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Undernutrition and its associated factors among pregnant women attending antenatal care at public health facilities in pastoral communities of Afar Regional State, northeast Ethiopia

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Abstract

Background: Maternal malnutrition during pregnancy increases the risk of miscarriages and foetal deaths, pre-term delivery, and maternal mortality. However, limited studies have been conducted in Ethiopia that may not represent the problem among pregnant women in pastoral communities like the Afar region. Therefore, this study assessed the prevalence and associated factors of undernutrition among pregnant women attending antenatal care at public health facilities in pastoral communities of the Afar region, northeast Ethiopia.

A facility-based cross-sectional study design was employed from 20 September to 5 October 2020. A sample of 387 pregnant women attending antenatal care clinics in randomly selected public health facilities was included. The collected data were checked, cleaned, and entered using Epi-data version 3.1 and exported into Stata version 14.0 for further analysis. Binary logistic regression analysis was used to measure the association between undernutrition and its predictors among pregnant women. Finally, the statistical significance level was declared using an adjusted odds ratio with its corresponding 95% confidence interval.

The overall prevalence of undernutrition among pregnant women was found to be 30.9% [95% CI 26.5%, 35.8%]. Being illiterate, living in rural, women's substance usage during pregnancy, not receiving counselling on a balanced diet, having chronic medical problems, not taking extra meals within 24 h, having food restrictions during this pregnancy, and being HIV-positive were the independent predictors of undernutrition.

Conclusion: This study indicated that nearly a third of pregnant women were undernourished. The regional and national governments should give due attention to women residing in rural areas to get access to education for women in pastoral communities. The health care providers should strengthen the screening of women with medical problems and interventions that improve maternal health during pregnancy. Besides the provision of prenatal dietary counselling on a balanced diet, avoiding food restrictions and encouraging them to take extra meal during pregnancy are recommended to avoid undernutrition among pregnant women in pastoral communities.

Keywords: Undernutrition, Associated factors, Pregnant women, Northeast Ethiopia

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Background

Maternal malnutrition is a public health problem affecting a high proportion of pregnant women worldwide and it poses a high risk for both the mother and

the foetus, such as stillbirth, preterm birth, maternal bleeding because of uterine atony, and other pregnancy-related complications (Archana et al. 2018; FMOH 2008).

In 2016, the prevalence of undernutrition among reproductive-age girls was between 18.5 and 31.5% in eastern Africa (GNR 2019). In Ethiopia, one in three women of reproductive age are undernourished (FMOH 2011), and studies conducted in different parts of the country reported a prevalence of undernutrition ranging from 9.2% (Desalegn et al. 2015) to 43.1% (Gelebo et al. 2021) that also showed a significant geographic variation.

According to the Ethiopian demographic and health survey report, the prevalence of undernutrition among reproductive age group women is in pastoral areas like the Afar region (39.1%) and lowest in Addis Ababa (13.4%) (Central Statistical Agency—CSA/Ethiopia and ICF 2017).

Though the prevalence of anaemia among reproductive age group women is 27.4% in the Afar region (EPHI 2015), the prevalence of undernutrition among pregnant women is not well determined in the pastoral community of the Afar region.

The previous studies had identified various contributing factors for undernutrition among pregnant women. Childhood undernutrition, infections during pregnancy, women married before 15 years, illiterate women, living in rural areas, no antenatal care visits, multi-parity, trimester of pregnancy, workload, low autonomy of decision at household, and anaemia of pregnancy found to be the independent predictors of undernutrition during pregnancy (Belete et al. 2016, Cambria et al. 2018, Dibaba 2018, Gebre et al. 2018; Haji 2016, Heyam et al. 2018, Loha 2013).

Due to the differences in characteristics of socio-cultural, socio-economic, ethnicity, and geographical location, associated factors for undernutrition in pregnant women might not be the same across different regions of Ethiopia.

Despite the Ethiopian government has developed a revised National Nutrition Program (NNP) to tackle the burden of malnutrition in lactating and pregnant mothers (FMOH 2020), undernutrition of women during pregnancy continues to be a public health concern in the country.

Even though some studies have been conducted to date to assess the prevalence and associated factors of undernutrition among pregnant women in different parts of Ethiopia, none of the studies includes the issue of undernutrition among pregnant women in pastoral communities like the Afar region. Thus, this study aimed to assess the prevalence and associated factors of undernutrition among pregnant women attending antenatal care at public health facilities in pastoral communities of the Afar region, northeast Ethiopia.

Methods and materials

Study setting and period

The study was conducted from 20 September to 5 October 2020 at public health facilities in Samara-Logia city administrative and Dubti district, Afar Regional State, northeast Ethiopia, that is located 588 km away from the capital city, Addis Ababa. The study settings are bordered on the south by the Afambo district, on the southwest by Mille, on the west by Chifra, on the northwest by the administrative zone 4, on the north by Kori, on the northeast by Elidar, and on the east by Aysaita district. The area has a 1200-m altitude above sea level, and the main source of income in this area is trade and pastoralism.

As of 2007, Ethiopia's population has been growing at a rate of 2.6% per annum. At this rate, the total population of the study settings will number 99,889 by 2019 (CSA 2007). Of these, 3097 are pregnant women. The area has a 1200-m altitude above sea level, and the main source of income in this area is trade and pastoralism.

The pastoral community is completely rain-fed. In normal years, the region receives annual rainfall in the range of 425–1300 mm. The area is marginal for agricultural production and suffers a food deficit every year. The main source of income is livestock production and trading. The main types of livestock are cattle, sheep, goats, and camels. Seasonal livestock migration to the major rivers to seek pasture and water is common during the long dry season (Bona).

Study settings have six functional public health facilities and 16 health posts with various private clinics, pharmacies, drug stores, and rural drug vendors. These health facilities are serving more than 250,000 population since the regional referral hospital is found in this area. According to the health office report of the year 2019, the health facilities give antenatal care services to nearly 5000 pregnant women.

Study design

A health facility-based cross-sectional study design was employed.

Source and study population

The source population is all pregnant women who were attending ANC follow-ups at selected public health facilities.

The study population is all pregnant women who were attending ANC follow-ups at selected public health facilities during the data collection period.

Eligibility criteria

Inclusion criteria

All pregnant women who were presented to health facilities for ANC follow-up during the data collection period at the selected public health facilities were included in this study.

Exclusion criteria

Pregnant women who were critically sick and came to the selected health facilities other than ANC check-ups during the data collection period were excluded from this study.

Sample size determination

The required sample size for this study was determined for both objectives (prevalence and associated factors), and the objective that provides the maximum sample size was considered as the final sample size for this study.

Thus, for the first objective, the sample size was calculated using single population proportion formula; the prevalence of undernutrition among pregnant women ($P = 35.5\%$) was taken from a study conducted in Sidama zone, Ethiopia (Loha 2013), with assumptions of 95% confidence interval, 5% margin of error, and 10% to compensate non-responses.

$$n = \frac{(Z\alpha/2)^2(P)(1-P)}{d^2}$$

where n is the sample size, $Z\alpha/2$ is the critical value for normal distribution at 95% confidence level (1.96), P is the prevalence of malnutrition among pregnant women, and d is the marginal error. Then, the calculated sample size becomes 387. Here, the maximum sample size was obtained for the first objective compared to the second objective (387 and 372, respectively).

Sampling techniques

In this study, from the six public health facilities found in Samara-Logia town and Dubti district, three health facilities were selected using a simple random sampling technique. Dubti Hospital was selected from the three health facilities in Dubti district. Similarly, Logia and Samara Health Centers were selected from the Samara-Logia city administration health facilities. Then, the calculated sample size was proportionally allocated for each randomly selected health facility based on the case flows they had reported in the previous 1 year. Similarly, the arrival of each pregnant woman for the first time to get antenatal care was considered at random. Thus, study participants were recruited based on their random arrival as per the inclusion criteria. The data was collected until the calculated sample size is satisfied.

Study variables

Dependent variable

- Nutritional status of pregnant women (undernourished or normal).

Independent variables

- Socio-economic and socio-demographic factors: maternal age (in years), a maternal education level (illiterate, primary level, secondary level, tertiary level), religion (Muslim, Orthodox Christianity, Protestant, and others), ethnicity (Amhara, Afar, Oromia, Tigray, and others), marital status (single, married, divorced, and widowed), mother's main occupation (housewife, farmer, civil servant, merchant, daily labourer, student, and others), average monthly household income (in Ethiopian birr), and family size-related (in number) information
- Knowledge of taking an extra meal during pregnancy
- Obstetric- and medical problem-related factors: ANC, pregnancy status, parity, HIV/AIDS, infections within 4 weeks, and so on
- Behavioural factors, such as alcohol, khat, and cigarette use during the pregnancy period

Data collection tools and techniques

Data collection instrument

The questionnaire was adapted and modified from the national nutrition programme guideline (FMOH 2013) and the Ethiopian demographic and health survey CSA (2016). Mid-upper arm circumference (MUAC) anthropometric measurement was used to measure the nutritional status of pregnant women participating in this study which is a commonly used approach in the diagnosis of acute malnutrition among pregnant women. The measurement was taken at the middle of the upper arm, and it was measured using adult size MUAC. Finally, the measurement of MUAC was rounded to the nearest 0.1 cm.

Data collection techniques

Face-to-face interviews were employed using a standardized, structured, and field-tested questionnaire to collect the data. Experienced data collectors who had conducted

similar interviews in the previous years were recruited. The principal investigators and supervisors have checked the activities of each team daily.

Three supervisors including principal investigators coordinated the overall data collection process. Six trained health professionals collected the data. The nutritional status of pregnant women was determined through anthropometric measurement using mid-upper arm circumference (MUAC), which is a commonly used approach in the diagnosis of acute malnutrition among pregnant women. MUAC of each woman was measured at the mid-point between the tips of the shoulder and elbow of the left arm using non-elastic, non-stretchable MUAC tapes, and measurements were recorded to the nearest 0.1 cm.

Data quality assurance

The questionnaire was standardized and contextualized. It was originally developed in English and translated into local language (Afar-aaf). It was back-translated into English version to keep its consistency. A pretest of the questionnaire was done on 5% (i.e. 20 participants) of the samples at a non-selected health facility (i.e. mille health centre), and an amendment was made based on the findings.

Two days of training were provided to the data collectors and supervisors focused on data collection procedures, quality, interviewing techniques, and related issues. Apart from the 2-day training, supervisors and the principal investigator reviewed the collected data daily to identify errors, omissions, and inconsistencies. Data were checked for completeness, accuracy, and clarity by the study core team and supervisors.

Data management and analysis

Data entry and coding were done using Epi-data 3.1. Data cleaning and analysis were carried out using Stata version 14.0. Descriptive statistics were done, and the results were presented using texts, frequency tables, and median with interquartile range. The median was used for continuous variables, which were not normally distributed.

Independent variables were explored in assessing maternal undernutrition using (1) socio-demographic characteristics (maternal age, educational status, marital status, ethnicity, religion, occupation, and average monthly household income); (2) access to and utilization of available health services (antenatal care checkup, distance to health facilities, using available health services and a household visit by community health workers); and (3) knowledge of extra meal taking during pregnancy-related variables was examined.

Correlation between independent variables was assessed using the variance inflation factor. Model fitness was checked using the Hosmer and Lemeshow fitness of test. Both crude odds ratio and adjusted odds ratio (AOR) with corresponding 95% confidence interval was reported to show the nature of associations observed. In multivariable analysis, a statistically significant level was declared using AOR with its corresponding 95% confidence interval.

Operational definitions

Undernutrition

Maternal undernutrition was assessed using a mid-upper arm circumference (MUAC) and categorized as undernutrition (MUAC < 22) and normal (MUAC ≥ 22) (Dadi and Desyibelew 2019; Haji 2016).

Good knowledge on an extra meal during pregnancy

Knowledge of the benefits of taking an extra meal during pregnancy is computed from five yes/no questions: (1) Do you know extra meal during pregnancy help the foetus to develop well? (2) Do you know the foetus competes for nutrients during pregnancy? (3) Do you know extra meal taking will help for the health of the foetus and yourself? (4) Do you know extra meal taking will help to prevent infections during pregnancy? (5) Do you know taking extra meal help to prevent anaemia during pregnancy? (EPHI 2015). Therefore, women who answered above the mean score were considered knowledgeable on extra meal taking, and those who answered below the mean score were considered as not knowledgeable on extra meal taking during pregnancy.

Substance use during pregnancy

If pregnant women use either alcohol, cigarette, or khat at least once during this index pregnancy, they were considered substance users.

Results

Socio-demographic characteristics of participants

In this study, 381 pregnant women were involved with a response rate of 98.4%. The median age of the participants was 23 with an inter-quartile range (IQR) of 6 years. Of the total participants, 305 (80.1%) were living in urban, 135 (35.4%) were illiterate, only 91 (23.9%) were employed, 195 (51.2%) of the husbands attended secondary and above education level, and 296 (77.7%) of the women had less than five family sizes. The households had 4000 ETB (78.87 USD) median monthly income with an IQR of 4315ETB (81.79 USD) (Table 1).

Obstetric and medical conditions of pregnant women

In this study, 275 (72.2%) pregnant women started antenatal care after 16 completed weeks of gestations. Of the total participants, 202 (53%) had two to three ANC visits, 352 (92.4%) of the pregnancies were planned, and

Table 1 Socio-demographic characteristics of the pregnant women in the Afar region, northeast Ethiopia

Lis of variable	Variable category	Frequency ($n = 381$)	Percentage (%)
Age	15–24	197	51.7
	25–34	169	44.4
	35 and above	15	3.9
Place of residence	Urban	305	80.1
	Rural	76	19.9
Marital status	Married	370	97.1
	Divorced	11	2.9
Ethnicity	Afar	188	49.3
	Amhara	146	38.3
	Tigray	33	8.7
	Others[a]	14	3.7
Religion	Orthodox	70	18.4
	Muslim	303	79.5
	Others[b]	8	2.1
Women's education level	Illiterate	135	35.4
	Primary	96	25.2
	Secondary and above	150	39.4
Husband's education level	Illiterate	91	23.9
	Primary	95	24.9
	Secondary and above	195	51.2
Women's occupation	Unemployed	290	76.1
	Employed	91	23.9
Husband's occupation	Farmer	63	16.5
	Merchant	126	33.1
	Government employee	138	36.2
	NGO employee	52	13.6
	Others[c]	2	.5
Income	≤ 1000	31	8.1
	1001–2000	64	16.8
	2001–3000	70	18.4
	3000 and above	216	56.7
Family size	≤ 5	296	77.7
	> 5	85	22.3

[a] Others (Oromo, Sidama, Argoba)

[b] Others (Protestant, Catholic, Adventist)

[c] Others (student, and carpenter)

53 (13.9%) of the pregnant women had a history of any medical problems before or during this pregnancy, and 264 (69.3%) of the women had experienced nausea and vomiting during pregnancy. The women were travelling on average 30 min with IQR 45 to arrive at the nearby health facilities (Table 2).

Prevalence of undernutrition and behavioural characteristics of the women

In this study, the overall prevalence of undernutrition among pregnant women is 30.9% [95% CI 26.5%, 35.8%]. This study revealed that 293 (76.9%) were counselled about the importance of a balanced diet during antenatal care visits. Of the total participants, 354 (92.9%) of the women believe that extra meal taking helps the foetus to be well developed and 360 (94.5%) of the pregnant women were taking iron and folic acid during pregnancy. On the other hand, 115 (30.2%) of the pregnant women had reported that they experienced food restrictions from their partners or family members. Regarding substance use, 29 (7.6%) of the pregnant women and 146 (38.3%) of their partners were chewing khat (Table 3).

Table 2 Obstetric and medical conditions of pregnant women in the Afar region, northeast Ethiopia

Variable	Category	Frequency ($n = 381$)	Percentage (%)
Gravidity	Prim gravida	143	37.5
	Multigravida	238	62.5
Gestational age at initiation of ANC visits	< 12 weeks	30	7.9
	12–16 weeks	76	19.9
	After 16 weeks	275	72.2
Number of ANC visits	Only one	144	37.8
	2–3 visits	202	53.0
	4 + visits	35	9.2
Place where ANC visit start	Health post	13	3.4
	Health centre	230	60.4
	Hospital	130	34.1
	Private clinic	8	2.1
Pregnancy planned	Yes	352	92.4
	No	29	7.6
Chronic medical problems before or during pregnancy (DM, cancer, renal diseases)	Yes	53	13.9
	No	328	86.1
HIV status	Positive	24	6.3
	Negative	357	93.7
Hypertension status	Normal	329	86.4
	Pre-HTN	22	5.8
	HTN	30	7.9
Excessive vomiting and nausea	Yes	264	69.3
	No	117	30.7
Time to travel the nearby health facilities	> 30 min	209	54.9
	≤ 30 min	172	45.1

Factors associated with undernutrition among pregnant women

In this study, the odds of undernutrition among illiterate women were three times higher compared to women who had attended secondary and above education levels [AOR = 3.08: 95% CI 1.24, 7.67]. Women who resided in rural areas had twice greater odds of undernutrition compared to women who were living in urban areas [AOR = 2.25: 95% CI 1.90, 5.65]. This study revealed that women who were substance users (alcohol, chat, or cigarette) during pregnancy had seven times higher odds of undernutrition compared to those women who were not non-users [AOR = 7.24: 95% CI 2.35, 22.28]. The pregnant women who have not received counselling on the importance of a balanced diet during antenatal care were 75% more likely to be undernourished compared to their counterparts [AOR = 1.75: 95% CI 1.17, 7.61]. The odds of undernutrition among women with chronic medical problems during or before this pregnancy was six times higher compared to the women without any medical problems [AOR = 6.55: 95% CI 2.64, 16.27]. The pregnant women who were not taking extra meals 24 h before the survey were three times more likely to be undernourished than women who were taking extra meals [AOR = 2.76: 95% CI 1.29, 5.89]. This study revealed that women who have experienced food restriction during this pregnancy had fourfold greater odds of undernutrition compared to their counterparts [AOR = 3.71: 95% CI 1.82, 7.55]. Finally, HIV-positive women had four times greater odds of undernutrition compared to HIV-negative pregnant women [AOR = 4.41: 95% CI 1.34, 14.52] (Table 4).

Discussion

This study assessed the prevalence and associated factors of undernutrition among pregnant women in the pastoral community, Afar region, northeast Ethiopia.

In this study, the overall prevalence of undernutrition among pregnant women was 30.9% which is similar to studies conducted in Samre Woreda, south-eastern Tigray, Ethiopia [31%] (Haileslassie et al. 2013), and central Rfitt Valley of Ethiopia [31.8%] (Dibaba 2018). However, this finding is higher than the studies conducted in eastern Ethiopia [19.1%] (Haji 2016); Rayitu district, Ethiopia [24%] (Gebre et al. 2018); national survey of Ethiopia [26.5%] (Telake 2010), Gondar town, Ethiopia [14.4%] (Dadi and Desyibelew 2019); systematic review and

Table 3 Nutritional status, lifestyle, and behavioural characteristics of pregnant women in the Afar region, northeast Ethiopia

Variable	Category	Frequency ($n=381$)	Percentage (%)
Taken extra meal in the last 24 h	Yes	215	56.4
	No	166	43.6
Frequency of feeding extra meal per 24 h ($n=215$)	Once only	38	17.7
	Twice per day	20	9.3
	Three times per day	57	26.5
	4 times per day	100	46.5
Experienced food restriction during pregnancy	Yes	115	30.2
	No	266	69.8
Taking iron-folic acid during this pregnancy	Yes	360	94.5
	No	21	5.5
Get counselling about balanced diet	Yes	293	76.9
	No	88	23.1
Foetus computes for nutrient during pregnancy	Yes	340	89.2
	No	41	10.8
Extra meals develop the foetus well	Yes	354	92.9
	No	27	7.1
Extra meals help to prevent anaemia during pregnancy	Yes	337	88.5
	No	44	11.5
Vegetables/fruits in the garden	Yes	28	7.3
	No	353	92.7
Drinking water source	In the compound	241	63.3
	Outsides the compound	140	36.7
Toilet facility	Yes	238	62.5
	No	143	37.5
Women drink alcohol during pregnancy	Yes	29	7.6
	No	352	92.4
Women chew khat during pregnancy	Yes	41	10.8
	No	340	89.2
Women smoke a cigarette during pregnancy	Yes	14	3.7
	No	367	96.3
Husband drinks alcohol in the last 24 h	Yes	41	10.8
	No	340	89.2
Husband chews khat in the last 24 h	Yes	146	38.3
	No	235	61.7
Husband smokes cigarette in the last 24 h	Yes	61	16.0
	No	320	84.0

meta-analysis of African studies [23.5%] (Desyibelew and Dadi 2019); and University of Gondar Hospital, northwest Ethiopia [16.2%] Gemechu (2018).

On the other hand, this finding is lower than studies conducted in Jordan [49.2%] (Heyam et al. 2018); Shashemenne district, Ethiopia [34%] (Belete et al. 2016); Kapenguria District, Kenya [32%] (KEMUNTO 2013); Boricha district, southern Ethiopia [35.5%] (Loha 2013); and northern Tigray, Ethiopia [47.9%] (Abraham et al. 2015). The discrepancies could be justified related to the differences in the quality of service delivered in the facility, socio-cultural barriers, women's compliance with the available service, and women's awareness of the importance of extra meal intake during pregnancy. In addition, the differences in the access to health care facilities and differences in measurement tools, sample size, and study setting might also contribute to these variations.

In this study, the odds of undernutrition among illiterate women were three times higher compared to women who had attended secondary and above education levels. This finding is consistent with studies conducted in

Table 4 Factors associated with undernutrition among pregnant women in the Afar region, northeast Ethiopia

Predictors	Category	Nutritional status		COR (95% CI)	AOR (95% CI)
		Undernourished, # (%)	Normal, # (%)		
Women's age	15–24	83 (70.3)	114 (43.3)	1.00	1.00
	25–34	34 (28.8)	135 (51.3)	0.34 (0.21, 0.55)	0.54 (0.37, 1.06)
	35 +	1 (1.8)	15 (4.3)	0.09 (0.02, 0.76)	0.19 (0.12, 1.12)
Place of residence	Urban	86 (72.9)	219 (83.3)	1.00	1.00
	Rural	32 (27.1)	44 (16.7)	1.85 (1.10, 3.11)	2.25 (1.90, 5.65)[a]
Women's education	Illiterate	57 (48.3)	78 (29.7)	2.69 (1.61, 4.52)	3.08 (1.24, 7.67)[a]
	Primary	29 (24.6)	67 (25.5)	1.59 (0.88, 2.86)	1.79 (0.78, 4.11)
	Secondary +	32 (27.1)	118 (44.9)	1.00	1.00
Partner education level	Illiterate	40 (33.9)	51 (19.4)	2.21 (1.31, 3.73)	1.65 (0.60, 4.54)
	Primary	27 (22.9)	68 (25.9)	1.12 (0.65, 1.94)	0.62 (0.29, 1.34)
	Secondary +	51 (43.2)	144 (54.8)	1.00	1.00
Women's occupation	Unemployed	95 (80.5)	195 (74.1)	1.00	1.00
	Employed	23 (19.5)	68 (25.9)	0.69 (0.41, 1.18)	1.64 (0.72,3.78)
Monthly income (in ETB)	≤ 1000	13 (11.0)	18 (6.8)	2.11 (0.97, 4.59)	0.75 (0.23, 2.54)
	1001–2000	20 (16.9)	44 (16.7)	1.33 (0.722, 2.45)	0.32 (0.11,1.94)
	2001–3000	30 (25.4)	40 (15.2)	2.19 (1.25, 3.85)	1.55 (0.69, 3.48)
	> 3000	55 (46.6)	161 (61.2)	1.00	1.00
Family size	< 5	94 (79.7)	202 (76.8)	1.00	1.00
	5 +	24 (20.3)	61 (23.2)	0.85 (0.49, 1.44)	1.19 (0.52, 2.75)
Gravidity	Prim gravida	61 (51.7)	82 (31.2)	1.00	1.00
	Multigravida	57 (48.3)	181 (68.8)	0.42 (0.27, 0.66)	0.25 (0.12, 1.23)
Women used substances during pregnancy	Yes	20 (16.9)	9 (3.4)	5.75 (2.53, 13.10)	7.24 (2.35, 22.28)[a]
	No	98 (83.1)	254 (96.6)	1.00	1.00
Husband used substances in the last 24 h	Yes	30 (25.4)	31 (11.8)	2.55 (1.45, 4.46)	2.73 (0.87, 5.98)
	No	88 (74.6)	232 (88.2)	1.00	1.00
Counselled about balanced diet	Yes	81 (68.6)	212 (80.6)	1.00	1.00
	No	37 (31.4)	51 (19.4)	1.89 (1.15, 3.11)	1.75 (1.08, 3.60)[a]
Chronic medical problems	Yes	26 (22..0)	27 (10.3)	2.47 (1.36, 4.45)	6.55 (2.64, 16.27)[a]
	No	92 (78.0)	236 (89.7)	1.00	1.00
Travel to health facilities (min)	> 30	71 (60.2)	138 (52.5)	1.00	1.00
	≤ 30	47 (39.8)	125 (47.5)	0.73 (0.47, 1.13)	0.44 (0.26, 1.31)
Feed extra meal in the last 24 h	Yes	57 (48.3)	158 (60.1)	1.00	1.00
	No	61 (51.7)	105 (39.9)	1.61 (1.03, 2.49)	2.76 (1.29, 5.89)[a]
Food restriction during pregnancy	Yes	44 (37.3)	71 (27.0)	1.61 (1.01, 2.55)	3.71 (1.82, 7.55)[a]
	No	74 (62.7)	192 (73.0)	1.00	1.00
Number of ANC visits	Only one	54 (45.8)	90 (34.2)	1.00	1.00
	2–3 visits	55 (46.6)	147 (55.9)	0.62 (0.39, 0.98)	0.77 (0.42, 1.46)
	4 + visits	9 (7.6)	26 (9.9)	0.57 (0.25, 1.32)	0.27 (0.15, 1.09)
HIV status	Positive	16 (13.6)	8 (3.0)	5.01 (2.07, 12.04)	4.41 (1.34, 14.52)[a]
	Negative	102 (86.4)	255 (97.0)	1.00	1.00
GA at the initiation of ANC (weeks)	< 12	6 (5.1)	24 (9.1)	1.00	1.00
	12–16	23 (19.5)	53 (20.2)	1.73 (0.62, 4.81)	0.81 (0.22, 2.94)
	> 16	89 (75.4)	186 (70.7)	1.91 (0.75, 4.85)	0.78 (0.24, 2.58)

Medical problems (diabetes mellitus, renal diseases, cardiac diseases, liver diseases, cancer)

COR Crude odds ratio, *AOR* Adjusted odds ratio, *CI* Confidence interval, *ANC* Antenatal care, *GA* Gestational age

[a] Statistically significant variables at 95% CI

eastern Ethiopia (Haji 2016); a systematic review and meta-analysis of 23 African studies (Desyibelew and Dadi 2019); University of Gondar Hospital, northwest Ethiopia (Gemechu 2018); and Shashemenne district, Ethiopia (Belete et al. 2016). Demographic and socio-economic status have been demonstrated to the low intake of dietary diversity (Joseph 2018) which is directly related to the low awareness of the women regarding the importance of balanced diet consumption during the pregnancy period. Thus, women with no formal education are more likely to be malnourished than literate women.

This study indicated that women who resided in rural areas had twice greater odds of undernutrition compared to women who were living in urban areas. This finding is consistent with studies conducted in Boricha district, southern Ethiopia (Loha 2013), a systematic review and meta-analysis of 23 African studies (Desyibelew and Dadi 2019), and University of Gondar Hospital, northwest Ethiopia (Gemechu 2018). This could be justified by the fact that women in rural areas may not have access to antenatal health care services, information regarding the balanced diet intake, and other maternal health services compared to women in urban residences. Thus, women in rural areas are prone to maternal undernutrition despite the surplus of food at home compared to women in urban settings.

This study revealed that women who were substance users during pregnancy had seven times higher odds of undernutrition compared to those women who were not users. This could be justified by women who use any substances (alcohol, khat, or cigarette) are less likely to have adhered to the counselling provided by the health care providers or colleagues. In addition, these women are economically disadvantaged due to the extra cost of the substances. Therefore, women who are substance users are more likely to be malnourished compared to their counterparts.

In this study, the pregnant women who have not received counselling on the importance of a balanced diet during antenatal care were 75% more likely to be undernourished compared to their counterparts. This finding is in line with studies conducted in eastern Ethiopia (Haji 2016) and Silte zone, southern Ethiopia (Muze et al. 2020). The pregnant women who were not taking extra meals 24 h before the survey were three times more likely to be undernourished than women who were taking extra meals. This finding is consistent with studies conducted in eastern Ethiopia (Haji 2016) and northern Tigray, Ethiopia (Abraham et al. 2015). Similarly, this study also revealed that women who have experienced food restriction during this pregnancy had fourfold greater odds of undernutrition compared to their counterparts. This finding is similar to studies conducted in Wondogenet district, southern Ethiopia (Desalegn 2015). Thus, women who were not taking extra meals with adequate diversity during pregnancy (Bekele et al. 2020) and those women who have experienced food restrictions during pregnancy were more likely to be undernourished compared to their counterparts.

This study revealed that the odds of undernutrition among women with chronic medical problems during or before this pregnancy were six times higher compared to the women without any medical problems. Similarly, HIV-positive women had four times greater odds of undernutrition compared to HIV-negative pregnant women. This study is similar to studies conducted in the Central Refit Valley of Ethiopia (Dibaba 2018) and University of Gondar Hospital, northwest Ethiopia (Gemechu 2018). This could be justified by any chronic or acute medical problems during pregnancy that exposes the pregnant women to undernutrition that in turn have an impact on the health of the mother as well as the newborns. Thus, women with medical problems before and/or during pregnancy are more likely to be undernourished than women without medical problems.

Limitations of the study

This study was facility-based, and the study participants may not represent the general population.

Conclusion

In this study, nearly one-third of pregnant women were undernourished. The multivariable logistic regression analysis showed that being illiterate, living in rural areas, women's substance usage during pregnancy, women not receiving counselling on a balanced diet, having chronic medical issues, not taking extra meals within 24 h, and having food restrictions during this pregnancy were the independent predictors of undernutrition. This study had identified different modifiable risk factors of undernutrition among pregnant women that need strengthening of the strategies and intervention towards the identified factors at regional and national levels. Thus, the regional and national governments should give due attention to women residing in rural areas to get access to education for women in pastoral communities. The health care providers should strengthen the screening of women with medical problems and interventions that improve maternal health during pregnancy. Besides the provision of prenatal dietary counselling on a balanced diet, avoiding food restrictions and encouraging them to take extra meals during pregnancy are recommended to avoid undernutrition among pregnant women in pastoral communities.

Abbreviations
ANC: Antenatal care; AOR: Adjusted odds ratio; COR: Crude odds ratio; CI: Confidence interval; CSA: Central Statistical Agency; EDHS: Ethiopia Demography and Health Survey; ETB: Ethiopian Birr; FMOH: Federal Ministry of Health; HIV: Human immunodeficiency virus; IRB: Institutional Review Board; MDG: Millennium Development Goals; MUAC: Mid-upper arm circumference; UN: United Nations; WHO: World Health Organization.

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Authors' contributions
AG designed the study and was involved in the data collection. AG, ABW, and SBA cleaned and analysed the data, interpreted the results, and drafted the manuscript. SBA revised and finalized the manuscript. The authors read and approved the final manuscript.

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Availability of data and materials
The datasets used during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate
Ethical clearance was obtained from Samara University, College of Medical and Health Science Research Ethical Review Committee (RERC) to assure that no potential risk to participants. After discussing the ultimate purpose and method of the study, a written support letter was sought from local authorities and concerned government officials.
Finally, verbal informed consent was obtained from pregnant women to be involved in this study, and we reassure that anyone not willing to take part in the study had full right to refuse and those involved can also be retired at any time. Confidentiality and anonymity were maintained by avoiding personal identifier utilization during data collection, processing, and analysis.

Consent for publication
Not applicable.

Competing interests
The authors declare that they have no competing interests.

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