Original Article

Infant care practice and associated factors in Southwest Ethiopia

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Abstract

Introduction: Appropriate infant care practices are crucial for the health and wellbeing of infants. It is the care from delivery until they are one year old, and includes clean delivery, thermal care, sanitary care, cord care, eye care, breastfeeding, immunization, and identification of newborn risk indicators. One of the important reasons for the high level of infant deaths in developing countries is poor infant care practice. Infant care practice services are not widely used in Ethiopia, especially in Mari Mansa woreda, and it is unclear what factors influence their use. This study was aimed to assess infant care practices and the factors that determine the practices among mothers who gave birth within the six months prior to the survey in Mari Mansa Woreda, Dawuro zone, Southwest Ethiopia, in 2023.

Methods: A community-based cross-sectional survey was conducted using a multi-stage sampling technique among 522 mothers who gave birth in the six months prior to the survey in Mari Mansa woreda. Face-to-face interviews were conducted with sampled mothers during 10–25 April 2023 using a structured questionnaire. Descriptive statistics such as proportion, frequencies, and measures of central tendency were calculated and presented in tables and figures. Bivariate and multivariable logistic regression analyses were used to explain factors associated with infant care practices among the mothers.

Results: About 44.4% (95% confidence interval [CI]: 40%-48%) of participants had good infant care practices based on seven composite variables. Mothers' educational status such as being able to read and write (adjusted odds ratio [AOR]: 4.49; 95% CI: 1.75-11.51)], primary education (AOR: 6.52; 95% CI: 2.62-16.19), and college education and above (AOR: 14.88; 95% CI: 4.19-52.88); mothers occupation (government employees) (AOR: 3.07; 95% CI: 1.03-9.17); high household wealth index (AOR: 2.28; 95% CI: 1.27-4.08); and delivery at health facilities (AOR: 4.0, 95% CI: 1.60-10.01) were significantly associated with good infant care practice.

Conclusions: Less than half of the mothers implement good infant care practices. This implies that infant care practices are unsatisfactory in the study area. We recommend that relevant bodies working in the health sector, and community-based associations/organizations should undertake targeted interventions on women's capacity building activities through education, economic empowerment, and improved access to health services.

Introduction

The term "infant care practice" refers to the attention provided to a baby from the moment of birth until they are one year old by the mother or by a caregiver. This includes clean delivery, thermal care, sanitary care, cord care, eye care, breastfeeding, immunization, and the identification of neonatal risk indications. Appropriate infant care practices are crucial for the health and wellbeing of infants (1). Good infant care is the best way to guarantee a newborn's survival and healthy development (2).

Infant mortality is one of the leading public health problems globally, and the problem is even more staggering in low-income countries. Globally, six developing countries including India, Pakistan, Nigeria, China, the Democratic Republic of the Congo, and Ethiopia accounted for half of all infant deaths(3). According to Ethiopia's strategic plan for 2015/16 Infant and Child Survival, mortality reduction was not uniform across the different childhood age groups and geographic and socio-demographic population groups. However, as the infant and child mortality figures (4) show, disaggregation of the mortality data by age reveals that the decline in infant mortality is still not yet to the level of decline expected at various children's age group (5).

According to the 2016 Ethiopian Demography and Health Survey (EDHS), the trend of infant mortality has decreased from 77 deaths per 1,000 live births in the 2005 EDHS, to 48 in 2016, and to 43 deaths per 1,000 live births in 2019 (6). The EDHS 2016 shows that the infant mortality rate in the Southern Nation Nationality People Regional State (SNNPR) is 65 per 1000 live births. This shows that infant mortality in the SNNPR was higher compare to other regions in the country (7). Studies on infant morbidity and mortality indicate that one of the important factors for the high level of infant deaths in developing countries is poor household infant care practices, and most infant deaths occur at home due to a lack of infant care practices. However, the contextual factors that affect (hinder or promote) good infant care practices among mothers could vary from country to country or community to community (8). Using primary survey data from sample of mothers in Mari-Mansa Woreda and statistical analytical tools, the objective of this study is to empirically uncover the key factors associated to good infant care practices.

Assessment of a mother's infant care practice is one of the key prerequisites required in designing a strategy that can improve infant health outcomes and end the preventable causes of infant morbidity and mortality. Thus, the findings from this study could provide policy relevant evidence that could guide decisions and interventions in the health sectors in the study area as well as other geographical locations with similar socio-economic and demographic conditions.

Methods and materials

Study setting

The study was carried out in Mari Mansa woreda (district) of Dawuro zone, Southwest Ethiopia. Mari Mansa woreda is located 535 km from Addis Abeba and 322 km from the regional state capital, Bonga. It is bordered by Esera woreda in the south, Tocha woreda in the west, Mareka woreda in the east, and Tarchazuria woreda in the north (9). According to the Mari Mansa woreda health office, the projected population of the Woreda is 80,854 with 51% female population of which about 45% women are reproductive age (15–49 years) with an estimated 2,798 deliveries per year. There are two public health centers, seventeen health posts, and two private clinics in the Woreda (10).

Study Design

This study employed quantitative communitybased cross-sectional study conducted from April 10-25, 2023.

Population

All mothers who had an infant aged less than six month and living within the Mari Mansa Woreda were the source population. All randomly selected mothers who had an infant aged less than six months, and meet the inclusion criteria of the study comprised of the study population.

Inclusion criteria

- Women who had infants aged less than six month old and residents of the study areas for more than six months were included in the study.
- Mothers who volunteer to participate in the study and give consent for the interview during data collection.

Exclusion criteria

 Mothers who were mentally incapable for an interview during a data collection Period was excluded.

Sampling technique

A multi-stage sampling technique was employed to select the required sample size. There are seventeen *kebeles* in the woreda, and six *kebeles* were selected using a lottery method after conducting a situational analysis using data from the family folder in the health posts, the health centers' registration book, and information from health development army (HAD) leaders to identify eligible mothers of the sampled *kebeles*. Participants of the study were selected through systematic random sampling from each *kebele*'s population proportionally based on the number of mothers with infants. The total number of women who gave birth in less than six months prior to the survey in the six *kebeles* was 1,430. After calculating the sampling Kth interval (K = 3), the first household of a mother with an infant was selected randomly (by the lottery method).

Sample size determination

Sample size was determined by using proportion-to-size approach where more respondents were sampled in Kebeles with more numbers of mothers with children less than six months (see Figure 1). Sample size was calculated using OpenEpi version-3, by considering the following assumption: Finite population: 2,529, proportion of population with outcome: 47.37% (11), 95% confidence interval, with 5% margin of error and 1.5 design effect. The calculated samples become 501. Then by adding 5% non-response, the total sample size $(n) = 501 + (501 \times 5\%) = 527.$

Data Collection

Primary data were collected using structured data collection instrument (questionnaire) and a faceto-face interview administered between 10 and 25 April, 2023. The English version of the questionnaire was prepared in such a way that it includes all the relevant variables to meet the objectives of the study. The English version of questionnaire was translated into the the Amharic language to ensure better understanding of survey questions by the enumerators during the interview. Locally recruited and well-trained enumerators who understand Amharic and the local language (Dawrogna) conducted the interview. Specifically, the enumerators comprise of health professionals and health development army (HDA) leaders. Enumerators



Figure 1: Schematic presentation of the sampling procedure, Mari Mansa woreda, 2023

received detailed line-by-line training of the questionnaire, the consent form, interview skills, on how to handle respondents including respondent's fatigue, time management during the interview, and data quality issues. Following the receipt of respondents' informed consent, data was gathered via face-to-face interviews. Field supervisors daily reviewed and checked the data to ensure accuracy, completeness, and finally, the principal investigator verified the completeness of questionnaires and the validity of recorded data to ensure the overall quality of data collection.

Data Quality Control

A one-day training was given about data collection procedures for data collectors and supervisors regarding the study purpose, how to conduct the interview, how to administer the questionnaire, how to take consent, keep confidentiality, and respect the rights of the participant. The collected data was checked by the supervisor daily for completeness, and finally, the principal investigator verified the completeness of questionnaires and the validity of recorded data in order to ensure the overall quality of data collection.

Data processing and analysis

Data was checked, coded, and entered EpiData version 3.1 and exported to IBM SPSS version 26 for analysis. Data entries were done by the principal investigator. Descriptive and analytical statistics, including percentages, ratios, and frequency distributions were presented using

tables and graphs. Bivariate logistic regression analysis was used to examine the association between dependent and independent variables. For all variables, bivariate logistic regression was done for each variable; only variables with a p-value less than 0.25 were taken to a multivariate regression model.

Operational definitions of key terms/variables

Descriptions and operational definitions of the variables used in this study are provided in Table 1.

Variable	Definition	Measurement
Dry your baby	Immediately dry baby soon after birth	If the mother / delivery assistant dry her infant soon after birth = yes (1). If the mother /assistant did not delivery dry her infant soon after birth = no (0).
Early initiation of breastfeeding	Mothers initiating breastfeeding to infants following delivery within one hour of life.	If the mother breastfeed her infant within one hour after birth = yes (1). If mother feeds breast to her infant after one hour of birth= no (0).
Baby bath	Avoidance of bathing before 24 hrs. of delivery and well wrapping of infant's whole body particularly the head with a dry cloth.	If mother bath her infant after 24 hrs. = yes (1). If mother bath her infant within 24 hrs. = no (0).
Cord care	Keeping the cord clean and dry without the application of any foreign substances until the umbilical stump falls off. Additional to the normal feeding.	If the mother does not apply any material on her infant cord = yes (1). If mother applies any material on her infant cord = no (0). If mother feeds her infant more than normal feeding
feeding	increase frequent breastfeeding	during illness = yes (1). If a mother feeds her infant less or equal to normal feeding during illness = no (0).
Treatment during illness:	The mother or caregiver takes her infant to health facilities immediately for treatment during illness.	If mother take her infant to a health facility during illness = yes (1) If the mother does not take her infant to a health facility during illness = no (0).

Table 1: Description and operational definitions of variables (1-7).

Table 1 continued.

Variable	Definition	Measurement
Give an additional diet before six months	The mothers or caregiver give any additional diet before six months (miss exclusive breast feeding)	If mother does not give an additional diet before six months = yes (1). If mother give an additional diet before six months = no (0).
Good infant care	practice	Those mothers who report four and more than mentions the question for infant care practice = yes (1) .
Poor infant care p	ractice	Those mothers who report four and more than four responded 'no' to the questions on good infant care practice

Results

Sociodemographic characteristics of the respondents

Among a total of 527 sampled subjects, 522 infants aged between 0 and 6 months with their mothers were enrolled in the study with a response rate of 99%. The mean age of respondents was 29.43 years with standard deviation of 8.1 years. About 168 (32.2%) were aged between 35 and 39 years. About 91 % of the respondents were married. In terms of occupational status, about 74.3% were housewives. Regarding the educational level of the respondents, about 16.5% were illiterate (unable to read and write). Table 2 presents summary of the socio-demographic characteristics of the respondents.

Housing characteristics and wealth index

Of the 522 sample households surveyed, about 92 % reported that they own residential houses. The most commonly used flooring materials (about 95%) of the houses were earth and sand while just over 99.4% of the roofs were corrugated iron sheet. Woods and mud were the common wall structure for almost 95.5% of the houses. Most respondents had agricultural land and livestock such as cattle and poultry. Table 3

presents the descriptive summary of housing characteristics and the wealth index of survey households.

Table 2: Socio demographic characteristics of respondents (n=522)

Variable	Frequency	Percent (%)			
Maternal age					
<19	79	15.1			
20-24	137	26.2			
25-29	34	6.5			
30-34	62	11.9			
35-39	168	32.2			
40-44	42	8.0			
Religious of the re	espondents				
Orthodox	232	44.4			
Protestant	272	52.7			
Catholic	15	2.9			
Educational status of the mother					
Unable to	86	16.5			
Read and					
write					
Read and	105	20.1			
write only					
Primary	162	31.0			
school (1-8)					
Secondary	146	28.0			
school (9-12)					
Collage and	23	4.4			
above					

Table 2 continued

Variable	Variable Frequency			
Marital status of t	he respondent			
Single	23	4.4		
Married	474	90.8		
Divorced	14	2.7		
Widowed	11	2.1		
Occupational status of the mother				
Housewife	388	74.3		
Merchant	95	18.2		
Government	22	4.2		
employer				
Private	17	3.3		
employer				
Number of family Size				
<3	215	41.2		
3-5	188	36.0		
>5	119	22.8		

Access to maternal health serves

Out of the total study participants, only 45.2% women gave birth in a government health center of which 74% obtained delivery assistance by a doctor, or a nurse, or a midwife; while 9 received assistance from traditional birth assistant (TBA). Regarding antenatal care (ANC) 68.2% of the respondents visited health centers at least once, of which about 57% visited four times. About 80% of the mothers received counselling services about infant care during ANC follows up. Table 4 shows key statistics on access/use of maternal health services.

Maternal knowledge related to infant care practices

Among the total study participants, 483 (83.9%) mothers had heard information about infant care practices. The major sources of information about infant care practice included health professionals (86.07%), family and relatives (4.34%), neighbors (2.05%), and television (TV) and radio (7.53%). Concerning the types of care, 130 (29.6%) were about exclusive breast-feeding, 94 (21.4%) were in the detection of danger signs, and 214 (49.0%) were in treatment

of illness. Most women (83.9%) reported having exposed the infant to sunlight. When asked their knowledge on infant care practices, 60% of the respondents claimed that they had 'good knowledge' about infant care practices (Table 5),

Table 3: Housing characteristics and wealth index of respondents (n=522)

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Variable	Frequency	Percent		
		(%)		
Ownership of houses				
Private	481	92.1		
Rented from	41	7.9		
individual				
Does this household ow	n livestock, mi	lk cows or		
cattle?				
Yes	357	68.4		
No	165	31.6		
Do you have agricultural land?				
Yes	362	69.3		
No	160	30.7		
Wealth index				
Low	174	33.4		
Middle	165	31.6		
High	183	35.0		

Breastfeeding practice

All the mothers in survey reported that they practice breastfeeding (colostrum), of which 66.7% confirmed they initiate breastfeeding their babies within one hour after delivery. The main reasons identified for those mothers who did not initiate breast their babies include lack of awareness, 24.9% and thus they supply additional diet before six months of age. Types of food that were given as an additional diet before six months were butter 53.8%, followed by cow milk 27.6%) (Table 6).

Variable	Frequency	Percent		
		(%)		
Where you deliver your i	nfant			
In-home	47	9.0		
In Health post	112	21.5		
In Health center	236	45.2		
In gov't hospital	109	20.9		
In Private health	18	3.4		
institution				
Who attended during t	he last time of	delivery		
Dr./Nurse/midwife	386	74.0		
Health extension	89	17.0		
workers				
TBA	47	9.0		
Antenatal (ANC) service				
Yes	356	68.2		
No	166	31.8		
Frequency of ANC visit				
Once	49	13.8		
Two time	56	15.7		
Three-time	47	13.2		
Greeter than four	204	57.3		
Have you ever been informed /advised				
about infant care during ANC				
Yes	288	80.2		
No	68	19.2		

Table 4: Use of maternal health serves of respondents (n=522)

Table 5: Knowledge of infant care practice among mothers (n=522)

Variable	Frequency	Percent (%)
Information heard abou	t infant care p	ractices
Yes	438	83.9
No	84	16.1
Types of care you know	v (n=438)	21.4
sign	94	21.4
Exclusive breastfeeding	130	29.6
Treatment illness	214	49.0
Did you have information breastfeeding after birth	on about when	n to start
Yes	506	96.9
No	16	3.1
Do you know about the	first breast m	ilk
Yes	499	95.6
No	23	4.4
Is it possible to expose	the infant to s	unlight
Yes	438	83.9
No	84	16.1
Reason, Why your infan sunlight?	nt couldn't ex	pose to the
Individual preference	4	4.7
Lack of knowledge	80	95.3
Do you know about the of first breast milk	e advantage o	r disadvantage
Advantage	427	81.8
Disadvantage	72	13.8
I don't know	23	4.4
What is the reason not f	eed of first m	ilk for infant
Cause diarrhea	39	54
Cause constipation	29	40
Decrease growth	4	6
When should the infant	be bathed	
Two times a day	335	64.1
Every day	123	23.6
Sometimes	27	5.2
Other days	37	7.1
Knowledge of mothe	er for infant c	are practice
Poor	208	39.8
Good	314	60.2

Immunization status of infants

About 91% of the responders have already received the Bacillus Calmette Gurion (BCG) and OPV0 vaccinations. However, OPV1, penta1, and rota1 were 475, and immunizations depend on infant age (Fig. 2).

Variables	Frequency	Percent (%)		
Initiation of first m	nilk (colostrum)			
Yes	522	100		
Time of initiation	first milk			
Within 1 Hr.	348	66.7		
After 1 Hr.	174	33.3		
Additional feeding before six months				
Yes	130	24.9		
No	392	75.1		
What trunce size a	dditional faadina ia	airran fan tha		

Table 6: Practice of women on timely initiation of breastfeeding (n=522).

What types give additional feeding is given for the infant before six months (n=130)

Water	19	14.6
Butter	70	53.8
Cow milk	36	27.6
Holy water	5	4.0



Figure 2: Immunization status of study infants, 2023

Infant care practice during illness

Among the total respondents, 91.8% reported illness. In terms of illness types, the highest frequency observed is fever (36%), followed by diarrheas (about 23%). Among infants that suffered illness, 100% took treatment for the illness mainly at the health facility (74%) followed by traditional healers (17%) (Table7).

Table 7: Distribution of infant care during illness among rural women (n=522)

Variables	Frequency	Percent (%)
Infant faced illness		
Yes	479	91.8
No	43	8.2
Types of illness faced the	e infant	
Fever	179	36.1
Diarrhea	113	23.7
Difficult to Breathing	111	23.2
Vomiting	73	15.3
Feeding problem	3	0.7
Did you take to treatme	ent for the in	nfant [n=479]
Yes	479	100
Where did you tal $1100000000000000000000000000000000000$	ke the	infant during
Health facility	354	74
Home treatment	43	9
Traditional treatment	82	17
Frequency of feeding du	ring illness	s for the infant
Equal with normal	171	32.8
More frequent	351	67.2
during illness		

Cord and bathing care practices

The umbilical cord of an infant should be cut with a safe instrument such as a new blade and health facility instrument. About half of the respondents reported that a new blade instrument for cord-cutting was used by health facility material and 19.3% applied material on umbilicus. The types of material applied reported include butter/milk and cow dung. Bathing of an infant should be delayed until after the first 24 hours of birth to prevent the risk of hypothermia, the result shows 424 (81.2%) of the women bathed their infant after 24 hours birth (Table 8).

Variable	Fraguancy	Dercent (%)		
	Trequency	reicent (70)		
Infant bath during bir	th			
Yes	522	100		
Time of infant bath du	uring birth			
Before 24 hr	98	18.8		
After 24 hr	424	81.2		
Materials used to cut	the cord			
New blade	260	49.8		
Health facility	262	50.2		
material				
(surgical blade)				
Apply any material on the cored				
Yes	101	19.3		
No	421	80.7		
Type of material applied on the cored				
Cow dung	21	20.8		
Milk/butter	80	79.2		
Total	101	100.0		

Table 8: Cord and bathing care practice among the study women (n=522)

Level of infant care practices

The level of good infant care practice was 44.4% with a 95% CI of (40%-48%) (Figure 3). Among the selected seven care practices for infant care, making the baby dry soon after birth, safe cord-care (applying the material on the cord), thermal care (bathing the infant after 24 hours), initiation of breast feeding within one hour, sick infant feeding (adding to the normal feeding to increase frequent breastfeeding), treatment during illness, and giving an additional diet before six months were the major contributors to poor infant care.

The seven infant care practice questions in that category were re-coded into two categories before doing computation by giving a "1" value for the correct practice category and a "0" for the wrong practice. After computation, the normality of the computed total practice was checked, and it was normal. Above the mean score value of mothers who had practiced infant care was calculated, and it was four.



Figure 3: Levels of infant care practice among women in Mari Mansa woreda Southwest, Ethiopia, 2023.

Factors associated with infant care practice among mothers in Mari Mansa woreda Southwest Ethiopia, 2023.

For all variables, bivariate logistic regression was done for each variable, and to limit the number of variables and unstable estimates in the subsequent models, only variables with a pvalue less than 0.25 were taken to a multivariate regression model hierarchically. In Bivariate analysis mothers' religious status, mothers' educational status, mothers' occupational status, monthly income, number of family size, housing characteristics (wealth index), place of delivery, attendant during the last delivery. ANC follow up, informed /advised about infant care during ANC visit, preparation for delivery during pregnancy, and mothers' knowledge about infant care practice were significant. In multivariate logistic regression educational status of the mother, occupational status of the mother, monthly income, housing characteristics (wealth index), and place of delivery of the infant were statistically significantly associated with infant care practice.

As Table 9 shows, mothers who read and write were 4.5 times more likely to have good infant care practice as compared to mothers who were unable to read and write (AOR: 4.48; 95% CI: 1.75-11.51). Likewise, primary educated mothers were 6.5 times more likely to have good infant care practice as compared to mothers who were unable to read and write (AOR: 6.52; 95% CI: 2.62-16.19) and college and above educated mothers were 14.8 times more likely to have good infant care practice as compared to mothers who were unable to read and write (AOR: 14.88; 95% CI: 4.19-52.88). Mothers who are government employees had 3 times more likely to have good infant care practice as compared to mothers who were housewives (AOR: 3.06; 95% CI: 1.02-9.17). Those women who had high wealth index had 2.28 times higher odds of infant care practice as compared to women with low wealth index (AOR: 2.28; 95% CI: 1.27-4.08). Mothers who delivered at health facility were 4 times more likely to have good infant care practice as compared to mothers who delivered at health facility are practice as compared to mothers who delivered at health facility were 4 times more likely to have good infant care practice as compared to mothers who delivered at home (AOR: 4.01; 95% CI: 1.60-10.01).

Table 1: Factors associated with infant care practices among mothers who gave birth in the last 6 months in Mari Mansa woredas, Ethiopia, 2023

Variable	Infant care			
	practice		COR (95%CI)	AOR (95%CI)
	Good	Poor		
Educational status of a mother				
Unable to read and write	7	79	1	1
Read and write only	43	62	7.827 (3.295, 18.595)**	4.489(1.751, 11.510)**
Primary education	71	91	8.805 (3.825, 20.252)**	6.518(2.623, 16.198)**
Secondary education	97	49	22.341(9.589, 52.052)**	14.231(5.657, 35.797)**
College and above	14	9	17.556 (5.617, 54.869)**	14.886(4.190, 52.886)**
Occupational status of the mother				
House wife	157	231	1	1
Merchant	54	41	1.938 (1.231, 3.051)*	1.632(0.908, 2.934)
Government employed	14	8	2.575 (1.055, 6.283)*	3.069(1.027, 9.170)*
Private employment	7	10	1.030 (0.384, 2.763)	0.723(0.237, 2.206)
Monthly income, Ethiopian Birr				
Income >1000 Birr	41	13	6.734 (3.469, 13.072)**	6.392(2.838, 14.395)**
Housing characteristics and Wealth	n index			
Low	51	123	1	1
Middle	76	89	2.959 (1.316, 3.222)*	2.352(1.212, 4.565)*
High	105	78	3.247 (2.094, 5.034)**	2.282(1.276, 4.082)**
Where did you deliver your infant				
Own home	9	38	1	1
Health post	25	87	1.213 (0.578, 7.819)	1.434(0.546, 3.770)
Health center	140	96	6.157 (2.846, 13.320)	3.324(0.882, 12.517)
Government hospital	49	60	3.448 (1.521, 7.819)**	1.820(0.666, 4.973)
Private health institution	9	9	4.222 (1.303, 13.678)	4.008(1.604, 10.016)**

Note: ** *Highly significance* (*P*<0.001) * *significance* (*p*<0.05)

Discussion

In this study, about 44% of mothers practiced good infant care. Mother's educational status, her occupational status, housing characteristics (wealth index), and place of delivery were significantly associated with good infant care practices. This low level of infant care practice could be due to several barriers to infant care practice among mothers and families in rural households in the study area, including agricultural and domestic labor, food insecurity, cultural beliefs and practices, lack of access to health services, low educational status, and lack of knowledge about infant care practice.

This finding was lower when compared to the studies conducted in Bangladesh (56%) (12), Nekemte Ethiopia (53%) (13), and Bonke district Gamo Zone (65%) (14). The possible reason for this difference could be due to different sociodemographic characteristics, like the educational background of the study participants. As shown in studies, educational background of mothers affects infant care practice. In this study, 16% of the study participants had educational backgrounds of being unable to read and write. This educational level difference might be one reason for the difference in infant care practice. The other reason might be due to study method difference: this study is conducted at the community level whereas the above mentioned three studies in Bangladesh were conducted at health facilities. Study participants of the health facilities could have better health services seeking behavior that gave them opportunity to have better awareness/ knowledge about infant care practice.

Our results are similar to the study conducted in Pawi district, Beneshagul Gumuz, Northwest Ethiopia(11) and studies conducted in Mandira (15). However, our finding is higher than studies conducted in rural Gedo district (24%) (16). The reason for this difference could be because health extension workers and other health professionals and care providers create awareness about infant care practices for all mothers at the home level. The above two studies have high home delivery rates compared with this study, their institutional delivery, and their access to health services. This additional difference might be due to the study setting.

The study result showed that, about 67% initiated breastfeeding within one hour. This finding is better when compared to the study conducted in Uganda (60%) (17), and in rural Nepal (41%) (18), Tigray (63%) (19), and Goba woreda (52%) (20). The reason for this difference is due to the wealth index. Our study's low wealth index was 33%, but the above studies low wealth index was 45%. Those women who have a better household income are expected to have better health care information and access. They are more likely to seek modern health care than those who have no better wealth index.

The initiation of breast feeding at 67% was lower than the results of studies conducted in Enderta district, Tigray (72%) (21), and EDHS (2016) (73.6%). The discrepancies in the findings might be due to study setting differences and the availability of health services in the study area.

In this study, 81% of the infants were bathed after 24 hours of birth. This result is higher than the study conducted in western Uganda after 24 hours of bathing (67%) (17) and Mekelle City, North Ethiopia (66%) (22). On the other hand, the result in our study is lower than the study conducted in Tharu, Chitwan district (97%) (23). This difference may be due to relatively increased awareness about when infants bathe and to the difference in counseling during pregnancy and the postpartum period. Health education differs from place to place (24).

In this study, mothers applied a material to a cord about 19% of the time. These studies showed lower rates than those conducted in Uganda (50%) (17), Nepal (40%) (19),

Bangladesh (44%) (27), and India (55%) (25), and in Ethiopia, different studies conducted in different areas: Tigray (39%), Somali (28%), Nekemte City (22%), and East Wollega Zone (23%) (24, 26, 30). The possible reason that mothers apply a substance to the cord might be because many people think that applying butter would lubricate the cord and prevent dryness. It is a traditional, cultural, and personal perception (17).

The educational status of women had a significant association with infant care practice. This study showed that women who could read and write were 4.5 times more likely to practice good infant care practices as compared to mothers who were unable to read and write. The studies conducted in Uganda, Gedieo Zone Ethiopia, Chencha District, and Amaro Woreda, Southern Ethiopia, also reported significant association (16,17,28,29), and the similar studies conducted in Mandura District and Mekelle City, North Ethiopia, did not report significant association(15,22). This difference could be explained by the understanding that health service utilization is more related to the educational status of mothers. In addition, uneducated mothers may face some difficulties in acquiring health information about appropriate infant care practices (31).

The occupational status of women had a significant association with infant care practice. Mothers who had government employers were three times more likely to practice good infant care practices as compared to mothers who had housewives. In a similar study conducted in Bonke district occupational status of women had a significant association with infant care practice (14), but in studies conducted in different areas of Ethiopia: Damot Pulasa Woreda, southern Ethiopia; Hossana town, Ethiopia; and Nekemte, Ethiopia, occupational status of women had no significant association with infant care practice (32,34,35).

In this study, the monthly income of women had a significant association with infant care practice. Those mothers who had a monthly income >1,000 ETB were 6.4 times more likely to practice good infant care practices as compared to mothers who had no income. Studies conducted in Bonke District, Southern Ethiopia, and Nekemte, Ethiopia, have reported statistically significant association with monthly income and infant care practice (36,37) This might be because of the influence of monthly income on the living standard.

The wealth index of mothers had a significant association with infant care practice. Mothers who had a high wealth index were 2.28 times more likely to practice good infant care practices as compared to women with a low wealth index. Another study conducted in Chencha District, Southern Ethiopia, found that wealth index is associated with infant care practice (38), and a study conducted in Bonke District, Southern Ethiopia, and Amaro Woreda, Southern Ethiopia, found that wealth index is not significantly associated with infant care practice (33). Wealth is a household characteristic that often has a large effect on health. The wealth index allows for the identification of problems particular to the poor, such as unequal access to health care, as well as those particular to the poor, such as increased risk for infection. This might be due to the effect of wealth index on living standard (personal hygiene, completion of basic needed materials) of the family (39).

Mother's place of delivery during the last pregnancy was found to have a statistically significant association with infant care practice. Mothers who delivered at a health facility were four times more likely to practice good infant care practices as compared to mothers who delivered at home. In a study conducted in Nekemte, Ethiopia, place of delivery was statistically associated with infant care practice (13), but the study conducted in Chencha District, and Bonke District, Southern Ethiopia, place of delivery is not statistically associated (28,40). The reason for this result could be that the health facility delivery service was a comparative service given to women by the health profession. which gave essential information and health education on how to properly care for infants. In addition, health professionals are more knowledgeable than traditional birth attendants about how to manage danger signs in infants. This might be the respondents that delivered in the health facilities could be positively influenced by health providers (41).

Despite the valuable insights provided by this study, there are certain limitations that should be considered. First, the study was conducted in a specific geographical area (Mari Mansa woreda) which may limit the generalizability of the findings to other regions or populations. The characteristics and practices of mothers in other areas may differ, and therefore caution should be exercised when extrapolating the results beyond the study area. Second, the study employed a cross-sectional design, which only allows for the assessment of associations between variables at a specific point in time. This design does not establish causality or provide information about changes in infant care practices over time.

Conclusion

The empirical findings in this study revealed the key factors that moderate infant care practices among mothers in rural households. Factors such as low educational status, occupational status, housing characteristics (wealth index), and place of delivery were significantly associated with the practice of good infant care. The findings indicated that mothers with higher education, government employment, higher income, and better wealth index were more likely to practice good infant care. Additionally, delivering in a healthcare facility was associated with higher rates of good infant care practices compared to home deliveries. These results highlight the importance of addressing socio-economic factors and improving access to healthcare services in promoting optimal infant care practices.

Based on the findings, we put forward the following policy recommendations or interventions to enhance infant care practices in rural areas. First, there is a need for targeted interventions to improve maternal education and literacy rates. Educational programs and campaigns can be implemented to increase awareness and knowledge about infant care practices among mothers with lower educational backgrounds. Second, efforts should be made to enhance economic empowerment for women, as higher household income and occupational status were associated with better infant care practices. This can involve promoting income-generating activities and providing support for women entrepreneurs. Furthermore, improving access to healthcare services in rural areas is crucial. Strengthening maternal and child health services, particularly in remote areas, can ensure that mothers receive adequate counseling and support during pregnancy, childbirth, and the postnatal period. This includes promoting facility-based and providing comprehensive deliveries postnatal care to mothers and infants. Health extension workers and community health workers play a vital role in delivering health education and counseling, and their training and be presence should expanded. Lastly, community-based awareness campaigns and culturally sensitive interventions should be designed to address traditional beliefs and practices that may hinder optimal infant care. Addressing these factors that impede mothers' capacity can improve infant care practices and better child health outcomes.

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Ethical considerations

Ethical clearance with reference number IRB/190/15 was obtained from the Institutional Review Board (IRB) of Hawassa University College of Medicine and Health Science. An official support letter from the School of Public Health was written to the Southwest Ethiopia Regional Health Bureau and the Mari-Mansa Woreda health office. Participants were made aware of the study's purpose throughout the research, and their willingness to participate was gauged. There was no breach of confidentiality or privacy. All the required administrative authorizations were obtained for data collection. The data was used for the purpose of this study and any variables/codes that could potentially identify the respondents were not accessible for any external persons.

Data availability statement

Data is not available for online access, however readers who wish to gain access to the data can write to the corresponding author Bereket Babulo at <u>bereketbabulotkg2011@gmail.com</u>.

Conflicts of interest

The authors declare that they have no competing interests.

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