Undernutrition and Associated Factors Among Pregnant Women in East Borena Zone, Liban District, Oromia regional state, Ethiopia, 2021

Godana Arero (garero2015@gmail.com)
Oromia Regional Health Bureau

Research Article

Keywords: Undernutrition, wasting, stunting, underweight

Posted Date: September 16th, 2022

DOI: https://doi.org/10.21203/rs.3.rs-2062842/v1

Abstract

Background

Undernutrition is “cellular imbalance between supply of nutrients, energy, and body’s demand to ensure growth, maintenance, and specific function. However, there was no study conducted earlier on this topic in East Borena Zone.

Objective

To assess the prevalence of undernutrition and associated factors among pregnant women in East Borena Zone, Liban district.

Method

A community-based cross-sectional study design was conducted on 420 study participants from November 20 to December 2021. The systematic sampling technique and simple random sampling methods were used to select the study participants. Data were double entered into Epi-info software version 7 and SPSS version 21 software for analysis. Descriptive statistics were used to describe the characteristics of the study participants. Bivariate and multivariable logistic regressions were carried out to identify the association between independent and dependent variables measuring the adjusted odds ratio and 95% confidence interval. P-values less than 0.05 were considered statistically significant.

Results

Prevalence of undernutrition among pregnant women was 44.9% [95%CI: (41.5, 50.1), family monthly income [AOR = 8.72 (4.80, 15.83)], women decision making, autonomy [AOR = 0.40 (0.19, 0.82)], skipping meal [AOR = 2.62 (1.41, 4.89)], substance use, [AOR = 2.01 (1.07, 3.77)], household food insecurity [AOR = 2.01 (1.06, 3.80)], lack of prenatal dietary advices [AOR = 2.73 (1.53, 4.89)], absence of household latrine [AOR = 9.23 (3.48, 24.46)], not participating health development army’s meeting at village level [AOR = 3.01 (1.57, 5.72)] and hand washing habit [AOR = 6.55 (3.02, 14.20)] had shown statistically significant association with undernutrition.

Conclusion

The prevalence of undernutrition among pregnant women was high. Income, women's decision making autonomy, skipping meals, substances use, household food insecurity, lack of prenatal dietary advice, poor hand washing habits, lack of latrine, and not participation in health development army’s meetings were found to be predictors of the undernutrition.

1. Introduction

Globally, undernutrition is an important health concern, predominantly in under-five children and pregnant women. The World Health Organization (WHO) classifies undernutrition as the greatest threat to public health (1) and every country is facing a serious challenge from undernutrition (2,3). In spite of extensive global economic growth in recent decades, maternal undernutrition is highly prevalent in most countries in south-central and southeastern Asia and Sub-Saharan Africa (3–6).

Ethiopia is one of the countries with a high burden of maternal and child undernutrition. Although maternal undernutrition has declined over the past 16 years, from 30% in 2000 to 22% in 2016, Ethiopia is still among the countries with a high burden of maternal undernutrition (7). Specifically, two institution-based cross-sectional studies conducted in the Amhara region reported a prevalence rate of undernutrition ranging from 16% to 29.8% (3, 8).

Maternal undernutrition in low and middle-income countries is an underlining cause of 3.5 million mother's deaths and disabilities due to the physical and mental effects of poor dietary intake in the earliest months of life (7, 9, 10). Previous studies have established that undernourished pregnant women suffer from a combination of chronic energy deficiency that leads them to have a low birth weight (LBW), and preterm and unsuccessful birth outcomes (11–13).

Regardless of significant gains and signs of progress in the last decade, maternal undernutrition still remains a major public health problem in Ethiopia (3,14). The government of Ethiopia has developed a revised national nutrition program in 2016 to address the double burden of undernutrition in pregnant and lactating women (1, 10, 15). Even though the progress of this program implementation needs to be supported with a piece of continuous evidence through research, limited institution-based studies that lack an important variable crucial for prioritizing, designing, and initiating intervention programs have been conducted (8). The objective of this study was, therefore, to assess the magnitude of undernutrition at the community level by including an important variable among pregnant women living in East Borena Zone.

The conceptual framework used for this study was adopted and modified from different literatures (21, 22, 23, 24, 25, 26). Maternal health status is greatly influenced by the dietary diversity and morbidity/physiological status of the mother, which are the immediate causes (Figure 1). When the dietary diversity is poor, it affects the woman's morbidity status as there is reduced immunity and increased chances of developing infections. On the other hand, morbidity status in pregnancy affects dietary diversity either due to poor appetite which leads to only likable foods being selected or some practices such as pica which affect nutrient intake.

2. Methods And Materials

The study was conducted in the East Borena Zone, Liban District, Oromia regional state, Ethiopia from November 20 to December 2021. The 2007 national census reported a total population for this district of

138,813, of which 70,130 were men and 68,683 were women; 1,385 or 1% of its population were urban dwellers. From this, women of child bearing age during the study period was 22,081, and pregnant women 4,170. A community-based cross-sectional study design was done on 420 study participants from November 20 to December 2021. The target population was all pregnant women in the Liban district, East Borena Zone. The source populations for the study were all pregnant women residing in Liban district whereas the study population was randomly selected pregnant women living in the district during the study period. Inclusion criteria was all pregnant women who lived in the district for more than six months, if they had got the chance of being selected.

2.1. Sample size determination and Sampling procedure

The sample size was estimated using a single population proportion formula, considering 46.5% of the prevalence of undernutrition among pregnant women from a study conducted in Jimma Town (28). Other parameters considered were 5% margin of error, 95% CI, 10%, non-response rate.

n = 3.84X 0.465(1- 0.535) = 382

d^2 =(0.05*0.05)

Where n = sample size Zα = Z, value corresponding to a 95% level of significance = 1.96
2

p = expected proportion of practices of mothers on nutrition during pregnancy = 50% =0.5

d = absolute precision (5%).

Therefore, from the above, sample size is = 382

n = 382*10% none-response rate = 38, n = 382 + 38 = **420**

2.2 Sample size determination for second objective:

The sample size for the second objective was calculated using the double population proportion formula using the Stat-Calc of Epi-Info Statistical Software Version 7.0 with the following assumptions: Confidence level = 95%, Power = 80%.

Table 1
Sample size calculation for the second specific objective

Variables	Magnitude		Power CI level	AOR	Sample size	Reference
	Exposed	Non exposed				
Average monthly income of HH	15.83%	4.8%	80%, 95%	8.72	73	(12)
Decision making autonomy of pregnant women	11.09%	1.81%	80%, 95%	2.7	160	(26)
Work load on women	28.8%	6.3%	80%, 95%	13.6	46	(26)
Practice frequent hand washing habits	14.20%	3.02%	80%, 95%	6.55	68	(12)
Educational status	2.91	0.77	80%, 95%	1.50	131	(11,59)

The maximum sample size that was obtained from the general/first objective was 420.This sample was the larger sample size than the sample size calculated from the second specific objective. Therefore, the final sample size that used for this study was the that obtained from the first objective (420).

2.3 Sampling Procedures:

First, kebeles (the lowest governmental administrative structure in Ethiopia) were stratified into urban and rural areas. The sample size was proportionally allocated for each stratum and then, representative pregnant women were randomly selected. A random sampling technique was utilized to select 10 Kebeles out of 35 total Kebeles. Finally, 420 samples were allocated proportionally to each selected Kebeles based on their total number of pregnant mothers. The calculated sample size of 420 study participants were proportionally allocated to randomly selected five health post out of 20 health post in the Liban district and two health centres out of five based on the number of clients attending antenatal care (4) at health post and health centre. Then every seven pregnant women who were register included in the study at each antenatal care unit till the desired sample size is achieved (14).

The dependent variable of this study was the nutritional status of pregnant women. Independent variables were Socio-demographic characteristics of the pregnant women like age, marital status, education, religion, ethnicity, residence area, family size, income, women's decision-making, autonomy, intra-households violence and polygamy. Reproductive, medical, and behavioural characteristics of the study participants like age at first marriage/ pregnancy, trimester of pregnancy, pregnancy intention, gravidity, parity, abortion, inter-pregnancy interval, and recent illness in the past 15 days and substance abuse were independent variables considered in this study. Others were health care, and environmental characteristics such as accessibility to health care, prenatal dietary advice, antenatal care follow-up, drinking water source, and latrine possession. Dietary characteristics of the study participants such as

Minimum Dietary Diversity of women, household food insecurity, improved dietary feeding, skipping meals/snacks, and eating an additional meal are also independent variables included in the study.

2.4 Data collection tools and procedure:

During data collection, face-to-face-interview, observation, anthropometric measurements, and standard structure questionnaires were used to collect data from pregnant women after the interviewers explained the purpose, of the study and obtained the participant's verbal consent to participate in the study. In this study, MDDW was measured by the FAO-2016 standard questionnaire developed for this purpose which is recommended for 24 hour dietary recall. Household food insecurity was measured by the FANTA-2007 standard tool that has nine questions with each comprising 3 responses; 27-score-based HFIAS scale. Undernutrition was measured by MUAC (in cm) on their left arm at the midpoint between tip of the shoulder (olecranon process) and tip of the elbow (acromion process) and, the insertion type of MUAC tape was benonelastic and non-stretchable to take with correct tension (not too loose/tight) with nearest 0.1 cm reading. Age at pregnancy, and interbirth time were approximated to local memorable events. The participants were nutritionally accessed through 24-hour recall. Additionally, anthropometric assessment MUAC measurement was involved. A structured questionnaire was developed and adopted from Mini-EDHS 2019, the food frequency questionnaire, and WHO standard. All the variables to be assessed were incorporated(8).

For data quality control, study instruments were translated into local languages (by native speakers and then back-translated to English by two other competent persons. Six interviewers and two supervisors were recruited for the survey and were trained on the overall data collection process. The six data collectors were BSC midwives and the supervisors were senior public health experts with Master of Public Health degree who were competent in local languages. Completeness and consistency of the data were assured through direct and daily supervision by the supervisors and principal investigator. Interviewers were readministered the questionnaires to the respondent under supervision by the supervisor. To ensure the quality of data, training of data collectors and supervisors were undertaken the questionnaire and, translated into the local language to facilitate understanding of the respondents. In addition to written documentation of responses from study participants, tape recordings were done after obtaining verbal consent to ensure that all feedbacks were captured for analysis.

Data collectors and supervisors were selected based on their educational background (particularly those who have been received training on essential nutrition actions), work position, and experience of data collection. Supervisors and data collectors were trained on the objectives, methods and, data collection techniques of the study. Daily discussions and check-ups of data completeness were made with supervisors and the principal investigator. The data cleaning and entry were conducted exclusively by the principal investigator. The questionnaire was pretested among 5% of the total sample size to assess its clarity, length, completeness, and consistency. After the pretest was conducted, adjustments were done according to enhance the reliability and validity of the tool. The structured questionnaire was then rephrased in light of the responses. Test-retest reliability was established by examining the consistency of pretest responses using, and the three main components of the test-retest method are as follows Test-

retest reliability of the research instrument was established during pretesting. Pretesting was done on two occasions but on the same respondents, on Monday and Friday: assume there is no change in the underlying condition (or trait you were trying to measure) between test 1 and test 2. And finally, compute the correlation between the two separate measurements and if test 1 and test 2 have become consistent, the questionnaire was considered reliable.

The collected data were checked for incompleteness and inconsistency. Data were entered into Epi-Info version 7.2 software then exported to SPSS version-21 for analysis. Prior to running for analysis, data were cleaned, composite indexes were computed, and recorded over missing values, and extreme values were identified and trimmed. Descriptive statistics were used to describe the sample accordingly. Bivariate logistic regression was carried out to assess the association of each independent variable with acute undernutrition and those with p-values less than 0.25 remained in the final model (multivariate logistic regression). Odds Ratios (OR) were generated for each variable and the independence of any association was controlled by entering all variables into the model using the backward stepwise method. The magnitude of the association between the independent variables in relation to acute undernutrition was measured using adjusted odds ratios (AOR) and 95% confidence interval (CI) and P-values below 0.05 were considered statistically significant. Descriptive statistics were used to show socio-demographic characteristics and the prevalence of nutritional status.

Logistic regression analysis was used to identify the association between factors, and the nutritional status of pregnant mothers, and multivariate logistic regressions were performed to determine independent predictors of the nutritional status of pregnant mothers. A p-value < 0.05 was declared as the statistically significant. The VIF, and tolerance taste were checked for the presence of multicolnearity among the independent variables. Stepwise model building strategy with p-value = 0.05 was applied to identify independent predictors of nutritional status, and the Hosmer-Lemeshow Test of Goodness-of-Fit was used to test how well the model explains the data. Adjusted Odds Ratios, and their 95% Confidence Intervals were reported. Additionally; tables and figures were used to present the findings.

3. Results

A total number of 420 pregnant women were interviewed making a response rate of 97.3%. Median ages of the mothers were (18.0 ± 1.2) years. The majority of the respondents were married (96.2%), housewives (75.5%), and residents of rural (78.8%). The Overall Prevalence of undernutrition among pregnant women was 44.9% [95%CI: (41.5, 50.1),

Table 2
Socio-demographic, and socio-economic characteristics of study participants (n = 420), 2021

Characteristics	Categories	Frequency	Percentage (%)
Residence area	Rural	309	78.8
	Urban	83	21.2
Age category in years	± 25	109	27.8
	26–29	96	24.5
	30–33	102	26.0
	≥ 34	85	21.7
Current marital status	Single	3	0.8
	Married	377	96.2
	Widowed	10	2.6
	Other	2	0.5
Educational Level	No formal education	110	28.1
	Primary education	144	36.7
	Secondary education	91	23.2
	Diploma and above	47	12.0
Occupation	Employee	11	2.8
	Private business	15	3.8
	Daily labourer	70	17.9
	Housewife	296	75.5
Family size	≤ 3	127	32.4
	4–6	189	48.2
	>= 7	76	19.4
Household Average monthly income	≤ 2000	126	32.1
	2001–2300	78	19.9
	2301–3000	117	29.8
	≥ 3001	71	18.1
Decision making autonomy	Low	19	4.8
	Medium	166	42.3

Characteristics	Categories	Frequency	Percentage (%)
	High	207	52.8
	Media	392	100.0
Intra households violence practice	No	342	87.2
	Yes	50	12.8

3.1. Reproductive, Medical and Behavioural Characteristics of Respondents

About 90% of pregnancies of women were planned and wanted. Around 85% of women do not had a history of illness, 93% had history of abortion, 79% worked all household jobs alone, and 94.1%) had substance abuse.

Table 3
Reproductive, medical, and behavioral characteristics of pregnant women in Liban District (n = 420), 2021

Characteristics	Categories	Frequency	Percentage (%)
Age at first pregnancy (in year)	≤ 18	98	25.0
	19–20	155	39.5
	≥ 21	139	35.5
Intention Pregnancy	Not Planned and wanted	40	10.2
	Planned and wanted	352	89.8
Parity	≤ 2	214	54.6
	3–4	124	31.6
	≥ 5	54	13.8
Any illness during current pregnancy	Yes	59	15.1
	No	333	84.9
History abortion any type	No	365	93.1
	Yes	27	6.9
Inter pregnancy interval	≤ 18	119	30.4
	19–24	125	31.9
	25–28	60	15.3
	≥ 29	88	22.4
ANC follow-up for current pregnancy	No	127	32.4
	Yes	265	67.6
Months of pregnancy at start ANC	≤ 4	239	61.0
	≥ 5	153	39.0
Work all household jobs alone	No	310	79.1
	Yes	58	14.8
Substance abuse	Substance abused	22	5.6
	No substance abuse	369	94.1

3.2. Dietary Characteristics of Respondents

Prevalence of undernutrition among pregnant women was (44.9%) and the rest were normal nutritional status. The household food security score indicates 103(26.5%) households were food insecure and 288(73.5%) were food insecure. Out of the 391 respondents, 272 (69.4%) took a minimum of six and above diet in the past 24 hours so that they had good minimum dietary diversification. More than three fourth 312(79.6%) pregnant women, had a habit of taking additional meals, and 298(76%) did not skip meals regularly taken meals.

Table 4
Dietary characteristics of pregnant women living in Liban District, (n = 420), 2021

Characteristics	Categories	Frequcy	Percentage (%)
Nutritional status	Under-nourished	30	7.7
	Normal	361	92.3
HFIAS score	Food insecu(< 5)	103	26.5
	Food secure(≥ 5)	288	73.5
Prenatal dietary feeding habits	Unimproved	283	72.2
	Improved	109	27.8
Habit taking additional meals	Yes	312	79.6
	No	79	20.2
Do you ever skip meals during this pregnancy	No	298	76.0
	Yes	94	24.0
Avoid any food	No	256	65.3
	Yes	111	28.3
Habit Eating snack between meal	No	320	81.6
	Yes	33	8.4
Minimum datary diversification for women	≥6	272	69.4
	< 6	120	30.6

A total of 420 study participants, 372 (98.2%) had consumed cereals in the previous 24 hours. The main cereal consumed was teff in the form of injera/ staple food for Ethiopian which is a made up of Teff and certain Barley and, Maize in the area. The vegetables held an integral part of the main meal for the majority of the study participants. More than171(43%) were consumed vegetables,123(84.8%) and, was consumed dark green leafy vegetables, and 124 (32.7%) were consuming other vegetables. An Oils and fat consumption was reported by 300 (76.5%) of the study participants. The white tubers and roots were consumed by 58(14.8%) (Table 4).

Table 4
Dietary characteristics of pregnant women Liban District, (n = 392), 2020

Characteristics	Categories	Frequency	Percentage (%)
Age at first pregnancy (in year)	<= 18	98	25.0
	19–20	155	39.5
	>=21	139	35.5
Intention Pregnancy	Not Planned and wanted	40	10.2
	Planned and wanted	352	89.8
Parity	<= 2	214	54.6
	3–4	124	31.6
	>= 5	54	13.8
Any illness during current pregnancy	Yes	59	15.1
	No	333	84.9
History abortion any type	No	365	93.1
	Yes	27	6.9
Inter pregnancy interval	<=18	119	30.4
	19–24	125	31.9
	25–28	60	15.3
	>= 29	88	22.4
ANC follow-up for current pregnancy	No	127	32.4
	Yes	265	67.6
Months of pregnancy at start ANC	<= 4	239	61.0
	>= 5	153	39.0
Work all household jobs alone	No	310	79.1
	Yes	58	14.8
Substance abuse	Substance abused	22	5.6
	No substance abuse	369	94.1

3.4 Health care and environmental characteristics of respondents:

Around 375(95.7%) pregnant women had access to health care services travelling on foot for less than one hour. Pregnant women 143(79%) were supplied with Iron-Folic Acid tablets during the second and third-trimester of pregnancy. About 270 (70.7%) had a history of using modern contraceptives for at least one year. The 287(71.7%) pregnant women had latrines, hand washing habit, and frequencies were 219 (55.9%).

Table 5
Health care and environmental factors of pregnant women in Liban district, (n = 420), 2021

Characteristics	Categories	Frequency	Percentage (%)
Access to health care	No	17	4.3
	Yes	375	95.7
Prenatal dietary advice	No	356	90.8
	Yes	36	9.2
Iron folic acid tablet supplementation	No	38	21
	Yes	143	79
Modern Contraceptive	No	121	25.8
	Yes	270	70.7
Latrine possession	No	105	25.5
	Yes	287	71.7
Hand washing habit/pattern	Not frequently	173	44.1
	Frequently	219	55.9
Type of drinking water source	Unprotected	85	21.7
	Protected	303	77.3

3.5 Nutritional status and associated factors:

The binary logistic regression analysis was performed for each variable written in the conceptual framework. Accordingly, average monthly income, decision making autonomy, intra-household violence practice, history of any type of abortion, antenatal follow-up, current pregnancy intention, any illness during the current pregnancy, substance use (≥ 1 of these substances), household food security status and type of latrine possessed were negatively associated with undernutrition. After Binary logistic regression analysis, those predictors which showed statistical significance and a p-value less than 0.25 were used in the multivariable logistic regression analyses. In a multiple logistic regression analysis, those who had a gestational age between 25 to 28 months were 5.51 times more likely to be normal nutritional status compared to those who had gestational age above 33 months (AOR = 5.51, 95% CI:

1.27–23.96) and, those respondents who had been following antenatal care were six times more likely to be in normal nutritional status compared to those who had not been following ANC (AOR = 5.95, 95% CI: (1.49 to 23.82). Look at Table six below.

Table 6
Multivariate analysis test for nutritional status of pregnant women

Characteristics	Nutritional Status		P-Value	Odds Ratio (95%CI)	
	Under-Nutrition (MUAC < 23 cm)	Normal (MUAC > = 23 cm)		COR	AOR
Household average monthly income in ETB					
<=2000	18(14.3%)	108(85.7%)	0.00	1	1
2001–2300	2 (2.6%)	76 (97.4%)	0.02	0.17(0.04 to 0.77) *	0.30(0.06 to 1.62)
2301–3000	8(6.8%	109(93.2%	0.92	1.10 (0.15 to 8.03)	2.96(0.31 to 28.18)
>= 3001	2(2.8%	69(97.2%)	0.25	0.39 (0.08 to 1.91)	0.26(0.05 to 1.55)
Intra household violence practice					
Yes	17(34.0%)	33 (66.0%)	0.00	1	1
No	13(3.8%)	329 (96.2%)	0.001	13.4 (5.82 to 29.19)**	18.81(6.34 to55.8)**
Decision making autonomy					
Low	4(21.1%)	15 (78.9%)	0.04	1	1
Medium	13 (7.8%)	153 (92.2%)	0.03	0.25 (0.07 to 0.87) *	0.29 (0.05 to 1.82)
High	13 (6.3%)	194 (93.7%)	0.56	0.79 (0.36 to 1.75)	1.92 (0.62 to 5.95)
Ant type of Abortion					
Yes	5(18.5%)	22(81.5%)	0.003	1	1
No	25(6.8%)	340(93.2%)	0.036	3.09 (1.08 to 8.86)*	4.30(1.08 to 17.17)*
This pregnancy intention					
Planned	9(22.5%)	31 (77.5%)	0.001	0.22 (0.09 to 0.52)**	0.29(0.10 to 0.90)*
Unplanned	21(6.0%)	331 (94%)	0.000	1	1
Any illness during current pregnancy					

Note: * Statistically significant at P value < 0.05.** Statistically significant at P value < 0.01

COR = Crude Odds Ratio, AOR = Adjusted Odds Ratio

Characteristics	Nutritional Status		P-Value	Odds Ratio (95%CI)	
	Under-Nutrition (MUAC < 23 cm)	Normal (MUAC > = 23 cm)		COR	AOR
Yes	9(15.3%)	50(84.7%)	0.000	1	1
No	21(6.3%)	312(93.7%)	0.021	0.37 (0.16 to 0.86)*	0.34(0.10 to 1.09)
Substance use (≥ 1 of these substances)					
Yes	7(31.8%)	15(68.2%)	0.000	1	1
No	22(6.0%)	347(94%)	0.001	0.14 (0.05 to 0.37)**	0.16(0.04 to 0.64)*
Household food security status (HFIAS score)					
Food Secure	17(5.9%)	271(94.1%)	0.034	0.44 (0.21 to 0.94)*	0.65(0.22 to 1.91)
Food Insecure	13(12.5%)	91(87.5%)	0.000	1	1
ANC follow up					
Yes	26(9.8%)	239(90.2%)	0.012	3.35(1.14 to 9.80)*	5.95(1.49 to 23.82)*
No	4(3.1%)	123(96.9%)	0.0	1	1
Type of latrine possessed					
Improved	3(2.8%)	105(97.2%)	0.04	0.27 (0.08 to 0.92)*	0.22(0.05 to 0.90)*
Unimproved	26(9.5%)	246(90.5%)	0.00	1	1
Gestational age					
<=24 Months	4(4.0%)	96(96.0%)	0.53	1	1
25–28 Mo	9(14.0%)	55(56.0%)	0.02	1.92(0.60 to 6.13)	5.51(1.27 to 23.96)*
29–32 Mo	5(7.60%)	61(92.4%)	0.82	0.49(0.20 to 1.22)	1.16(0.32 to 4.41)
>= 33 Mo	12(7.4%)	150(92.6%)	0.13	0.98(0.33 to 2.88)	2.96(0.74 to 11.78)
Note: * Statistically significant at P value < 0.05.** Statistically significant at P value < 0.01					
COR = Crude Odds Ratio, AOR = Adjusted Odds Ratio					

4. Discussions

The study showed that (92.3%) of the women had normal nutrition status, while (44.9%) were undernourished. Average monthly income, decision-making autonomy, intra-household violence practice, history of any type of abortion, antenatal care follow-up, current pregnancy intention, any illness during the current pregnancy, substance use, food security and type of latrine possessed were factors associated with nutritional status. The reasons for normal and undernutrition might be due to study setup and MUAC cut-off points to categorize as normal or undernourished for their nutritional status. This finding is almost consistent with studies conducted in Wondo Genet District in Southern Ethiopia which was 9.2% (24) and, in Rwanda 8.2% (60) of pregnant women were undernourished.

The prevalence of undernutrition was lower than the finding from a cross-sectional study conducted in Gonder Town 14.4% (29), and an institutional-based study in the Gonder District16.2% (30), Gambella 28.6% (27), and rural eastern Ethiopia(61). The prevalence of undernutrition in present study was higher than the finding in Sudan 4.4% (31), and Uganda 6.4%(62). The possible reason for variation is might be due to a difference in study design, and, socio-economic status of women's' decision-making autonomy, and intra-household violence practices during pregnancy were associated with undernutrition status. The pregnant women whose household monthly income of 2001–2300 ETB per month were less likely to be normal in their nutritional status compared to ≤ 3001 ETB (AOR = 0.17, 95%CI: 0.04 to 0.77). This finding is in line with studies conducted in eastern Ethiopia (25), Gumay District, Jimma Zone, South West Ethiopia(12), and rural Bangladesh(14). The pregnant women having medium decision-making autonomy were less likely to be normal in their nutritional status than those with high decision-making autonomy (AOR = 0.25, 95%CI: 0.07 to 0.87). This finding is consistent with studies conducted in Gumay District, Jimma Zone, south-west Ethiopia(12) and, eastern Ethiopia (25), and the University of Gondar Hospital, Northwest Ethiopia (30). In addition, this finding was also consistent with the findings of cross-sectional household studies done in rural India which showed a statistically significant association of maternal autonomy with stunting(63). The above-indicated finding is also in agreement with other studies conducted in India that show a statistically significant association between maternal undernutrition and their autonomy at the household level. The pregnant women with no intra-household violence practice at home compared to those with intra-household violence practice are 13.04 times more likely to be normal in their nutritional status (AOR = 13.04, 95%CI: 5.82 to 29.19).

History of any type of abortion, gestational age, pregnancy intention of any illness during the current pregnancy, and substance use were among the reproductive, medical, and behavioural characteristics of women that were associated with nutritional status. Pregnant women with no history of any type of abortion compared to those with abortion were 3.42 times more likely to be normal in their nutritional status (AOR = 3.42, 95%CI: 0.97 to 11.98). Pregnant women with Gestational age of 25–28 weeks were increased likely hood of to be normal nutritional status by a factor of 5.5 than those who were > = 33 weeks GA (AOR = 5.51, 95%CI: 1.27 to 23.96). Concerning pregnant women, current pregnancy intention, those pregnant women who were not planned for pregnancy were less likely to be normal in their nutritional status than those with planned (AOR = 0.22, 95%CI: 0.09 to 0.52).Concerning pregnant women with history of any illness during current pregnancy, those pregnant woman who were ill were less likely to be normal in their nutritional status than those who were not ill (AOR = 0.37, 95%CI: 0.16 to 0.86). Our

study also showed that pregnant women who used above one type of substance were less likely to be normal in their nutritional status than those who did not use the substance at all (AOR = 0.14, 95%CI: 0.05 to 0.37). The present findings are consistent with the findings of studies conducted in Gumay District, Jimma Zone, South West Ethiopia(12), Eastern Ethiopia (61), data from a systematic review and dose-response meta-analysis (64), and another study conducted on cigarette smoking, alcohol use and adverse pregnancy outcomes(65). In this study the household food security status was also another variable that showed a statistically significant association with pregnant women's nutritional status. Pregnant women with household food security status (HFIAS score), food-insecure pregnant women were less likely to be normal in their nutritional status than those who were food secure (AOR = 0.44, 95%CI: 0.21 to 0.94). This finding is consistent with the findings of studies conducted in the Tigray region(15), Jimma Zone, (12) Gambella (27), and Nepal(19).

Finally, pregnant women, ANC attendants, and households possessing improved latrines were health care and environmental factors of respondents that were associated with nutritional status, those pregnant women who were attending FANC at health facilities were increased likely hood of to be normal nutritional status by a factor of 6 than those who don't attendance FANC (AOR = 5.95, 95%CI: 1.49 to 23.82).Pregnant women of households possessing improved type latrine less likely to have been normal nutritional status in comparison to those having unimproved latrine (AOR = 0.22, 95%CI: 0.05 to 0.90).

Conclusions: In this study, the prevalence of undernutrition among pregnant women was 7.7% and it is interpreted as low magnitude. Average family income of households of the respondents, decision making autonomy of pregnant women at household level, Using Substance, household food insecurity, household average monthly income, women decision making autonomy, intra-household violence practice during the current pregnancy, history of any type of abortion, gestational age, pregnancy intention, of any illness during current pregnancy and substance use, household food security status, pregnant women FANC attendant and household possessing improved type latrine were found to be independent predictors of pregnant mother nutritional status.

Abbreviations And Acronym

AHMC: Adama hospital medical college; AOR; Adjusted Odds Ratio; COR: Crude Odds Ratio; CI: Confidence Interval; CED: Chronic energy deficiency; DHS: Demographic and Health Survey; EDHS: Demographic and Health Survey; FANTA: Food and Nutrition Technical Assistance; FANC: Focused antenatal care; GDP: Gross Domestic Product; GA: Gestational age; HFIAS: Household Food Insecurity Access Scale; IFA: Iron Folic Acid; IUGR: Intra-Uterine Growth Restriction; LBW: Low birth Weight; MDD: Minimum Dietary Diversity; MDDW: Minimum Dietary Diversity-Women; MUAC: Mid-Upper Arm Circumference; NCD: Non-communicable disease; SD: Standard deviation; WDDS: Women Dietary Diversity Score; WRA: Women in Reproductive Age.

Declarations

Ethics approval and consent to participate:

The study was conducted in accordance with the Declaration of Helsinki and approved by the Institutional Review Board of the Oromia Regional Health Bureau: project code: ET.ORHB.REC.0283.235). Permission to conduct the study was secured from Ziway District Health Office, and a permission letter was written to the selected health centre to conduct the study. Oral informed consent was obtained from each study participant after a clear explanation about the benefits and harm of the study. The importance of their participation, the confidentiality of the information, participation was voluntary and refusal to participate has no effect on the subject or any family member.

Consent for publication: “Not applicable”

Availability of data and materials: The dataset used and/or analyzed during the current study are at the hand of principal investigator.

Competing interests: Not applicable

Funding: Not applicable

Author's contributions: conceptualization, proposal development, methodology, data collection, analysis, write-up, project administration, advising, consultation, revision, and edition

Acknowledgment: I would like to acknowledge Oromia Health Bureau, East Borena Zone, Liban district health office, and study participants for their support.

References

1. Infant. & Young Child Nutrition Project.
2. McGuire S. World Health Organization. Comprehensive implementation plan on maternal, infant, and young child nutrition. Geneva, Switzerland, 2014. Adv Nutr. 2015;6(1):134–5.
3. A.M.N.T A RS, D.G.N.G W CL. Assessment of Nutritional Status of Pregnant Women in a Rural Area in Sri Lanka. Trop Agric Res. 2016;27(2):203–11.
4. Ramakrishnan U, Grant F, Goldenberg T, Zongrone A, Martorell R. Effect of women’s nutrition before and during early pregnancy on maternal and infant outcomes: a systematic review. Paediatr Perinat Epidemiol. 2012;26:285–301.
5. Desta M, Akibu M, Mesfin T, Tesfaye M. Dietary Diversity and Associated Factors among Pregnant Women Attending Antenatal Clinic in Shashemane, Oromia, Central Ethiopia: A Cross-Sectional Study. J Nutr Metab. 22:7.
6. Kuche D, Singh P, Moges D, Belachew T. Nutritional status and associated factors among pregnant women in Wondo Genet District, Southern Ethiopia. J Food Sci Eng. 2015;5(2):85–94.

7. Alice M, chung M, Kimberly D, Norma T, Andrews E, Nega A, et al. Determining a Global Mid-Upper Arm Circumference Cutoff to Assess Malnutrition in Pregnant Women. USAID Foof Nutr Tech Assist III Proj; 2016.
8. Desyibelew HD, Dadi AF. Burden and determinants of malnutrition among pregnant women in Africa: A systematic review and meta-analysis. PLoS ONE. 14(9).
9. Loudyi FM, Kassouati J, Kabiri M, Chahid N, Kharbach A, Aguenaou H, et al. Vitamin D status in Moroccan pregnant women and newborns: reports of 102 cases. Pan Afr Med J. 2016; 24.
10. Nana A, Zema T. Dietary practices and associated factors during pregnancy in northwestern Ethiopia. BMC Pregnancy Childbirth. 2018;18(1):183.
11. Kumera G, Gedle D, Alebel A, Feyera F, Eshetie S. Undernutrition and its association with socio-demographic, anemia and intestinal parasitic infection among pregnant women attending antenatal care at the University of Gondar Hospital, Northwest Ethiopia. Matern Health Neonatol Perinatol. 2018;4(1):18.
12. Shiferaw A, Husein G. Acute Under Nutrition and Associated Factors among Pregnant Women in Gumay District, Jimma Zone, South West Ethiopia. J Women's Health Care. 2019;8(459):2167-0420.1000459.
13. Bhutta ZA, Ahmed T, Black RE, Cousens S, Dewey K, Giugliani E, et al. What works? Interventions for maternal and child undernutrition and survival. The lancet. 2008;371(9610):417–40.
14. Hasnat Milton A, Smith W, Rahman B, Ahmed B, Shahidullah SM, Hossain Z, et al. Prevalence and determinants of malnutrition among reproductive aged women of rural Bangladesh. Asia Pac J Public Health. 2010;22(1):110–7.
15. Abraham S, Miruts G, Shumye A. Magnitude of chronic energy deficiency and its associated factors among women of reproductive age in the Kunama population, Tigray, Ethiopia, in 2014. BMC Nutr. 2015;1(1):12.
16. Aviram A, Hod M, Yogev Y. Maternal obesity: Implications for pregnancy outcome and long-term risks–a link to maternal nutrition. Int J Gynecol Obstet. 2011;115:6–10.
17. Black RE, Victora CG, Walker SP, Bhutta ZA, Christian P, De Onis M, et al. Maternal and child undernutrition and overweight in low-income and middle-income countries. The lancet. 2013;382(9890):427–51.
18. Endalifer ML, Tewabe M, Adar AD. Undernutrition and associated factors among pregnant women attending ANC follow up in Alamata general hospital, Northern Region, Ethiopia, 2017. J Nutr Health Food Eng. 2019;9(3):70–8.
19. Acharya SR, Bhatta J, Timilsina DP. Factors associated with nutritional status of women of reproductive age group in rural, Nepal.
20. Agarwal A, Udipi SA. Textbook of human nutrition. 2014.
21. Girma W, Genebo T. Determinants of nutritional status of women and children in Ethiopia. 2002.

22. Devgun P, Mahajan SL, Gill KP. Prevalence of chronic energy deficiency and socio-demographic profile of women in slums of Amritsar city, Punjab, India. Sci Int J Research Health. 2014;2(2):527–32.
23. Tebekaw Y, Teller C, Colón-Ramos U. The burden of underweight and overweight among women in Addis Ababa, Ethiopia. BMC Public Health. 2014;14(1):1126.
24. Kuche D, Singh P, Moges D, Belachew T. Nutritional status and associated factors among pregnant women in Wondo Genet District, Southern Ethiopia. J Food Sci Eng. 2015;5(2):85–94.
25. Kedir H, Berhane Y, Worku A. Magnitude and determinants of malnutrition among pregnant women in eastern E thiopia: evidence from rural, community-based setting. Matern Child Nutr. 2016;12(1):51–63.
26. Belete Y, Negga B, Firehiwot M. Undernutrition and associated factors among adolescent pregnant women in Shashemenne District, West Arsi Zone, Ethiopia: a community-based. J Nutr Food Sci. 2016;6(1):1–7.
27. Nigatu M, Gebrehiwot TT, Gemeda DH. Household Food Insecurity, Low Dietary Diversity, and Early Marriage Were Predictors for Undernutrition among Pregnant Women Residing in Gambella, Ethiopia. Adv Public Health. 2018; 2018.
28. Goshu H, Teshome MS, Abate KH. Maternal dietary and nutritional characteristics as predictor of newborn birth weight in Jimma Town, Southwest Ethiopia, 2017. J Public Health Epidemiol. 2018;10(5):155–64.
29. Alemayehu MS, Tesema EM. Dietary practice and associated factors among pregnant women in Gondar Town North West, Ethiopia, 2014. Int J Nutr Food Sci. 2015;4(6):707–12.
30. Kumera G, Gedle D, Alebel A, Feyera F, Eshetie S. Undernutrition and its association with socio-demographic, anemia and intestinal parasitic infection among pregnant women attending antenatal care at the University of Gondar Hospital, Northwest Ethiopia. Matern Health Neonatol Perinatol. 2018;4(1):18.
31. Elmugabil A, Rayis DA, Abdelmageed RE, Adam I, Gasim GI. High level of hemoglobin, white blood cells, and obesity among Sudanese women in early pregnancy: a cross-sectional study. Future Sci OA. 2017;3(2):FSO182.
32. Adinma JIB, Umeononihu OS, Umeh MN. Maternal nutrition in Nigeria. Trop J Obstet Gynaecol. 2017;34(2):79–84.
33. Ibrahim HK, El Borgy MD, Mohammed HO. Knowledge, attitude, and practices of pregnant women towards antenatal care in primary healthcare centers in Benghazi, Libya. J Egypt Public Health Assoc. 2014;89(3):119–26.
34. Loaiza E. Maternal nutritional status. DHS Comparative Studies No. 24. Calverton Md Macro Int Inc.; 1997.
35. Teller CH, Yimer G. Levels and determinants of malnutrition in adolescent and adult women in Southern Ethiopia. Ethiop J Health Dev. 2000;14(1):57–66.

36. United Nations Children's Fund NY. Strategy for Improved Nutrition of Children and Women in Developing Countries. A UNICEF Policy Review. ERIC Clearinghouse; 1990.
37. Getaneh T, Assefa A, Tadesse Z. Protein-energy malnutrition in urban children: prevalence and determinants. Ethiop Med J. 1998;36(3):153–66.
38. Genebo T, Girma W, Haider J, Demissie T. The association of children's nutritional status to maternal education in Zigbaboto, Guragie Zone, Ethiopia. Ethiop J Health Dev. 1999;13(1):55–61.
39. Aguillon DB, Caedo MM, Arnold JC, Engel RW. The relationship of family characteristics to the nutritional status of pre-school children. Food Nutr Bull. 1982;4(4):1–8.
40. Popkin BM, Bisgrove EZ. Nutrition and Urbanization (Part 2): Urbanization and Nutrition in Low-Income Countries. Food Nutr Bull. 1988;10(1):1–22.
41. Service GS, Demographic MI, Surveys H. Ghana demographic and health survey, 1998. Ghana Statistical Service; 1999.
42. Yimer G. Malnutrition among children in Southern Ethiopia: Levels and risk factors. Ethiop J Health Dev. 2000; 14(3).
43. Regassa N, Stoecker BJ. Contextual risk factors for maternal malnutrition in a food-insecure zone in southern Ethiopia. J Biosoc Sci. 2012;44(5):537–48.
44. Begum S, Sen B. Maternal Health. Child Well-Being and Chronic Poverty: Does Women's, Agency Matter? Bangladesh Dev Stud. 2009; 69–93.
45. Leslie J. Women's work and child nutrition in the Third World. World Dev. 1988;16(11):1341–62.
46. Taddese Z, Larson CP, Hanley JA. Anthropometric status of Oromo women of childbearing age in rural southwestern Ethiopia. Ethiop J Health Dev EJHD. 1998; 12(1).
47. Ferro-Luzzi A, Scaccini C, Taffese S, Aberra B, Demeke T. Seasonal energy deficiency in Ethiopian rural women. Eur J Clin Nutr. 1990;44:7–18.
48. Shetty PS, James WP. Body mass index. A measure of chronic energy deficiency in adults. FAO Food Nutr Pap. 1994;56:1–57.
49. Unit WM. Poverty situation in Ethiopia. Minist Econ Dev Co-Oper Addis Ababa; 1999.
50. Gedefaw L, Ayele A, Asres Y, Mossie A. Anaemia and associated factors among pregnant women attending antenatal care clinic in Walayita Sodo town, Southern Ethiopia. Ethiop J Health Sci. 2015;25(2):155–64.
51. Muchemi OM, Echoka E, Makokha A. Factors associated with low birth weight among neonates born at Olkalou District Hospital, Central Region, Kenya. Pan Afr Med J. 2015; 20(1).
52. Mondal B, Tripathy V, Gupta R. Risk factors of Anemia during pregnancy among the Garo of Meghalaya, India. J Hum Ecol. 2006;14:27–32.
53. Nguyen PH, Sanghvi T, Kim SS, Tran LM, Afsana K, Mahmud Z, et al. Factors influencing maternal nutrition practices in a large scale maternal, newborn and child health program in Bangladesh. PLoS ONE. 2017;12(7):e0179873.

54. Demographic CE. Health Survey-2011. Central Statistical Agency Addis Ababa. Ethiopia ICF International Calverton, Maryland, USA. 2012. 2016.
55. UNICEF. Progress for children: a report card on maternal mortality. UNICEF; 2008.
56. Shetty PS, James WP. Body mass index. A measure of chronic energy deficiency in adults. FAO Food Nutr Pap. 1994;56:1–57.
57. Delbiso TD, Rodriguez-Llanes JM, Altare C, Masquelier B, Guha-Sapir D. Health at the borders: Bayesian multilevel analysis of women's malnutrition determinants in Ethiopia. Glob Health Action. 2016;9(1):30204.
58. Lume woreda. health office performance report of HMIS Indicaters of 2018.
59. Ferede A, Lemessa F, Tafa M, Sisay S. The prevalence of malnutrition and its associated risk factors among women of reproductive age in Ziway Dugda district, Arsi Zone, Oromia Regional State, Ethiopia. Public Health. 2017;152:1–8.
60. Zgheib C, Matta J, Sacre Y. Evaluation of Food Behaviour and Nutritional Status of Pregnant Women Resident in Keserwan. J Preg Child Health. 2017;4(331):2.
61. Kedir H, Berhane Y, Worku A. Khat chewing and restrictive dietary behaviors are associated with anemia among pregnant women in high prevalence rural communities in eastern Ethiopia. PLoS One. 2013; 8(11).
62. UBOS I. International Inc. Uganda Demographic and Health Survey 2011. Kampala Uganda. 2012.
63. Oakley L, Baker CP, Addanki S, Gupta V, Walia GK, Aggarwal A, et al. Is increasing urbanicity associated with changes in breastfeeding duration in rural India? An analysis of cross-sectional household data from the Andhra Pradesh children and parents study. BMJ Open. 2017;7(9):e016331.
64. Chen L-W, Wu Y, Neelakantan N, Chong MF-F, Pan A, van Dam RM. Maternal caffeine intake during pregnancy is associated with risk of low birth weight: a systematic review and dose-response meta-analysis. BMC Med. 2014;12(1):174.
65. Cogswell ME, Weisberg P, Spong C. Cigarette smoking, alcohol use, and adverse pregnancy outcomes: implications for micronutrient supplementation. J Nutr. 2003;133(5):1722S–1731S.

Figures

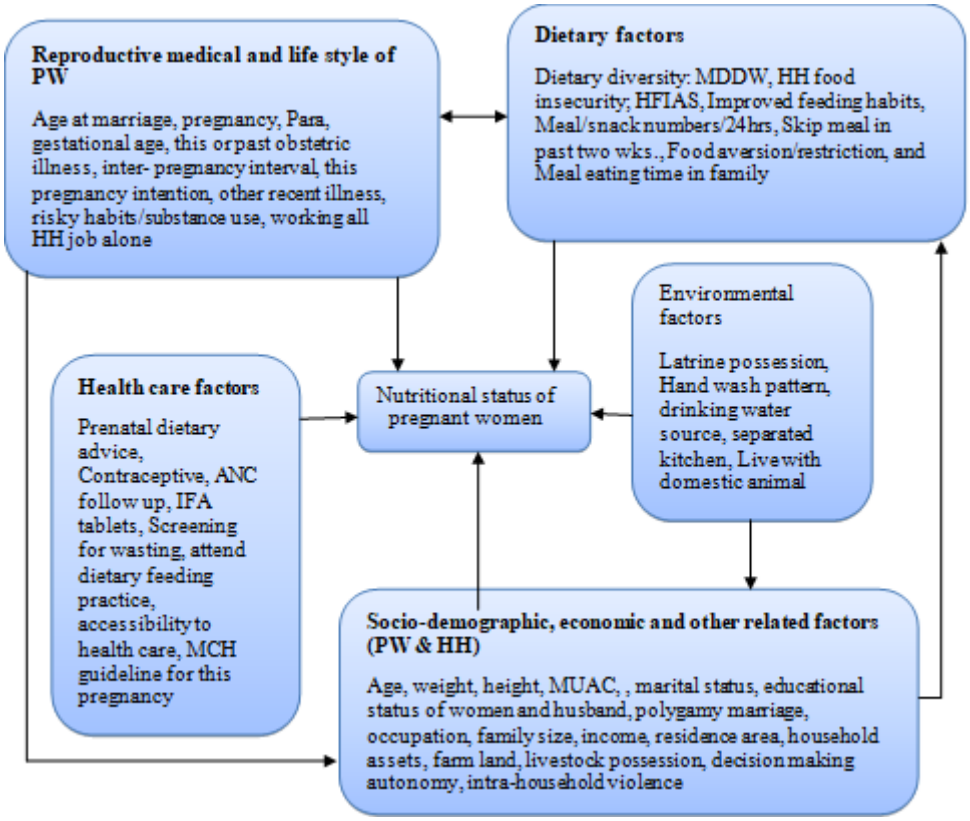

Figure 1

Conceptual framework adopted by PI from read literature, 2019 (6,12,30)

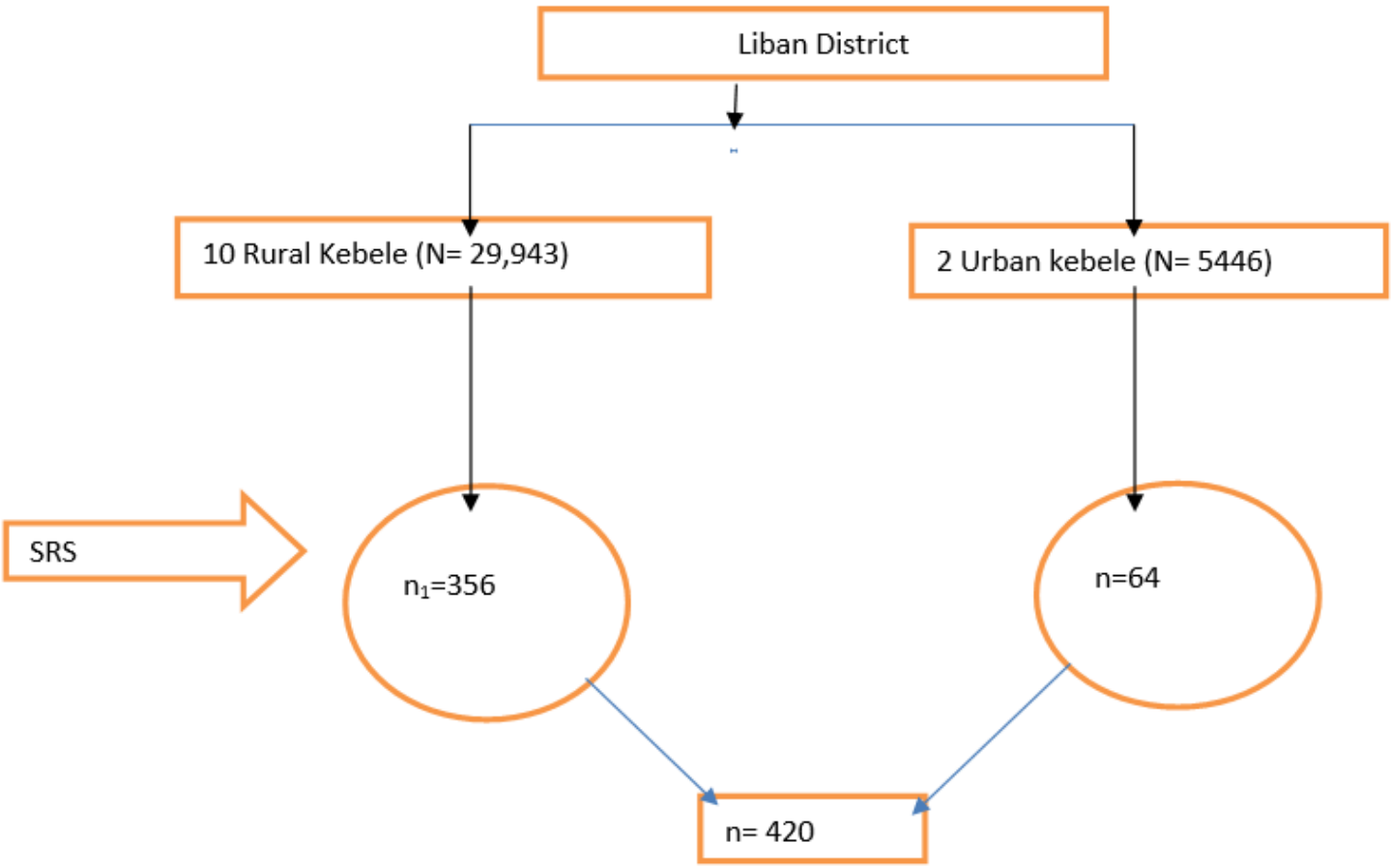

Figure 2

Sampling scheme for study on nutritional status and associated factors among pregnant women in Liban District, East Borena Zone, Oromia regional state,Ethiopia 2020(12).

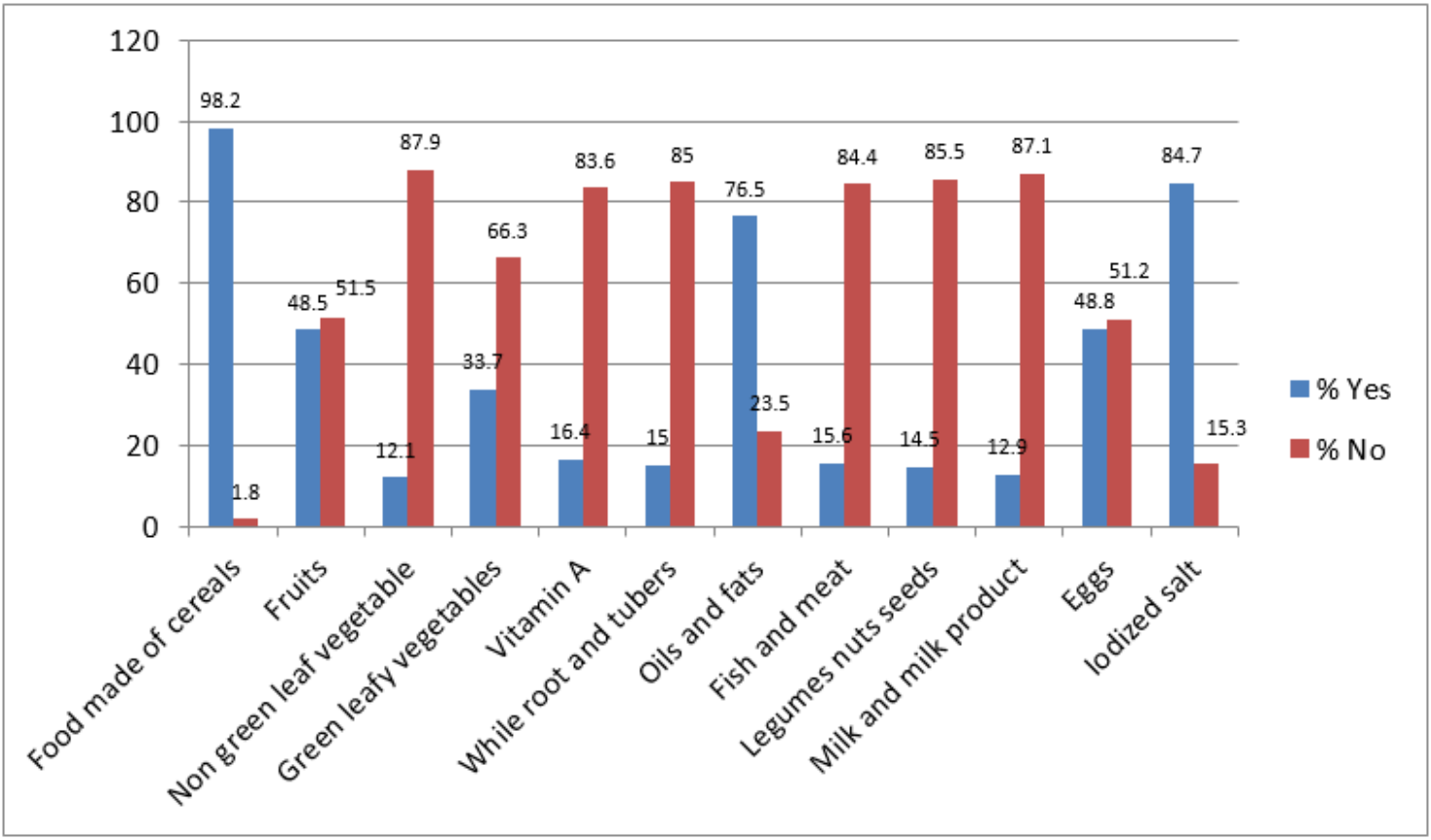

Figure 3

Shows dietary intake of pregnant women during the previous 24-hours period (yesterday day and night), Liban District, East Borena Zone, Oromia regional state, Ethiopia, 2020(n=392)

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- SupplementaryMaterials.docx
- SupplementaryFile.doc