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Determinants of underweight among lactating mothers in public health facilities, Siraro District, Southern Ethiopia: unmatched case–control study

Tuke Gizachew¹, Bikila Lencha^{2*}, Girma Beressa³ and Biftu Geda²

Abstract

Background Ethiopia is reported to have one of the highest prevalence of underweight among lactating mothers in Africa. In our study setting, the nutritional report from the district health office showed a high number of underweight lactating mothers and recurrent malnutrition problems. However, the determinants of underweight among lactating mothers were not well understood in our study setting. The study aimed to assess the determinants of underweight among lactating mothers in public health facilities of Siraro District, Southern Ethiopia.

Methods Unmatched case control study was conducted among 390 (130 cases and 260 controls) lactating mothers in public health facilities of Siraro District from April 30 to May 30/2022. Cases were lactating mothers with BMI < 18.5 kg/m² and controls were mothers whose BMI was ≥ 18.5 kg/m². To identify the determinants of underweight, bivariate and multivariable binary logistic regression analysis were carried out. The final model was interpreted using adjusted odds ratio (AOR), along with a 95% confidence interval (CI). Significance was declared at *p*-value < 0.05.

Result Multivariable logistic regression analysis revealed that having; antenatal care visits [AOR = 0.43, 95% CI (0.26, 0.72)], latrine availability [AOR = 0.50, 95% CI (0.27, 0.93)], poor food consumption score [AOR = 5.40, 95% CI (3.15, 9.27)], inadequate dietary diversity score [AOR = 1.66, 95% CI (1.20, 2.78)], medium [AOR = 3.34, 95% CI (1.52, 7.33)] and poor wealth index [AOR = 6.32, 95% CI (3.12, 12.81)] were significantly associated with being underweight among lactating mothers.

Conclusion Antenatal care visits, latrine availability, poor food consumption scores, inadequate dietary diversity score, medium and poor wealth index were the determinants of underweight. A multi-sectoral approach focusing on latrine construction, economic empowerment and food diversification, as well as ongoing awareness creation, is essential to increase the nutritional status of lactating mothers and break the vicious cycle of malnutrition.

Keywords BMI, Dietary diversity score, Food consumption score, Lactating mother, Underweight

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Introduction

According to the World Health Organization (WHO), adult underweight is defined as a BMI of <18.5 kg/m² [22]. Underweight is a form of under-nutrition and is an indicator of both acute and chronic malnutrition [32]. If the nutritional demand during lactation is not met, breast milk composition and production are negatively affected leading to increased risk for child morbidity and mortality [15]. Although largely preventable, underweight is a major public health problem worldwide, accounting for 45% of all maternal deaths and the underlying cause of more than 100,000 women's deaths each year [24].

Low energy levels and reduced cognitive abilities are common among lactating mothers, due to this reason they always face difficult to give adequate care for their young children. This is why underweight is transferred from one generation to another, and the vicious cycle of under nutrition continues from child to adulthood [30]. Growth of the children born of underweight lags behind in subsequent years because of diminished immune status and remains vulnerable to infections and poor performance in school [13].

Even though under-weight is largely preventable, it remained a severe public health problem globally accounting for half of all maternal deaths [24]. Underweight is common in lactating women in low-income countries [6]. Ethiopia is also one of the sub-Saharan Africa (SSA) country with the highest prevalence of underweight among lactating women contributing about 22% of underweight [14]. Prevalence of underweight among lactating mothers in Ethiopia ranged from 14.1% in Dodata District [17], to 32.8% in Afar Region [25].

Socio-demographic and economic factors, obstetric factors, nutritional factors and environmental factors were identified as determinants of underweight among lactating mothers in Ethiopia and SSA [4, 5, 8, 12, 15, 16, 23, 28, 31, 34]. However, the factors may vary from place to place, depending on culture and geographical location. It is important to conduct site-specific studies to identify any differences in the determinants of underweight among breastfeeding mothers.

Underweight, breastfeeding women are unable to perform physical labour, are less likely to attend school and suffer economic losses. Africa and Asia lose 11% of their gross domestic product each year due to poor nutrition [21]. The National Nutrition Program II set a target of reducing low BMI to 16% by 2020 [1]. Despite the Ethiopian government's effort to reduce maternal malnutrition, maternal underweight is still a significant public health problem in the country.

Despite the growing number of studies reporting the prevalence of maternal underweight [2, 6, 17, 28], very few studies have highlighted the determinants of

underweight among lactating mothers in Ethiopia [3, 30]. In our study setting, the nutritional report of the district health office showed a high number of malnutrition cases and recurrent attack of malnutrition problems [26]. However, the determinants of underweight in lactating mothers have not been addressed in our setting. Thus, we aimed to identify the determinants of underweight among lactating mothers in Siraro District of Southern Ethiopia.

Methods

Study setting and period

The facility-based unmatched case control study was conducted among lactating mothers in Siraro District, Oromia Regional State, South Ethiopia from April 30 to May 30/2022. The District is located 72 km West of Shashamane town and about 330 km from Addis Ababa, the capital city of Ethiopia. The District has an area of 1312.855 square kilometers and has been experiencing erratic rain-fall and a late start to the autumn rains, which affect the food security situation in the area. At present the District has 1 District hospital, 6 health centers, 32 health posts, 11 private clinics and 4 drug stores [26].

Study population

All lactating mothers who visited Siraro District public health facilities were our source population. All lactating mothers who visited Siraro District public health facilities during the study period were our study population. Cases were defined as lactating mothers who had a BMI <18.5 kg/m² during the study period from the selected health facilities where as controls were lactating mothers who had a BMI ≥ 18.5 kg/m² during the study period from the selected health facilities.

Inclusion and exclusion criteria

For cases, all lactating mothers who had a BMI <18.5 kg/m² and gave birth before six weeks prior to the study period and were able to give oral consent were included in the study, while for controls, all lactating mothers who had a BMI ≥ 18.5 kg/m² and gave birth before six weeks prior to the study period and were able to give oral consent were included in the study. Two controls were selected for each underweight mother on the same day as the cases. Non-lactating mothers and those with hearing impairment or physical deformities were excluded from the study.

Sample size determination and sampling technique

Sample size was calculated using Epi-info-7 using the assumption of 95% confidence level, 80% power, control to case ratio of 2:1, age of the mother at first pregnancy

was taken from the study conducted in Dangila District, Ethiopia [3] and 10% non-response rate, the final sample size was estimated to be 390 (130 cases and 260 controls) lactating mothers.

There are seven public health facilities that give health service for the peoples living in Siraro District (one District hospital and six health centers). From these facilities, 30% of them (3 health centers) were selected by lottery method. Based on the annual child immunization report from selected facilities, population proportion to sample size allocation was made to each selected health facilities. All lactating mothers who had a child age from 6 weeks to 23 months old who visited health facilities for maternal and child health services were consecutively screened for their nutritional status during entry to the service points. Based on the eligibility criteria, lactating mothers with BMIs of $<18.5 \text{ kg/m}^2$ were designated as cases and mothers with BMIs of $\geq 18.5 \text{ kg/m}^2$ were designated as controls. As the case was identified, two controls were taken consecutively on the same day as the cases. If more than 2 eligible controls were found at the same time, then two of them were randomly selected.

Data collection tool and procedures

An interviewer-administered structured questionnaire was developed after reviewing relevant related literatures [17, 18, 29, 30]. To ensure consistency, the questionnaire was written in English, translated into the local language (Afaan Oromo), and then translated back into English by language experts. The questionnaire included sections on socio-demographic and economic factors, obstetric factors, environmental factors, and nutritional factors. A battery-powered digital scale and wooden height board were used for the measurement of weight and height, respectively. Four trained BSc nurses were recruited for data collection and one BSc nurse was recruited for supervision based on their previous experience with data collection.

Variable measurement

Weight was measured using calibrated battery-powered digital scale and the reading was taken to the nearest 0.1 kg. Height was measured using height board scale and the respondents were asked to erect upright on bare-foot, the reading measurement was taken to the nearest 0.1 cm. Body mass Index was simultaneously computed using WHO BMI Calculator for each respondent. Then, those who had BMI $<18.5 \text{ kg/m}^2$ were classified as cases and those who had BMI $\geq 18.5 \text{ kg/m}^2$ were classified as controls according to WHO BMI classification.

Independent variables were categorized as follows: age (<25 , $25\text{--}32$ & >32 years), residence (urban & rural), marital status (married & live with partner, live

alone), occupational status (housewife & others), ethnicity (Oromo, Amhara, Hadya & other), educational status (no formal education, primary & secondary), household head (husband & wife), wealth index (poor, medium & rich), parity (≤ 3 , $4\text{--}5$ & ≥ 6), ANC follow up (yes & no), place of delivery (home & health facility), PNC service (yes & no), birth interval (<24 months & ≥ 24 months), exclusive breast feeding (yes & no), duration of breast feeding (≥ 2 years & <2 years), age at first pregnancy (<18 & ≥ 18 years), nutritional counseling (yes & no), food consumption score (poor & good), dietary diversity score (inadequate & adequate), latrine availability (yes & no), water source (unimproved & improved), waste disposal area (open field, in the garden & pit).

Operational definition

Dietary diversity score

Is the sum of 9 food groups eaten by the mother over the last 24 h prior to interview, serves as a proxy indicator of nutrient adequacy. Nutrient adequacy was classified as inadequate dietary diversity (mean value <5.74) and adequate dietary diversity (≥ 5.74) based on the 9 food groups recommended by the Food and Agricultural Organization (FAO) [19]. Dietary diversity score measurement is validated in Ethiopian context.

Food consumption score

Is a score calculated using the frequency of consumption of 9 food groups consumed by the mother during the 7 days before the day of interview. Mothers whose food consumption score (FCS) was less than the mean (<46.5) were considered as poor FCS and those who had FCS of greater than or equal to the mean were categorized as having good FCS (mean ≥ 46.5). The reliability of FCS question was checked by the Cronbach's alpha and it was estimated to be 0.647.

Improved water source

Includes piped household water connection inside the users dwelling, public taps or standpipes, tube wells or boreholes, protected dug wells, protected springs and rainwater collection [11].

Improved toilet facility

Includes flush or pour-flush to a piped sewer system, septic tank or pit latrine, ventilated improved pit latrine, pit latrine with slab, and composting toilet [11].

Wealth index

We considered both productive and non-productive assets of the household and twenty two variables were selected and explored for assumptions of principal component analysis (PCA). The assumptions were

checked using measure of sampling adequacy and Kaiser–Meyer–Olkin (KMO) was (≥ 0.5), Bartlett's test of sphericity ($p < 0.05$) and anti-image correlation (> 0.4). Variables with communalities less than 0.5 and correlations > 0.4 in more than one component were removed after further iteration because of their exhibited complex structure. Nine variables had eigen value greater than 1 and collectively explained the variance in the set of variables were computed for further analysis. Wealth index was divided in to tertiles as poor, medium and rich for the purpose of analysis.

Data quality control

The anthropometric measurements for weight and height were calibrated daily before the commencement of next day's activities. Data collectors and a supervisor were given training for two days about the objectives of the study, methods of data collection and anthropometric measurements. Pretest was done in FandeEjersa Health center and necessary amendments were made before actual data collection was commenced. The questionnaire was checked daily to ensure completeness and consistency of the data. Reliability of the tool for food consumption and dietary diversity related question was checked using cronbach's alpha and it was found to be 0.647 and 0.72, respectively.

Data processing and analysis

The data were checked manually, coded and entered into Epi-Data version 3.1 and exported to SPSS version 23 for analysis. Outcome variable was dichotomized into 1=cases and 0=controls. The descriptive statistics were used to describe the characteristics of lactating mothers. The Chi-square test was used to compare the proportion of cases and controls between selected categorical variables and it was reported along its corresponding p -value. Bivariate logistic regression analysis was run for each explanatory variable and variables with $p < 0.25$ in bivariate logistic regression analysis were entered in to multivariable logistic regression model to control potential confounding effects. Multicollinearity was checked using variance inflation factor (VIF) and it was less than 10 for all independent variables. The fitness of the model was checked using Hosmer and Lemeshow goodness of fit test and it was fit with P -value of 0.067. In the model, adjusted odds ratio (AOR), along with its corresponding 95% confidence interval (CI) was used to estimate the strength of the association. Statistical significance was declared at p -value < 0.05 . Finally, the results were reported using text, table and figures.

Results

Socio-demographic and economic characteristics

All cases (130) and controls (260) were included in the study with a response rate of 100%. The mean (SD) ages of cases and controls were 29.41 (± 3.21) and 29.45 (± 3.25) years, respectively. There was no significant difference between cases and controls in terms of their age (P -value = 0.72). Most cases 120 (92.4%) and controls 219 (83.9%) lived in rural area. Less than half, 101 (44.7%) of cases and more than half 125 (55.3%) of the controls had no formal education. More than two thirds 88 (67.7%) of the cases were in the poor wealth quintiles whereas only 111 (42.7%) of the controls were in that quintiles (Table 1).

Obstetric history of lactating mothers

More than half of the cases 75 (57.7%) and controls 136 (52.3%) were para four to five. Most of the cases 78 (60%) had no ANC follow up while more than two third of controls 180 (69.2%) had ANC follow up. Most cases, 58 (44.6%) gave birth at home compared to controls 64 (24.6). More than 7 in 10 mothers 282 (72.3%) received postnatal care; 78 (60%) of cases and 204 (78.5%) of controls (Table 2).

Nutritional status of lactating mothers

More than half 53 (40.5%) of the cases and 138 (53.1%) of the controls had adequate dietary diversity score. Less than half of cases 54 (41.5%) and slightly more than half of controls 133 (51.2%) had received nutritional counseling. Similarly, 53 (40.5%) of cases and 138 (53.1%) of controls had adequate dietary diversity. More than one in four cases 37(28.5%) and 162(62.3%) of controls had good food consumption score (Table 3).

Environmental factors of lactating mothers

Seven out of ten cases, 91(70%) of the cases and 229 (88.1%) of the controls had access to latrine. Half of cases, 66(50.7%) and slightly less than three fourth of controls 191(73.4%) had used unimproved water source for drinking. More than half of cases, 77(59.2%) and 140(53.8%) of controls had used open field waste disposal.

Determinants of underweight among lactating mothers

Eighteen variables were checked in bi-variable logistic regression analysis for association at p -value of < 0.25 and 12 of the variables were candidate for multivariable analysis. These variables were residence, occupation status, educational status, wealth index, ANC follow up, place of delivery, PNC, latrine availability, waste

Table 1 Socio-demographic and economic characteristic of lactating mothers at Siraro District, West Arsi zone, 2022

Variables	Category	Case status		X ²	P-value
		Case (%)	Control (%)		
Age	< 25	16 (12.3)	29 (11.2)	0.64	0.72
	25–32	89 (68.5)	188 (72.3)		
	> 32	25 (19.2)	43 (16.5)		
Residence	Urban	10(7.6)	42(16.1)	5.37	0.020
	Rural	120(92.4)	219(83.9)		
Marital status	Married and live with partner	125(96.1)	250(96.2)	0.01	1.00
	Live alone	5(3.8)	10(3.9)		
Occupation	House wife	121(93.1)	206(79.2)	12.26	< 0.01
	Others*	9(6.9)	54(20.8)		
Ethnicity	Oromo	75(57.7)	154(59.2)	0.64	0.88
	Amhara	7(5.4)	16(6.2)		
	Hadya	36(27.7)	63(24.2)		
	Other**	12(9.2)	27(10.4)		
Education	No formal education	101(44.7)	125(55.3)	31.27	< 0.01
	Primary	22(18.3)	98(18.3)		
	Secondary	7(15.9)	37(84.1)		
HH head	husband	125(96.1)	250(96.2)	0.001	1.00
	woman	5(3.8)	10(3.9)		
Wealth index	Poor	88(67.7)	111(42.7)	44.51	< 0.01
	Medium	27(20.8)	98(37.7)		
	Rich	15(11.5)	51(19.6)		

Others* = daily laborer, private employee

Other** = Gurage, Wolayita HH- household

Table 2 Obstetric related characteristics of lactating mothers at Siraro District, West Arsi zone, 2022

Variables	Category	Case status		X ²	p-value
		Case (%)	Control (%)		
Parity	< / = 3	25(19.2)	57(21.9)	1.012	0.60
	4–5	75(57.7)	136(52.3)		
	> / = 6	30(23.1)	67(25.8)		
ANC follow up	Yes	52(40)	180(69.2)	30.72	< 0.01
	No	78(60)	80(30.8)		
place of delivery	Home	58(44.6)	64(24.6)	16.13	< 0.01
	Health Facility	72(55.4)	196(75.4)		
PNC Service	Yes	78(60)	204(78.5)	14.75	< 0.01
	No	52(40)	56(21.5)		
Birth interval	< 24 months	93(71.5)	198(76.2)	.975	.324
	> = 24 months	37(28.5)	62(23.8)		

ANC Antenatal care, PNC post natal care

disposal area, nutritional counselling, food consumption score and dietary diversity score.

In the multi-variable logistic regression analysis; ante-natal care visits [AOR = 0.43; 95% CI: (0.26, 0.72)], latrine

availability [AOR = 0.50; 95% CI: (0.27, 0.93)], poor food consumption score [AOR = 5.40; 95% CI: (3.15, 9.27)], poor dietary diversity score [AOR = 1.51; 95% CI: (1.88, 2.59)], being in poor [AOR = 6.32; 95% CI: (3.12, 12.81)] and medium wealth index [AOR = 3.34; 95% CI: (1.52, 7.33)] were significantly associated with maternal underweight among lactating mothers (Table 4).

Discussion

The present study aimed to assess the determinants of underweight among lactating mothers in Siraro District, Southern Ethiopia. Determinants of underweight among lactating mothers identified were: ANC visit, latrine availability, poor food consumption score, poor dietary diversity score, poor and medium wealth status of mothers. This finding highlights the importance of integration of water, sanitation and hygiene (WASH), nutrition, and economic empowerment for the improvement of maternal nutritional status among lactating mothers.

ANC follow up reduced the odds of being underweight by half among lactating mothers compared to those who didn't attend ANC. This finding is similar to the study conducted at Debre Tabor General Hospital, North central Ethiopia which showed that women who had regular

Table 3 Nutritional related characteristics of lactating mothers at Siraro District, West Arsi zone, 2022

Variables	Category	Case status		X ²	p-value
		Case (%)	Control(%)		
Exclusive breast feeding	Yes	98(75.4)	108(41.5)	39.84	< 0.01
	No	32(24.6)	152(58.5)		
Duration of breast feeding	> / = 2 years	59(45.4)	106(40.8)	0.75	0.38
	< 2 years	71(54.6)	154(59.2)		
Age at first pregnancy	< 18 years	13(10.0)	16(6.2)	1.86	0.17
	> = 18 years	117(90.0)	244(93.8)		
Nutritional counseling	Yes	54(41.5)	133(51.2)	3.21	0.07
	No	76(58.5)	127(48.8)		
Food Consumption Score	Poor	93(71.5)	98(37.7)	39.7	< 0.01
	Good	37(28.5)	162(62.3)		
Dietary diversity score	Inadequate	75(49.3%)	77(50.7%)	4.6	0.03
	Adequate	185 (77.7)	53 (22.3)		

Table 4 Determinants of underweight among lactating mothers at Siraro District, West Arsi zone, 2022

Variables	Category	Case status		COR(95%:CI)	AOR(95%:CI)
		Case (%)	Control (%)		
Residence	Urban	10(7.6)	42(16.1)	1	
	Rural	120(92.4)	219(83.9)	2.31(1.12,4.77)	1.04(0.39,2.76)
Occupational status	house wife	121(93.1)	206(79.2)	3.52(1.68,7.39)	1.84(0.76,4.45)
	Others*	9(6.9)	54(20.8)	1	1
Educational status	No formal education	101(44.7)	125(55.3)	4.27(1.82,9.99)	1.6(0.56,4.36)
	Primary education	22(18.3)	98(18.3)	1.19(0.47,3.01)	0.73(0.24,2.21)
	secondary education	7(15.9)	37(84.1)	1	1
ANC follow up	Yes	52(40)	180(69.2)	0.30(0.19,0.46)	0.43(0.26,0.72)**
	No	78(60)	80(30.8)	1	
place of delivery	Home	58(44.6)	64(24.6)	2.47(1.58,3.86)	1.74(0.97,3.10)
	Health Facility	72(55.4)	196(75.4)	1	1
PNC Service	Yes	78(60)	204(78.5)	0.41(0.26,0.65)	0.76(0.22,2.58)
	No	52(40)	56(21.5)	1	
Nutrition counseling	Yes	54(41.5)	133(51.2)	0.68(0.44,1.04)	1.26(0.65,2.43)
	No	76(58.5)	127(48.8)	1	
latrine availability	Yes	91(70.00)	229(88.1)	0.32(0.19,0.54)	0.50(0.27,0.93)**
	No	39(30)	31(11.9)	1	1
Waste disposal area	Open field	77(59.2)	140(53.8)	3.39(1.37,8.39)	2.41(0.87,6.71)
	In the garden	47(36.2)	83(31.9)	3.49(1.37,8.88)	1.75(0.61,5.01)
	Pit	6(4.6)	37(14.2)	1	
FCS	Poor	93(71.5)	98(37.7)	4.16(2.63,6.56)	5.40(3.15,9.27)**
	Good	37(28.5)	162(62.3)	1	1
DDS	Inadequate	76(58.5)	122(46.9)	1.59(1.04,2.44)	1.66(1.20,2.78)**
	Adequate	54(41.5)	138(53.1)	1	1
Wealth index	Poor	88(67.7)	111(42.7)	6.92(3.75,12.78)	6.32(3.12,12.81)**
	Medium	27(20.8)	98(37.7)	3.63(1.78,7.38)	3.34(1.52,7.33)**
	Rich	15(11.5)	51(19.6)	1	1

AOR adjusted odds ratio, COR crude odds ratio, DDS dietary diversity score, FCS food consumption score

** -significant at p-value < 0.05 1- Reference category Maximum VIF = 5.05

ANC follow up were less likely to be underweight [12]. Similar findings were reported in Angecha District, KembataTembaro Zone and Afar region [9, 25]. The possible justification could be that having ANC follow up increased the access to nutrition-related information and in turn, it might have promoted the choice and use of dietary diversified food.

Mothers who had latrine were 50% less likely to be underweight compared to those mothers who had no latrine. Similar finding was reported from the study conducted in Dera District, North Ethiopia which revealed that mothers with access to latrine facility were less likely to be underweight as compared to those without the facility [33]. This result was also supported by research findings from Southern Ethiopia [18]. Possible justification could be the role of latrine in preventing women from being exposed to fecal–oral infections which reduces the odds of being underweight. This finding implies the importance of hygiene in preventing malnutrition among lactating mothers. Therefore, universal accessibility and availability of latrines very crucial in rural parts of Ethiopia.

Mothers who had poor food consumption score (FCS) were more likely to be underweight compared to those mothers who had good food consumption score. This finding is supported by the study conducted in Dangila District, North Ethiopia and Arba Minch Zuria District, Southern Ethiopia which indicates that; food consumption score is one of the determinants of underweight [3, 31]. The possible explanation for this could be due to poor food eating habits and poor agricultural practice of the community. The area is also vulnerable and highly affected by drought. Therefore, it is very important to practice drought resilient agriculture in Siraro District in order to improve nutritional status of lactating mothers.

Mothers who had inadequate dietary diversity were 66% more likely to be underweight compared to those mothers who had adequate dietary diversity score. This was supported by the study conducted in Moyale District, Borena Zone, Southern Ethiopia [6], Dedo and Seqa-Chekorsa Districts of Jimma Zone [Alemayehu, 2015 #3] and Shey-Bench District Bench-Sheko [27], MizanAman, Southwest Ethiopia [7]. Possible justification could be the eating habit of society, low nutrition education at health facility and the community level. The study conducted in Offa woreda of Wolayita zone showed that dietary diversity score was not associated with underweight [16]. Possible justification for the difference could be due to seasonal variation of access to diversified foods at household level.

In the current study, mothers who were in poor and medium wealth status were more likely to be underweight compared to their counterparts. This finding

is in line with studies done in India [20], Tanzania [23] and rural Ambo District [34]. This finding also agreed with the study conducted using nationally representative data in Ethiopia [10]. This could be due to the fact that the women from poor family had difficulties of meeting their dietary requirements, could not afford varieties of foods with high nutritious value and mostly engaged in strenuous works like daily laborer and have little access to health care services. However, wealth status was not significant in the study conducted in Debre Tabor Hospital [12]. This variation might be due to socio-economic status of the different community in low-income countries. It is very important to involve women in economic empowerment via small scale businesses in order to improve their income.

In this study, socio-demographic variables like age, occupational status, marital status and educational status were not significant but in other studies these variables were associated with the development of underweight among lactating mothers [23, 27]. The possible difference might be due to multi-causal nature of underweight in developing countries that varies from place to place depending on socio-demographic, cultural and behavioral characteristics of the society.

Our study had the following limitations. First, the current study might not be representative of all lactating mothers in the community. Second, the seasonal variation in food consumption might exist so that results regarding dietary information are only limited to the specific season of the year in which the study was conducted. Third, the possibility of recall bias is also possible for some variables. Despite all the limitations, this study identified important variables that need to be considered when we design interventions to tackle underweight among lactating mothers.

Conclusion

ANC follow up and availability of latrine facility were positively associated with being underweight among lactating mothers while poor food consumption score, inadequate dietary diversity score, poor and medium wealth status were negatively associated with being underweight. It is important to ensure availability of latrines, which have a positive impact on improving the nutritional status of lactating mothers. ANC follow up should be encouraged by health care providers. The Siraro District Agriculture and Rural Development Sector should dietary diversity to improve the nutritional status of mothers in the community. Women living in poor and middle-income households should be empowered to engage in income-generating activities to alleviate underweighting.

Abbreviations

ANC	Antenatal Care
AOR	Adjusted Odds Ratio
BMI	Body Mass Index
CI	Confidence Interval
COR	Crude Odds Ratio
DDS	Dietary diversity score
FCS	Food consumption score
NNP	National Nutrition Program
UNICEF	United Nations Children's Emergency Fund
WFP	World Food Program
WHO	World Health Organization

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Authors' contributions

TG: Formulated the research questions, conception of the study, analysis and write-up of the manuscript. BL: made substantial contribution in the formulation of the research questions, design of the study, analysis of the data and write-up of the manuscript. GB: Participated in supervision, advise and analysis of the data. BG: Critically evaluated the research question, methods, analysis and write-up of the manuscript. All authors read and approved the manuscript.

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Availability of data and materials

The datasets used and/or analysed during the current study are included in the manuscript and the details can be obtained from corresponding author based on reasonable request.

Declarations

Ethics approval and consent to participate

Ethical clearance was obtained from Ethical Review board of MaddaWalabu University with the reference number of MWU/SHC/65/2014 on October 5/2021. Permission letter was obtained from West Arsi Zone Health Office and Siraro District health office. Permission was obtained from health center managers to conduct the study. Informed verbal consent was obtained from all the study participants. For the sake of confidentiality, the names of participants were not recorded on the questionnaire. They were informed well that they had full right to totally refuse to participate and/or with draw from the study at any time without any precondition. The study followed the relevant principles of the Declaration of Helsinki.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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