)	1.38(0.64–2.98)
	Preparatory(11-12th) and Diploma	33(25.8%)	73(21.0%)	1.02(0.56–1.85)	0.92(0.41–2.08)
	Degree and above	30(23.4%)	65(18.7%)	1	1
Occupation(women's)	Unemployed	17(13.3%)	63(18.1%)	2.22(1.06–4.65) *	2.72(1.02–7.21)*
	Merchant	58(45.3%	167(48%)	1.73(0.96–3.11)	1.66(0.74–3.74)
	Private employee	29(22.7%)	78(22.4%)	1.61(0.83–3.13)	1.42(0.56–3.61)
	Public employee	24(18.8%)	40(11.5%)	1	1
ANC follow up	No	19(14.8%)	96(27.6%)	2.18(1.27–3.75)**	1.15(0.32–4.10)
	Yes	109(85.2%)	252(72.4%)	1	1
Number of ANC visits	< 4times	76(59.4%)	168(72.1%)	1.77(1.12–2.78)	2.40(1.32–4.30)**
	4 times and above	52(40.6%)	65(27.9%)	1	1
Dietary diversity	1.Low	84(65.6%)	273(78.4%)	1.91(1.22–2.98)	3.10(1.65–5.79)***
	2. High	44(34.4%)	75(21.6%	1	1

Significant at *p = < 0.05, **p = < 0.01, ***p = 0.000, 1 = reference

Meal frequency per day	< 3 times per day	19(14.8%)	98(28.2%)	2.25(1.31–3.86)**	1.993(0.57–6.93)
	≥ 3 times per day	109(85.2%)	250(71.8%)	1	1
IFA supplementation	No	13(10.2%)	106(30.5%)	3.87(2.10–7.18)***	2.69(1.10–6.58)*
	Yes	115(89.8%)	242(69.5%)	1	1
Mode of delivery	IAVD	28(21.9%)	152(43.7%)	2.46(1.50–4.03)***	3.70(1.952–6.86)***
	c/s	32(25%)	46(13.2%)	0.65(0.38–1.11)	0.59(0.27–1.27)
	SVD	68(53.1%)	150(43.1%)	1	1
GIT parasites	Yes	10(7.8%)	62(17.8%)	2.56(1.27–5.16)**	3.23(1.37–7.59)**
	No	118(92.2%)	286(82.2%)	1	1
Pre-delivery anemia	Yes (< 11 g/dl)	27(21.1%)	163(54.5%)	4.48(2.77–7.26)***	2.96(1.48–5.91)**
	No (≥ 11 g/dl)	101(78.9%)	136(45.5%)	1	1
Lacerations (birth canal and perineal)	Yes	12 9.4%	70 20.1%	2.43(1.27–4.66) **	3.87(0.88–17.11)
	No	116(90.6%)	278(79.9%)	1	1
Significant at *p = < 0.05, **p = < 0.01, ***p = 0.000, 1 = reference					

In this study, educational status of the postpartum women was independent factor significantly associated with IPPA. The odds of IPPA was higher among postpartum women who had no formal education (AOR = 3.01, 95%CI: 1.12–8.08) and unemployed once (AOR = 2.72, 95%CI:1.02–7.21). Likewise, the higher likelihood of IPPA was noticed among postpartum women who had < 4 ANC visits (AOR = 2.40,95%CI: 1.32–4.30), instrumental assisted vaginal delivery(IAVD) (AOR = 3.70,95%CI: 1.952–6.86), pre-delivery anemia (AOR = 2.96,95%CI: 1.48–5.91) and GIT parasites (AOR = 3.23,95%CI: 1.37–7.59). Furthermore, postpartum women who had low dietary diversity (AOR = 3.10,95%CI:1.65–5.79) and had no IFA supplementation (AOR = 2.69,95%CI:1.10–6.58) during their recent pregnancy were almost three times more likely to develop IPPA compared to their counterparts(Table 5).

Discussion

This study was conducted to assess the magnitude and factors associated with immediate postpartum anemia among postpartum women admitted to maternity ward at public hospitals in Dire Dawa administration, eastern Ethiopia. In this study, immediate postpartum anemia (IPPA) was considered based on World health organization definition of hemoglobin level of postpartum women < 10gm/dl within the first 48 hours of post-delivery. partum (14, 54). Based on this, we found the overall magnitude of IPPA was 26.9% (95% CI: 22.9–31.1%). This finding was in line with a study conducted in Madrid, Spain (29%)(58), India(26.5%)(24, 59), Uganda (30%) (60), Costal Karnataka (26.5%)(24); and in Ethiopia, Debre Markos (24.3%)(21) and Mekelle (24.2%)(49) and Jimma (28.7%) (47).This consistency might be related to the fact that all of the study participants in these studies were same population (postpartum women, female sex), almost all were in similar physiological state (post-delivery period), related time frame (within 24 hrs. Or 48hrs or 1week post-delivery) and singleton pregnancy rather than twins or more. Likewise, some socio-demographic characteristics of study participants were highly related like marital status (majority were married) and majority were urban dwellers. Besides, related to the obstetrics characteristics of the study participants, majority were multiparous.

However, the finding of this study was lower than studies conducted in Pakistan(49.7%) (61), Alcazar de san Juan, Spain (45%) (62), Spain (49.7%) (41), Beijing, China (32.7%)(63);Tamil Nadu, India (47.3%)(59); Bursa, Turkey (45.1%) (64) and Jeddah, Saudi Arabia (59.3%) (65) and Enugu, Nigeria(72.8%) (19). The possible explanation for this variation might be due to the use of different hemoglobin concentration cut-off points to define postpartum anemia (for instance some studies use a cut of value of hemoglobin less than 11 g/dl a or < 12g/dl and some others including this study used a cut-off points < 10g/dl). Additionally, possible explanation for this variation might be due the differences in sample size and time of screening postpartum anemia and this study was excluded diagnosed pre-conception anemia, uterine rupture and laparotomy to minimize over estimation of postpartum anemia. Moreover, this finding was higher than studies conducted in California(7.3%)(66),Germany(22%)(17),Ghana(16%) (5), Kenya(16.4%) (6) and Uganda(18.8%) (67). This inconsistency might be differences in study times, and some socio-demographic characteristics like age, educational level and residence area. The variation also might be high coverage of ANC follow up and supplementation of IFA tablets during pregnancy which is crucial in preventing anemia and directly impacts on IPPA. Besides, such inconsistency could be due to difference in sample size, study times and use of different time frame for PPA. For instance, the above studies were used study periods which was far from immediate postpartum close to 6 weeks of postpartum period but this study used a time frame from immediately after child birth up to 48 hrs. As the period of postpartum period extends physiologic changes during pregnancy returned to normal and the women will have recover from anemia and this highly creates variation in magnitude of PPA. Due to lack of consensus on the definition of postpartum anemia, scholars use different HGB cut-off points. For instance, Nawagi < 11 g/dl at 24hr, Rubio-Alvarez et al < 11 g/dl, I Brichs et al were used Hgb < 11 g/dl, Dundar and Cakmak were used Hgb < 11 g/dl at 6 hrs. And Rakesh et al were used Hgb < 12 g/dl at 6 weeks as cut-off points in contrast to this study (Hgb < 10 g/dl at 48 hrs.) to define IPPA. Other factors might be study settings, geographical differences, dietary practices (dietary diversity or/and meal frequency, amount and access),

health seeking behaviors (like prevention, detection and treatment of malaria and other parasites) of the community of different area of the world.

Strength of the Study

The study included both public hospitals with high postpartum women admission rate in the study area which increases the external validity of the study. Data collection was done by interview complemented with review of medical cards which allowed interview for variables commonly missed in documentation or referring to the documents for getting clinical data difficult to obtain through interview.

Limitation of the Study

The study was institutional based, and therefore it may difficult to generalize the result in the general population and since the study participants were came from different geographical area with different altitudes, it was difficult to made adjustment for hemoglobin. In addition, since the study design was a cross-sectional, a causal relationship could not be established. Some sort of social desirability bias was expecting in this study. But efforts were made to manage them through doing pre-test of the questionnaire, training of data collectors and supervisors, interviewing postpartum women privately, close supervision of data collectors on how to approach respondents and explaining the purpose of the study for study participants and reviewing medical cards well.

Conclusion

The finding of this study indicated that immediate postpartum anemia is a high public health problem as per WHO cut-off value and other previous studies in Ethiopia. Women's educational status, occupation, dietary diversity, IFA supplementation during pregnancy, number of ANC visits, mode of delivery, pre-delivery anemia and presence of gastro-intestinal parasites showed a significant association with immediate postpartum anemia. This finding may help to improve the health professionals to intervention against IPPA via identification of risk factors of immediate postpartum anemia during prenatal, intranatal and postnatal period.

Recommendation: Recommendations were forwarded for responsible body based on the study findings as follows:

To Health care professionals in studied hospitals

- Might provide due attention on counseling on frequent ANC visits, dietary diversity, IFA supplementation or pregnant women to feed iron rich nutrients.
- Might detect pre-delivery anemia and GIT parasites to prevent IPPA
- Might consider complications of mode of deliveries like Instrumental assisted vaginal delivery and their appropriate usage to prevent IPPA

Hospital administrators and non-governmental organizations

- Could create functional multi-sectorial collaboration strategies to improve women's education, ANC service utilization and dietary diversity.
- Had better to work to create collaboration among all level of health care administrations and professionals to provide better services for pregnant women during ANC visit, delivery and postpartum period.

Abbreviations

IPPA: Immediate postpartum anemia, ANC: Antenatal Care, IFA: iron ad folic acid, AOR: Adjusted odds, CI: Confidence Interval, COR: Crude odds ratio, WHO: world health organization, SPSS: Statistical Package for

Declarations

Researchers

Other researchers could do further investigation to identify other factors by using large sample size and other study designs.

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Declaration

We confirm that the manuscript has been read and approved by all named authors and that there are no other persons who satisfied the criteria for authorship but are not listed. We further confirm that the order of authors listed in the manuscript has been approved by all of us

Ethical approval and consent to participate

Ethical clearance was obtained from the institutional ethical review board of Dire Dawa University with Ref no. DDU-IRB-2022-02

An official letter of permission was sent to Dire Dawa Health Bureau(DHB) from Dire Dawa University Research Affairs Directorate (RAD) and then an official letter of cooperation was written to each hospital administrators from DHB. The hospital administrators were informed about the objective of the study including the benefits and confidentiality issues. The participants also were informed clearly about the objective, benefit, and rights to participate or refuse or withdraw the interview. Study participants' privacy

was respected and their confidentiality was maintained throughout the research process by giving code, omitting their names. After all, voluntary informed consent was obtained from study participants.

Competing interests

The authors would like to declare that they have no any competing interests

Authors' contribution

Asma Bireda: Conceptualization, data curation, formal analysis, funding acquisition, investigation, methodology, software, writing, original draft, writing review and editing

Aminu Mohammed: carried out the overall design and execution of the study, performed statistical analysis, reviewed the manuscript

Mikiale Hailu: software, data curation, formal analysis, writing review and editing

Kedir Ali: software, data curation, formal analysis, writing review

All authors read this manuscript and finally approved for submission.

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Availability of data and materials

All the data of this study are available from the Principal investigator and corresponding author upon request.

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Figures

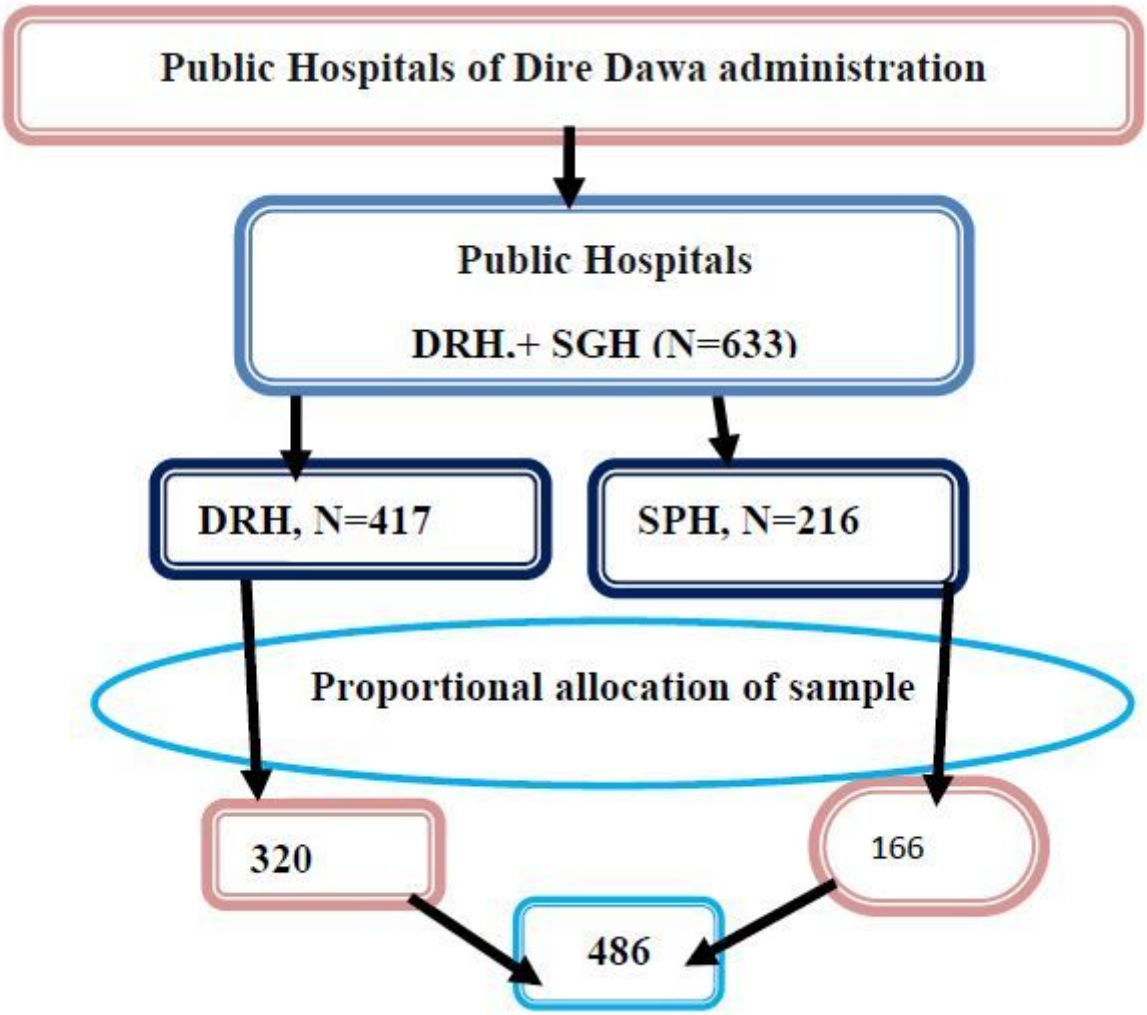

Figure 1

Diagram presentation of sampling procedure for the study on magnitude and associated factors of IPPA at public hospitals in Dire Dawa administration, Eastern Ethiopia, 2022

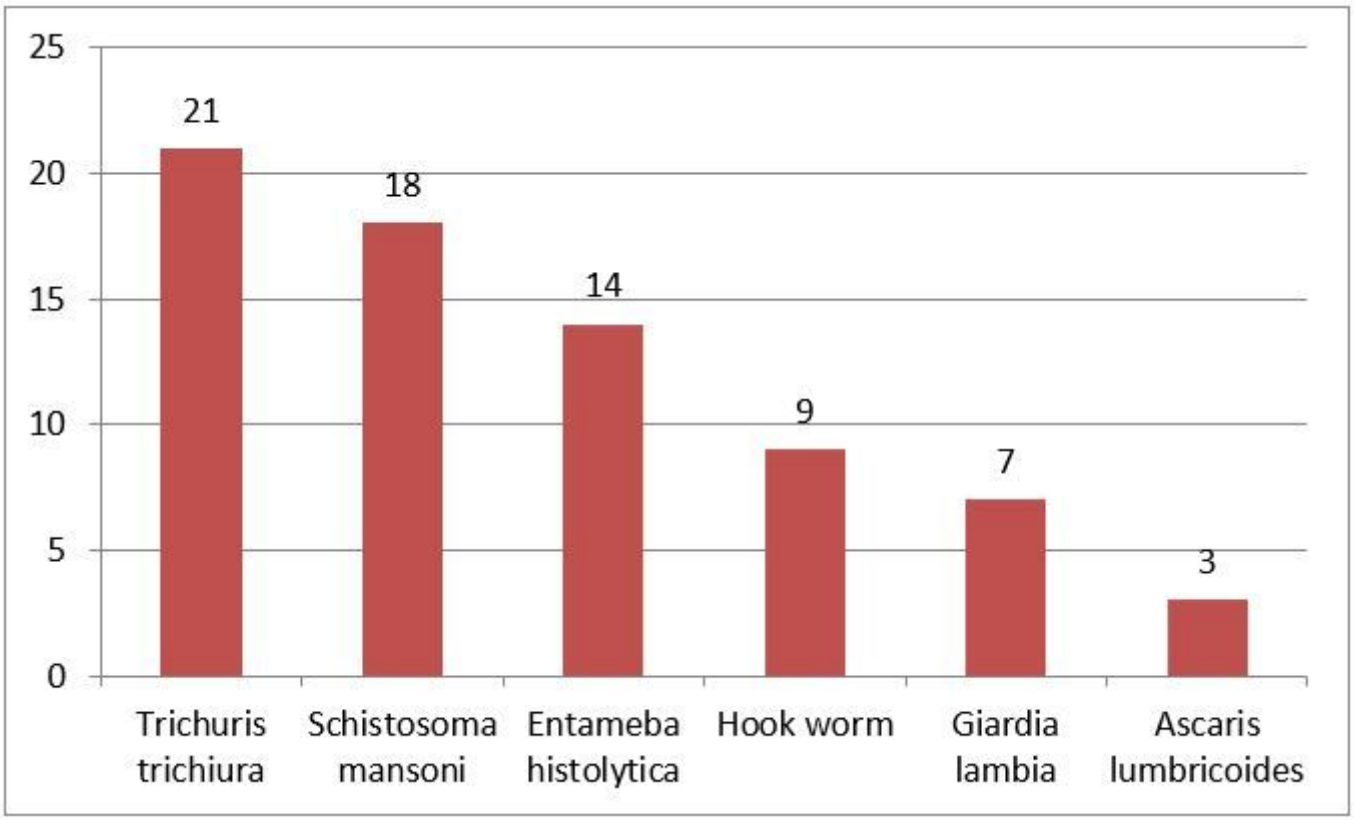

Figure 2

Clinically confirmed GIT parasites during pregnancy among postpartum women admitted at maternity ward in public hospitals in Dire Dawa administration, Eastern Ethiopia, 2022 (Frequency=72, valid percent=15.1%).