


# Practice of Sunlight Exposure of Infants and Associated Factors Among Infant Coupled Mothers at Dejen District, Amhara Region, Northwest Ethiopia 2021

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Amare Bekalu<sup>1</sup>, Abebaw Molla<sup>2</sup>, Bayachew Asmare<sup>1</sup>, Yidersal Hune<sup>1</sup> and Habtamu Temesgen<sup>1</sup>

<sup>1</sup>Department of Human Nutrition, College of Health Science, Debre Markos University, Debre Markos, Ethiopia. <sup>2</sup>Department of Public Health, College of Health Sciences, Mizan Aman University, Mizan, Ethiopia.

## ABSTRACT

**INTRODUCTION:** Currently, nutritional rickets has become a concern of many nutrition experts in many countries. Sunlight is the best and most reliable Source of vitamin D. Since, there is scarce information regarding infant sunlight exposure practice and the determinant factors. Hence, this study aimed to assess mothers' infant sunlight exposure, practice level, and associated factors.

**METHODS:** A community-based cross-sectional study was conducted on 884 mothers from March 20 to April 4, 2017. Through the multi-stage simple random sampling method, the study areas had selected. The data were collected using a structured and pre-tested questionnaire and were entered into Epidata version 3.1 and exported to SPSS version 20 for analysis. The strength of association was measured using binary logistic regression at a 95% CI odds ratio. Finally,  $P < .05\%$  was declared statistically significant.

**RESULTS:** From 884 infant coupled mothers, 866 were recruited in the study with a response rate of 97.9%. Only 44% of mothers had good practice of infant sunlight exposure. In multivariate analyses; Knowledge status (AOR = 1.4, 95% CI: 1.0-1.9), Attitude status (AOR = 1.4, 95% CI: 1.1-1.9), mothers age group (AOR = 8.6, 95% CI: 5.1-14.4), mothers educational status (AOR = 5.2, 95% CI: 1.6-16.9), delivery at health facility (AOR = 1.5, 95% CI: 1.0-2.1), and friend influence (AOR = 1.6, 95% CI: 1.2-2.1) were significantly associated with maternal exposure status of their infants to sunlight.

**CONCLUSION:** This finding showed that the majority of the mothers did not expose their infants to sunlight appropriately. The mother's knowledge, attitude, educational status, institutional delivery, and friend influence were the significant factors and needs to work on these.

**KEYWORDS:** Infants, poor-practice, sunlight exposure

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**CORRESPONDING AUTHOR:** Amare Bekalu, Department of Human Nutrition, College of Health Science, Debre Markos University, Debre Markos 269, Ethiopia. Email: amarebekalu3@gmail.com

## Introduction

For centuries back to ancient Rome and Greece civilization, Sunlight exposure had used for therapeutic purposes (heliotherapy).<sup>1,2</sup> During the second half of the 19th Century, the sunlight had realized as a bactericidal and therapy purpose for rickets.<sup>1-4</sup> The level 25(OH)D also determines the body's calcium homeostasis, bone health, cellular health, and immunity function. At least a level of 20 and 30 ng/ml of 25(OH)D are required to maintain calcium homeostasis and maximal bone health and cellular health orderly.<sup>5-8</sup> It is crucial for the Immune system, maintaining cardiovascular function, healthy heart and circulation, respiratory system, healthy lungs and airways for Brain development, Muscle function, and anti-cancer effects.<sup>9</sup>

Exposure of the body in a bathing suit to one minimal erythemal dose (MED) is equivalent to taking 10 000 to 25 000 IU vitamin D orally. Therefore exposure of the body parts like arms, face, legs, and hands to sunlight for one MED 2 to 3 times a week is sufficient to get adequate body vitamin D requirement and even for the storage of vitamin D3 in the body fat.<sup>8</sup>

Sunlight exposure is the cheapest source of vitamin D. When the skin expos to the sun, vitamin D will produce. Sunscreen blocks ultraviolet light from damaging the skin, But, it does affect vitamin D production from the skin. Although most people believe using sunscreen lowers vitamin D production from our skin, no proven evidence supports their belief.<sup>10,11</sup>

Some literature said that reduced exposure to the sun and choose sunglasses with medium to dark lenses for UV-A and UV-B protection during peak hours between 11 am and 4 pm when a person's shadow appears shorter than they are.<sup>10,12</sup>

Vitamin D can produce by our skin upon exposure to ultraviolet B (UVB) irradiation (280-320 nm) from sunlight.<sup>13</sup> More than 90% of the circulating vitamin D in the body originates from cutaneous production.<sup>13</sup> Sunlight converts 7-dehydrocholesterol in the skin to vitamin D3, which will be transported to the liver and hydroxylated to 25-hydroxyvitamin D (25(OH)D). It will then be conveyed to the kidney and hydroxylated to 1,25-dihydroxyvitamin D (1,25(OH)D).<sup>13</sup> 1,25(OH)D is the metabolically active prohormone. The level



has uses as a determinant factor of vitamin D status. Vitamin D deficiency will result in osteomalacia and rickets.

Recent studies have shown that vitamin D insufficiency is common in tropical countries even if there is sunshine throughout the year in this region due to malpractice and inadequate knowledge toward the exposure of infants to sunlight.<sup>14</sup>

Ethiopia adopts health education as a strategy to change maternal behavior on infants' sunlight exposure to prevent rickets in the country during the 1960s.<sup>15</sup> Implementation of this strategy remains low, inconsistent, and health messages had no focus that positively influences maternal practice, infants not to get adequate sunlight. Lack of sufficient information on the determinant of this risky behavior and the attitude of Ethiopian mothers.<sup>15</sup>

Vitamin D deficiency is prevalent among urban and rural Ethiopian school children for 61.8% and 21.2%, respectively.<sup>16</sup> The study had conducted on pregnant women and women of reproductive age showed that vitamin D deficiency is prevalent in Ethiopia.<sup>15-17</sup> Some initial and recent studies suggested that daily practice to sunshine remains the cheapest, safest, and most effective method of preventing rickets.<sup>15,17</sup>

There is scarce information regarding the mother's practice of infant sunlight exposure and its determinant factors. Hence, this study aimed to assess mothers' infant sunlight exposure, practice level, and associated factors.

## Methods and Materials

### *Study design, setting, and period*

A community-based cross-sectional study was done at Dejen woreda from March 20 to April 4, 2017. The woreda had latitude and longitude of 10°10'N38°8'E and an elevation between 2421 and 2490 m above sea level. It is one of the woredas in the Amhara Region of Ethiopia.

Based on the 2007 national census conducted by the Central Statistical Agency of Ethiopia (CSA), the woreda has 23 kebeles and 102 359 total population. Seven Kebeles had selected for the study.

### *Study participants and sampling procedures*

All mothers who had an infant during the data collection period in the selected kebeles were the study populations. While mothers who fulfilled the inclusion criteria were the study participants. Multi-stage sampling technique and computer generated random sampling methods were used to recruit 884 infant coupled mothers from 7 kebeles (Figure 1) A single population proportion formula was used to determine sample size using the Epi Info Version 3.5.1 StatCalc software considering a proportion of 50%, confidence interval (CI) of 95%, and margin of error 5. In addition, the Epi Info StatCalc was also used to calculate sample size using the risk factors for sunlight exposure status: using proportion of good and poor practice of

infants' exposure status to sunlight, exposed to unexposed group ratio of 1:1, a power of 80%, odds ratios, and 95% CI as shown in Table 1. After that, a sample size of 384 was calculated, however, with a 15% non-response rate and a design effect of 2, the final sample size was estimated to be 884.

$$n = (z\alpha / 2)^2 p(1-P) / d^2 \quad (1)$$

Where n = sample size

P = proportion take as 50% (no previous study)

d = margin of error

α = 5%

Zα/2 with 95% confidence level = 1.96.

And hence  $1.96^2 \cdot 0.5(1-0.5)/0.05^2 = 384$  samples were required.

And hence considering none response rate of 15%, and the sample size of this study was calculated as;  $384 \times 15\% = 58$  then  $58 + 384 = 442$  sample.

Multiplying 442 by the design effect 2 gives 884. For the associated factors, a double population proportion formula using EPI Info version 3.5.1 StatCalc had used to calculate the sample size.

But the value was lower than the above sample size. Then the final sample size was 884 infants.

### *Data collection methods and instruments*

The data had collected through 5 diploma Nurses and 1 BSc nurse supervisor. The Data were collected through the home-to-home visits using a structured adapted interviewer-administered questionnaire. The questionnaires had 5 parts, socio-demographic characteristics, Knowledge, Attitude, Practice related, and associated factors of mothers toward their infant sunlight exposure. The questionnaires were prepared initially in the English version and translated to Amharic version and Amharic version questionnaire was used for data collection.

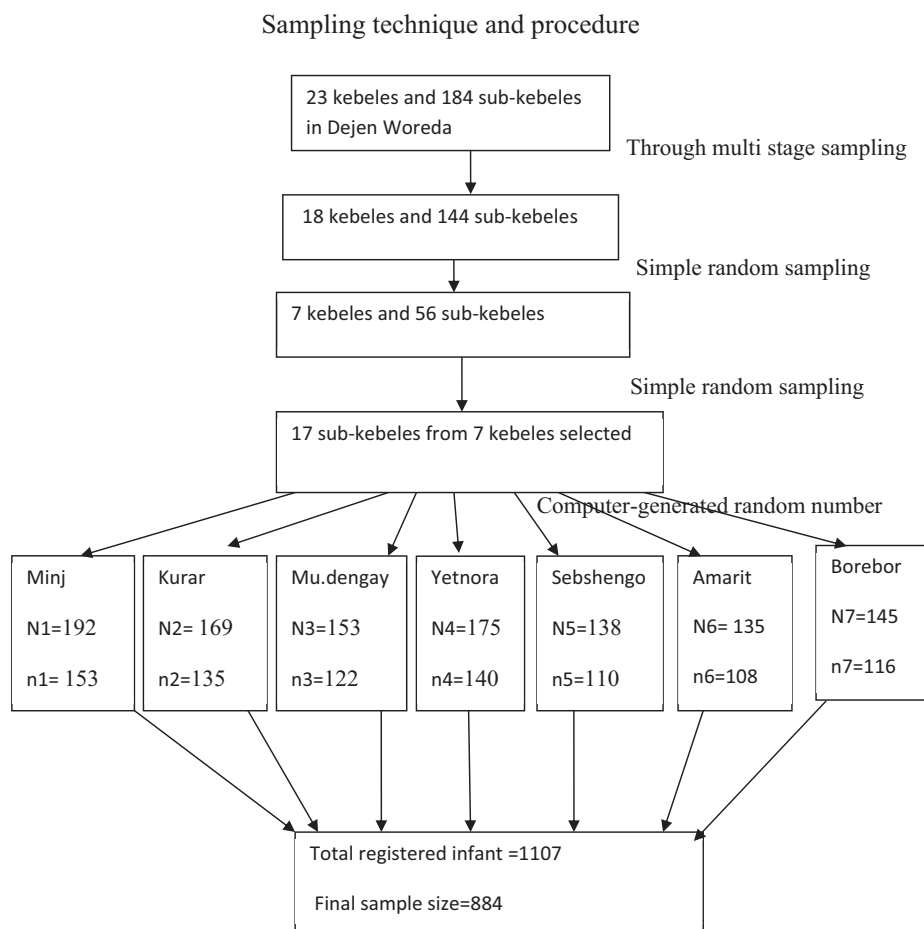
### *Variables of the study*

The dependent variable was maternal practice level regarding infant sunlight exposure. Socio-demographic variables (Age of infant, Age of mothers, Mother Educational status, Husband educational status, Mothers Religion, Family size, Mothers Occupation, Father's occupation), social factor (media influence, health professional influence, infant grandmother influence), and health-seeking behavior of mothers (ANC follow up, place of delivery), Knowledge status, and Attitude status were the independent variables.

### *Operational definition*

Infant: a child whose age is less than 12 months old.

Good practice: those mothers who responded to the practice-related questions and scored above the median.<sup>18</sup>



**Figure 1.** Schematic presentation of sampling procedure of knowledge, attitude, practice, and associated factors of mothers toward infant sunlight exposure in Dejen 2017.

**Table 1.** Sample size determination of the study participants using EPI Info version 3.5.1.

S.NO	VARIABLES	% PREVALENCE	CONFIDENCE LEVEL (%)	POWER (%)	PREVALENCE OF GOOD PRACTICE (%)	THE RATIO AMONG EXPOSED TO UNEXPOSED	ODDS RATIO	CALCULATED SAMPLE SIZE
1	Mother age group >33years	16.6	95	80	40	1:1	8.67	40
2	Diploma and above educational status of mothers	24.9	95	80	60	1:1	3.24	136
3	Family size b/n 4-6	59.1	95	80	39.1	1:1	3.88	214

Poor practice: those mothers who failed to respond to the practice-related questions and scored less than or equal to the median values.<sup>18</sup>

Good-knowledge: those mothers who responded to the knowledge-related questions and scored above the median.<sup>19</sup>

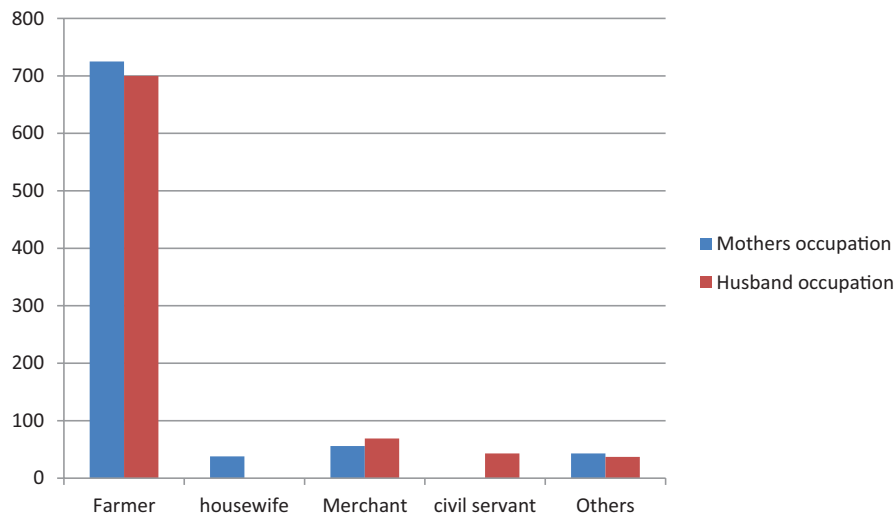
Poor knowledge: those mothers who respond knowledge related questions and scored less than or equal to the median values.<sup>19</sup>

Favorable attitude: those mothers who responded to attitude-related questions and scored above the median value.<sup>20-22</sup>

Unfavorable attitude: those mothers who responded to attitude-related questions and less than or equal to the median values.<sup>20-22</sup>

*Data quality control*

Two days of training had given for both the data collectors and supervisor. The adapted questionnaires were prepared initially in the English version and translated to the Amharic version and then back to the English version for consistency. The pre-test



**Figure 2.** Occupational status of the husband and mothers of the study participants Dejen woreda, Ethiopia 2017.

had done on 5% of the sample in the other woreda. The completeness of data, missing, and inappropriate data filling was checked daily by supervisor and principal investigator.

#### Data processing and analysis

The data was checked visually, coded and entered into EPI data version 3.1 and exported to IBM-SPSS version 20 for statistical analysis. The association between each independent variable with the outcome variable had assessed using bivariate logistic regression. Model fitness was checked using Hosmer and Lemeshow goodness of fit.  $P < .2$  in bivariate analysis covariate retained for multivariate analysis. Logistic regression analysis had performed to identify factors associated with the outcome variable. Finally, a  $P < .05$  declare as statistical significance. The data had presented using tables, charts, and texts.

## Result

### Socio-demographic characteristics

Of 884 sampled mothers, 866 of them were recruited in the study with a response rate of 97.96%. Among 866 study participants, 534 (61.7%) mothers had less than or equal 6 months of age infant. More than half, 460 (53.1%) mothers had age less than or equal to 30 years old (Figure 2). The mean age of study mothers and infants were 31.1 (95% CI, 30.5-32.0 with standard deviation of  $\pm 6.371$ ) years and 5.71 (95% CI, 6.2-6.6 with standard deviation of  $\pm 3.1$ ) months respectively. The majority of mothers 847 (97.8%), were orthodox by religion, 863 (99.7%) were Amhara by ethnicity. Almost 827 (95.5%) were married (Table 2).

Majority of study mothers, 769 (88.8%) were farmers by occupation as shown in Figure 2.

**Table 2.** Distribution of socio-demographic characteristics of study participants in Dejen woreda, East Gojam Zone, Amhara Region, Ethiopia, 2017 (n=866).

VARIABLES NAME	FREQUENCY	%
Mother age group (years)		
15-20	14	1.6
21-26	214	24.7
27-32	334	38.6
33+	304	25.1
Infant's age group (months)		
0-6	534	61.7
7-12	332	38.3
Mothers religion		
Orthodox	847	97.8
Muslim	19	2.2
Mothers ethnicity		
Amhara	863	99.7
Oromo	3	0.3
Mothers marital status		
Single	21	2.0
Married	823	95
Divorced	15	1.7
Widowed	7	0.8
Family size (members)		
1-3	272	31.4
4-6	487	56.2
$\geq 7$	107	12.4

**Table 3.** Practice level of study mothers regarding their infant sunlight exposure in April 2017.

PRACTICE RELATED QUESTIONS		FREQUENCY	%
A mother intentionally expose their infant to sunlight		829	95.7
A mother who exposes 10-30min daily to the sunlight.		732	84.5
Apply body lotion before exposing it to sunlight.		571	65.9
Apply butter to the infant's body before exposing to sunlight.		439	50.7
Covered all of the infant's body by cloth during exposure to sunlight.		459	53
Expose their infants to the sunlight at the mid-day	Outdoor	208	24
	Longer than 1 h in a day	668	77.1
	Longer than 1 h in a day	252	29.1
	After applying sunscreen lotion	429	49.5
	Expose equally during summer and winter	496	57.3
	Expose their infant to sunlight 10-30 min daily	761	87.9
	Expose their infant to sunlight 40-60 min weekly	96	11.1
Expose their infant to sunlight for 1 h at the weekend.		8	0.9
Expose their infant to sunlight for 2 h and above at the weekend.		1	0.1
Did you start sunning your infant at the age of before 15 days?		214	24.7
Started sunning their infant at the age of 15-45 days		457	52.8
Started sunning their infant at the age of above 45 days		195	22.5

### *Knowledge of mothers toward infant sunlight exposure*

The median value of knowledge of study participants was 7.5. Out of 866 study participants, 433 (50%) had poor-knowledge status regarding infant sunlight exposure. The majority of mothers (852, 98.4%), knows infant sunlight exposure were essential to the infant, and 373 (43.1%) had answered infant sunlight exposure are for the development, growth, and strength of bone, and 779 (90%) of mothers know relatively the safest period of infant sunlight exposure. Regarding knowledge of the harmful effect of sunlight exposure (246, 28.4%), (38, 4.4%), (454, 52.4%), and (107, 12.4%) of mothers mentioned that it causes skin cancer, gigantism, dark skin pigmentation, and fever were respectively.

### *Attitude level of study mothers toward infant sunlight exposure*

Almost 473 (54.6%) of mothers had an unfavorable attitude. From these, 239 (27.6%) and 211 (24.4%) mothers strongly disagreed that sunlight exposure did not have an evil eye effect.

### *Practice level of study mothers on infant sunlight exposure in April 2017*

Five hundred six (56%) of mothers scored less than the mean value practice-related questionnaire. Even though 829 (95.7%)

of mothers intentionally expose their infants to sunlight. The majority of mothers 439 (50.7%) and 571 (65.9%), expose infants after applying butter on the infant's body and cover with a cloth (Table 3).

### *Determinant factors of mothers' infant sunlight exposure practice*

A significant association was observed between mothers' knowledge status; attitude status, age groups; educational level with the mother's practice level regarding infant sunlight exposure. Mothers who had good knowledge regarding infant sunlight exposure were 1.4 times more likely to have a good practice of infant sunlight exposure than those mothers who had poor knowledge (Table 4).

## **Discussion**

More than 829 (95.7%) of mothers intentionally expose their infants to sunlight. It is almost similar to the study done at Debre Markos, 96.6%.<sup>18</sup> But higher than the study done at Yirgalem General Hospital which was 84.7%.<sup>23</sup> The variations could be attributed to differences in educational status and cultural practices in different geographical locations within the same country. More than 77% of mothers expose their infants to sunlight outdoor. These were lower than the study done at Debre Markos and Sakarya which were 89.4%<sup>13</sup> and 87.5%<sup>18</sup> respectively. Ninety (90.5%) of mothers expose their infant in

**Table 4.** Multivariate analysis of characteristics' associated with the practice status of study mothers regarding their infant sunlight exposure.

VARIABLES	PRACTICE STATUS		COR (95% CI)	AOR (95% CI)	P
	GOOD (%)	POOR (%)			
Mother age group (years)					
15-20	10 (71.4)	4 (28.6)	8.4 (2.5-27.5)	4.9 (1.1-21.6)	.036
21-26	151 (70.6)	63 (29.4)	8.0 (5.4-11.9)	8.6 (5.1-14.4)	.000
27-32	150 (44.9)	184 (55.1)	2.7 (1.9-3.8)	2.8 (1.9-4.3)	.000
≥33	70 (23)	234 (77)	1	1	.004
Mothers educational status					
URAW	42 (27.1)	113 (72.9)	1	1	
1-8	115 (45.6)	137 (54.4)	2.3 (1.5-3.5)	2.3 (1.1-4.5)	.020
Certificate	47 (78.3)	13 (21.7)	9.7 (4.8-19.8)	5.2 (1.6-16.9)	.007
Knowledge status					
Good	216 (49.9)	217 (50.1)	1.6 (1.2-2.1)	1.4 (1.0-1.9)	.000
Poor	165 (38.1)	268 (61.9)	1	1	
Attitude status					
Favorable	199 (50.6)	194 (49.4)	1.6 (1.3-2.2)	1.4 (1.1-1.9)	.000
Unfavorable	182 (38.5)	291 (61.5)	1	1	
Delivered at the health facility					
Yes	286 (47.2)	320 (52.8)	1.6 (1.2-2.1)	1.5 (1.0-2.1)	.029
No	95 (36.5)	165 (63.5)	1	1	
Friend influence					
Yes	190 (40.3)	282 (59.7)	1.4 (1.1-1.8)	1.6 (1.2-2.1)	.002
No	191 (48.5)	203 (51.5)	1	1	

Abbreviations: AOR, adjusted odds ratio; COR, crude odds ratio; URAW, unable to read and write.

the relatively safest (morning before 10 am and after 5 pm) period that was lower than the study report from Debre Markos.<sup>18</sup> The variation may be due to differences in awareness level of mothers concerning the importance of infants' sunlight exposure. Half of the mothers in the present study exposed their infant after applying butter to the infant's body before exposing infants to sunlight. However, the finding was higher than the study report from Debre Markos, 43.7%.<sup>18</sup> This might be due to knowledge gap regarding the disadvantage of mal-practice (application) between the studies and it might have an impact in the synthesis of Vitamin-D properly. About 53% of the study mothers expose their infant after covering with a cloth which is higher than the study done at Yirgalem General Hospital that was 27.8%.<sup>23</sup> Such big discrepancies might be resulted either from cultural influences or poor awareness. More than 56% of mothers had poor practice of infant sunlight exposure which is higher than the study done at Yirgalem

General Hospital that was 45%,<sup>23</sup> study done at St. Paul's Hospital that was 40%,<sup>24</sup> and a study done in Farta district which was 45.7%.<sup>25</sup> The possible reason may be the study period, study area, and cultural difference. However, it is lower than the study done at Aleta Wondo Health Center which was 67.4%.<sup>26</sup> The reason behind this may be cultural and educational status difference.

In this study, more than half mothers (52%) had started exposing their infant at the age of 15 to 45 days which is lower than the study done at Yirgalem Hospital that was 66.4%.<sup>23</sup> The reason may be the study period difference.

A mothers' educational status had a significant association with the practice of infant sunlight exposure. This was supported by the study report from Debre Markos.<sup>18</sup> knowledge status, Attitude status, mother's educational status, mother age group, delivery at a health facility, and mothers' friend influence had a significant association with the mothers' practice status.

## Conclusion

More than half of the mothers did not practice appropriate infant sunlight exposure. Mothers' educational statuses, knowledge status, attitude status, education status, age group, friend influence, and health facility delivery had significantly associated with the practice level of infant sunlight exposure. The present study finding indicates a need of awareness creation for the community concerning the importance of infants' exposure to sunlight with the proper practice.

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## Authors' Contributions

AB conceptualization. AB, AM, YH, BA, and HT formal analysis. AB, AM, YH, BA, and HT development or design of methodology. AB, AM, YH, BA, and HT entering data into software. AB, AM, YH, BA, and HT supervision. AB, YH, BA, and HT writing original draft. AB, AM, YH, BA, and HT writing review and editing. AB and ABYHBAHT prepares all figures. AB, ABYH, and BAHT prepare all tables. AB, ABYH, and BAHT wrote the main manuscript text, all authors read and approved the final manuscript.

## Ethics Approval and Consent to Participate

The proposal was submitted and approved by the Debre Markos university ethical review committee as ህገ/ምር/ማህ/አገ/ደህ/ም/አሰ/339/15/09 in 2017. A letter of permission had obtained from the Dejen woreda health office. A briefing had given for every study participant before taking oral consent. Confidentiality was maintained by excluding their name and personal identifiers.

## ORCID iD

Amare Bekalu  <https://orcid.org/0000-0003-4790-1773>

## Data Availability Statement

The data sets used and analyzed in this study are available from the corresponding author. Data will not be shared to preserve the participant anonymity.

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