

# Assessment of Practice and Factors associated with Sunlight Exposure of Infants among Mothers in Debre Berhan Town, North Shewa Zone, Amhara Region, Ethiopia

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**Background:** Vitamin D deficiency is a common worldwide problem with its prevalence magnified in infants. Prevalence in infants is believed to range from 2.7% to 45% in different countries of the world. Appropriate sunlight exposure of skin is thought to be vital for the prevention of vitamin D deficiency. However, due to a dearth of study the practice of sunlight exposure is incompletely understood. Thus, assessing practice and factors affecting sunlight exposure of infants by mothers was relevant.

**Objective:** To assess practice level and factors associated with sunlight exposure of infants by mothers in Debre Berhan town, North Showa, Ethiopia, 2019.

**Materials and Methods:** A community-based cross-sectional study was conducted to collect relevant data among 530 mothers with infants at selected kebeles in Debre Berhan town. A simple random sampling technique was used to select kebeles and systematic sampling was complemented to identify study participant. Data were collected with interview using a pre-tested structured and semi-structured questionnaire. Bivariable and multivariable logistic regressions were run to examine the association among dependent and independent variable. Significant association was declared at P value  $\leq 0.05$ .

**Results:** All the mothers were interviewed and 65.7% of them had good practice in sunning of their infant. In multi-variable analysis, mothers who are housewives or government employees, have a maternal age of 33 and above, perceive that sunlight strengthen infant bones, perceive that sunlight makes their infants healthier, and who got information from health-care professionals were significantly associated with good practice in sunning of their infant.

**Conclusion and Recommendation:** Finding of this study indicated that 34.3% of participants have poor practice in sunning of infants. This is a pointer that sunlight exposure of infants still needs attention from the government and other concerned bodies.

**Keywords:** rickets, sunlight exposure, ultraviolet index, vitamin D, VDD

## Introduction

The healing power of the sun and its use in medical treatment (heliotherapy) has extended back into ancient times<sup>1</sup> starting from about 1400 BC.<sup>2</sup> In 1919, the first scientifically established health benefit of sun exposure was that sunlight can be used to prevent and cure rickets.<sup>3</sup>

Recently being exposed to ultraviolet radiation has been a subject of epidemiological interest due to both its beneficial and detrimental effects. Excessive ultraviolet radiation (UVR) is associated with skin cancer, sunburn, accelerated skin

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aging, and cataracts and it also reduces the effectiveness of the immune system. Contrary to the adverse effect, small amounts of UVR are beneficial to health, and play an essential role in the production of vitamin D.<sup>4</sup> Sunlight exposure also still has inadequately explored benefits, which include release of nitric oxide, production of beta-endorphin, and regulation of circadian rhythms.<sup>5</sup>

Vitamin D is used for maintaining the plasma concentration of calcium and phosphate in normal physiologic range and it interacts with parathyroid hormone to maintain bone mineralization.<sup>6</sup> Around 80–90% of vitamin D in humans is sunlight-derived production in the skin.<sup>7</sup> But, to get such amount of vitamin D there are different factors to be considered. Such factors are time spent outdoors, skin pigmentation, degree of latitude, season, the amount of cloud cover, the extent of air pollution, the amount of skin exposed, and the extent of ultra-violet B (UVB) protection, including clothing and sunscreens.<sup>8–10</sup> For efficient production of vitamin D regular exposure of unprotected skin (without use of sunscreen and/or without clothing) to the available UVB radiation is recommended.<sup>11</sup> UVB (short-wave ultraviolet rays) is found maximum in the midday sun. Thus, the best time of day for vitamin D production is near to solar noon from 10 a.m. to 2 p.m.<sup>5,11,12</sup> Below latitudes of approximately 35° north, UVB radiation is sufficient for vitamin D<sub>3</sub> synthesis throughout the year, however, at higher latitudes (above 35° north) vitamin D<sub>3</sub> is not produced during the winter months and people may be predisposed to vitamin D deficiency unless taking vitamin D supplementation.<sup>13</sup>

Vitamin D deficiency (VDD), which is serum 25-hydroxyvitamin D (25OHD) level less than 30 nmol/l, is a worldwide health problem with numerous health consequences.<sup>14</sup> Around 1 billion people worldwide, across all age groups, have a VDD. Epidemiological studies in different countries revealed that VDD is highly prevalent among infants, regardless of age, ethnicity, geographic location and climatic conditions and is believed to range from 2.7% to 45%.<sup>15,16</sup> Ethiopia is not an exception from this burden. A study done in Addis Ababa revealed that 41% of children below three years of age visiting an out-patient department had vitamin D deficiency rickets and the frequency was higher in infants.<sup>17</sup> Another study done in Jimma town found that the prevalence of vitamin D deficiency rickets in infants was 11%.<sup>18</sup>

Low vitamin D status is associated with demineralization of the skeleton, cardiovascular disease, cognitive

decline, depression, diabetes mellitus, pregnancy complications and autoimmune diseases,<sup>19</sup> growth retardation and skeletal deformities in children and infantile eczema in neonates.<sup>8,20,21</sup> VDD has also substantial economic burdens. As much as 25% of health-care dollars could be saved just by improving the world's vitamin D status.<sup>10</sup>

Although it is fairly simple to obtain vitamin D, lack of appreciation for the importance of sensible sunlight exposure to meet vitamin D requirements of children and adults has led to a worldwide VDD pandemic.<sup>10</sup> Furthermore social, religious norms and health practice of mothers might lead to vitamin D deficiency by preventing infants from sunlight exposure.<sup>22</sup> Previous study revealed that maternal age, maternal educational status, maternal occupation, family size and fathers' educational status were significantly associated with practice of sunlight exposure.<sup>23</sup>

Efforts to prevent VDD with supplementation of vitamin D, fortification of milk or other foods with vitamin D and/or adequate sunlight exposure are recommended worldwide.<sup>15</sup> Guidelines in Ethiopia recommend sunning of neonates starting from 2 weeks old for 15–20 minutes per day.<sup>24</sup> Although health education to change maternal behaviour to expose infants to sunshine was adopted as the main strategy to combat rickets in the early 1960s, the implementation of this strategy is inconsistent.<sup>25</sup> Despite all these efforts, lack of sunlight exposure continues to be the major risk factor of VDD rickets in Ethiopian children.<sup>26,27</sup>

There is an abundance of sunlight in Ethiopia throughout the year, but studies indicating the practice of mothers on sunning of their infants and factors barring infants from getting adequate sunshine are insufficient and especially no evidence is available in the study area. Therefore, this study aimed to assess the practice and factors associated with sunlight exposure of infants by mothers in the study area.

## Materials and Methods

### Study Design, Period, Setting and Populations

A community based cross-sectional study was conducted from March 15, 2019 to April 15, 2019 in Debre Berhan town. Debre Berhan town was founded by Emperor Zara Yaqob and it is a zonal administrative town of North Shewa, Amhara national regional state. It is 130 km away from Addis Ababa, the capital city of Ethiopia and

690 km from Bahir Dar, capital of Amhara region. The town is located at a latitude and longitude of 9°41'N 39°32'E and has an elevation of 2840 m above sea level. It has 14 kebeles, one referral hospital, 3 health centers and 14 health posts. A kebele is the smallest administrative unit in Ethiopia. Each kebele in larger cities of Ethiopia has its own kebele office encompassing at least 500 households. Data obtained from health extension workers' family folders in all 14 kebeles of the Debre Berhan town indicated that there were 1946 mothers with a child less than 12 months old in 2019.

All mothers with a child less than 12 months old living in Debre Berhan town were the source population and all mothers with child less than 12 months old living in selected kebeles of Debre Berhan town were the study population. Respondents who were living in the town for less than 6 months and who were not able to speak or were severely ill during the data collection time were excluded from the study.

### Sample Size and Sampling Procedure

A single population proportion formula was used to determine a total sample of 530 with the assumption of: 95% confidence interval, 5% margin of error, proportion (P) = 50% to get maximum sample size since there was no previous community-based study, design effect 1.5 and 10% non-response rate.

To identify study participants a multistage sampling technique was used. First, seven kebeles were selected from the existing 14 kebeles with a simple random sampling technique. Then the calculated sample size was proportionally allocated to each selected kebele of the town based on the number of infants available from the health extension workers' family folders. Then, participants in each kebele were selected with systematic random sampling technique with an every two interval. During data collection the center of each selected kebele was located and with spinning pen the direction where the first household with infant was identified towards the tip of pen. Afterwards the first household with infant included in the study was selected by lottery methods from the first two households in the selected direction. In cases where two infants were found in one household only the caretaker of one infant was selected by lottery method. Revisit of three times was made in cases where eligible respondents were not available at the time of the survey.

### Data Collection Tool and Procedure

Data were collected with face-to-face interview using pre-tested, structured and semi-structured Amharic version questionnaires by trained nurses. Data collection tools were prepared in English by reviewing different literatures and adapted to the local context then translated into Amharic language and back to English by respective language experts to check consistency. The questionnaire included seven questions related to socio-demographic characteristics; seven questions to evaluate practice of mother on sunning of infants; and four questions related to perceived consequence of sunlight exposure and three questions linked to health service utilization.

The data collection tool was pre-tested among 5% of the total sample size, and its clarity, length, and completeness were checked and appropriate amendment was undertaken. The pre-test was conducted in Chacha town, which is 51 km away from Debre Berhan town, to avoid information contamination. Six diploma nurses were recruited to conduct interview questionnaires with two BSc nurse supervisors. Training was given for one day on the objective, relevance of the study, informed consent, confidentiality of information and technique of interviewing.

### Data Processing and Analysis

First data were checked for completeness and consistency before being entered in the computer. Then data were coded and entered to Epi-Data version 3.1 software and exported to SPSS statistical software version 22 for analysis. Descriptive statistics including frequency distribution, percentages, and measures of central tendency were used to summarize data. Binary and multiple logistic regression analysis were determined to assess the association between independent and dependent variables. The strength of statistical association was measured by odds ratio and 95% confidence intervals, and statistical significance was declared at  $p < 0.05$ .

### Key Words and Operational Definitions

Good practice: Mother responded to practice questions and scored above 3.5 median values

Poor practice: Mother responded to practice questions and scored 3.5 and below 3.5 median values

Completely covered: Infant wearing clothes that cover the whole body except the face. Unclothed: Infant wearing no clothes except pants.

Partly covered: Infant wearing minimal clothing (pants and vest) and not long shorts such that legs, arms and face are not covered.

Got antenatal care: mother who had at least one visit in health facility prior to onset of labour.

Got postnatal care: mother who had at least one return visit of health facility for postnatal care within six weeks of postpartum period.

## Ethical Consideration

Ethical clearance was obtained from the Institutional Review Board (IRB) of Addis Ababa

University, school of nursing and midwifery. Then a formal letter of cooperation was written to Debre Berhan Town Health Office, and permission was obtained. Informed written consent was obtained from study participants and from their parents for those lower than 18 years old beside to individual assent. The purpose of the study was explained to the study participants, and anonymity, privacy, and confidentiality were ensured. Participants had the right to self-determination regarding to participate in study, both initially and during the data collection process. This study was conducted in accordance with the Declaration of Helsinki.

## Results

### Socio-Demographic Characteristics of Respondents

A total of 530 mothers were asked and responded to the interviewee. From those 331 (62.5%) mothers had infants less than or equal to six months old. The mean age ( $\pm$ SD) of the participants was 27.96 ( $\pm$  4.252) years. Two hundred and thirty-six (44.5%) participants had an age range of 27–32 years old. The majority of mothers (437; 82.5%) were orthodox followers. Most (468; 88.3%) mothers were married, 231 (43.6%) mothers had reached grade 9–12 in their educational status, 302 (57%) of mothers were housewife in their occupation. Four hundred and eight (77%) of mothers had three to four family members. Regarding their husbands' educational status, 193 (36.4%) had diploma and above (Table 1).

### Practice of Mothers About Sunlight Exposure of Their Infants

Out of 530 respondents almost all (525; 99.1%) respondents intentionally expose their infant to direct sunlight. Four hundred and fifty (85.7%) of mothers start to expose their infants before they are 15 days old. Furthermore, in this study 322 (60.8%) mothers expose their infants to sunlight daily, with

**Table 1** Distribution of Socio-Demographic Characteristics of Study Participants in Debre Berhan Town, North Shewa Zone, Ethiopia, 2019 (n = 530)

Variables Categories	Frequency	Percentage	
Maternal age group	15–20 years	27	5.1
	21–26 years	179	33.8
	27–32 years	236	44.5
	33 and above years	88	16.6
Infants age group	0–180 days	331	62.5
	181–364 days	199	37.5
Maternal religion	Orthodox	437	82.5
	Muslim	28	5.3
	Protestant	60	11.3
	Catholic	5	0.9
Marital status	Single	40	7.5
	Married	468	88.3
	Divorced	14	2.6
	Widowed	8	1.5
Mother's educational status	No formal education	46	8.7
	Grade 1–8	95	17.9
	Grade 9–12	231	43.6
	Diploma and above	158	29.8
Occupational status	Student	20	3.8
	House wife	302	57.0
	Government employee	88	16.6
	Daily laborer	24	4.5
	Private employee	45	8.5
	Merchant	51	9.6
Family size	<3	23	4.3
	3–4	408	77
	≥ 5	99	18.7

509 (96%) mothers exposing in the morning before 10 a.m. and 188 (35.5%) mothers exposing their infants for a duration of 10–15 minutes. Regarded the condition of clothing during sunning of infant, 290 (54.7%) mothers expose with only putting diaper or naked. Three hundred and six (57.7%) of respondents did not apply any lubricant/body lotion during sunning of their infant (Table 2).

### Mother's Level of Practice About Sunlight Exposure of Their Infants

For the above seven practices questions the median value is 3.5. Out of 530 respondents 182 (34.3%) scored less

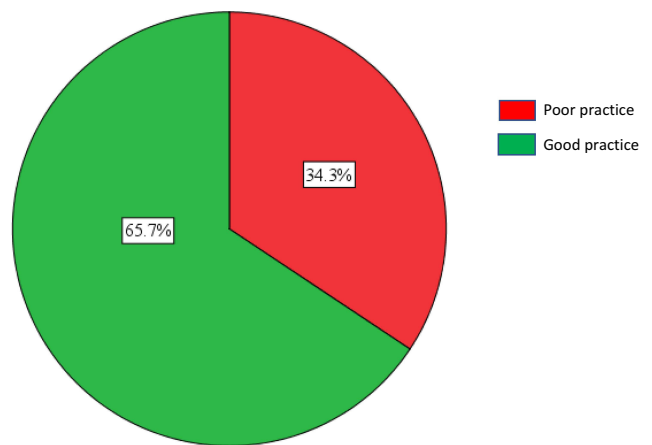
**Table 2** Distribution of Mothers by Their Practice Concerning Sunlight Exposure of Infants in Debre berhan Town, North Shewa, Ethiopia, 2019

Variables	Categories	Frequency	Percent
Mothers who intentionally expose their infant to direct sunlight (n = 530)	Yes	525	99.1
	No	5	0.9
Age of infant to start sunlight exposure (n = 525)	0–15 days	450	85.7
	16–30 days	66	12.6
	31–45 days	5	0.9
	45 days and above	4	0.8
Frequency of sunlight exposure (n = 525)	Daily	322	61.3
	Sometimes	203	38.7
Time of the day to expose infant outdoors (n = 525)	Morning before 10am	509	97
	Mid-day	16	3
	10AM-2 PM		
Condition of clothing during sunlight exposure (n = 525)	Only diapers/naked	290	55.2
	Partly covered	213	40.6
	Completely covered	22	4.2
Duration of sunlight exposure	5–10 minutes	154	29.3
	10–15 minutes	189	36.0
	15–20 minutes	168	32.0
	Above 20 minutes	14	2.7
Apply lubricants/lotion on infant's body during sunlight exposure (n = 525)	Yes	219	41.7
	No	306	58.3

than the median value. Therefore, depending on the operational definition 34.3% of mothers had poor practice (Figure 1).

### Mother's Source of Information for Intentional Exposure of Their Infant to Sunlight

Regarding the source of information for sunlight exposure of infants, most (370; 70.5%) mothers got information from health professionals followed by 202 (38.5%) mothers who got information from neighbours/family (Figure 2).



**Figure 1** Distribution of mothers by their level of practice score regarding sunlight exposure of infants in Debre Berhan town, North Shewa, Ethiopia, 2019 (n = 530).  
Notes: ■ Poor practice. ■ Good practice.

### Perception of Mothers Towards Sunlight Exposure of Infant

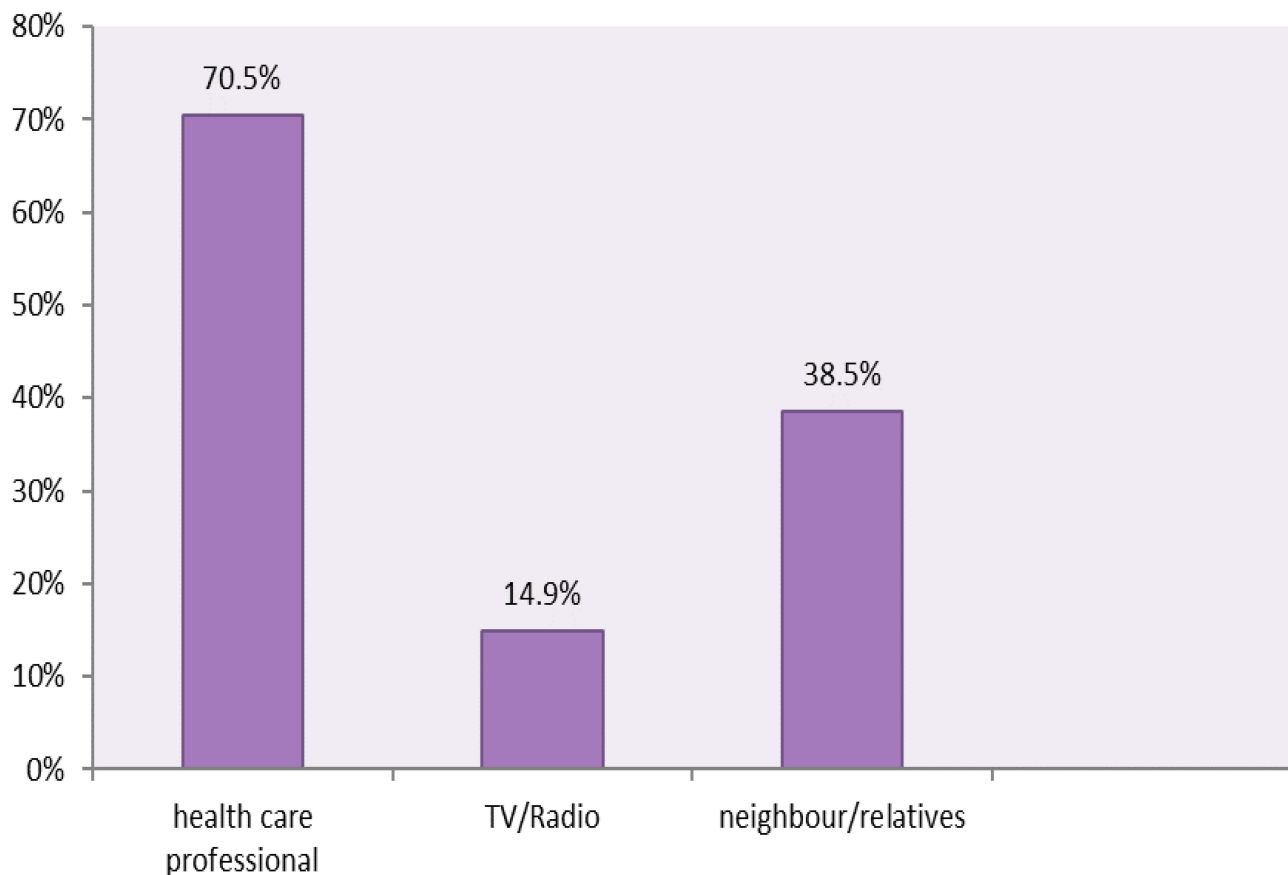
Concerning the benefit of sunlight exposure, 515 (97.2%) respondents perceive sunlight exposure is good for infants. The majority (411; 79.8%) of mothers perceive sunlight exposure is important to strengthen infant bones followed by 332 (64.5%) mothers who thought that exposure benefits the sleep of infants. On the other hand, 18 (3.4%) mothers perceive that sunlight exposure had harmful effect and 13 (72.2%) of them thought sunning of infant predispose to pneumonia (Table 3).

### Health Service Utilization of Mothers

Almost all respondents (527; 99.4%) delivered in a health facility but only 242 (45.9%) of them were advised to expose their child to sunlight and out of 504 mother who had ANC 155 (30.8%) were advised about sunning of their infant. Moreover from 473 (89.2%) mothers who had postnatal follow up, 285 (60.3%) were advised about sunning of their infant (Figure 3).

### Bivariable and Multivariable Analysis of Mother's Practices Regarding Sunlight Exposure Their Infant

In this study occupational status, infant age, family size, maternal educational status, marital status, source of information from health-care professional, from television/radio and from neighbours/relatives, maternal perception related to the benefit of sunning specifically to strengthening infant bones and to being healthier, to



**Figure 2** Distribution of mothers by their source of information about sunlight exposure of infants in Debre Berhan town, North Shewa zone, Ethiopia, 2019 (n = 525 to each).

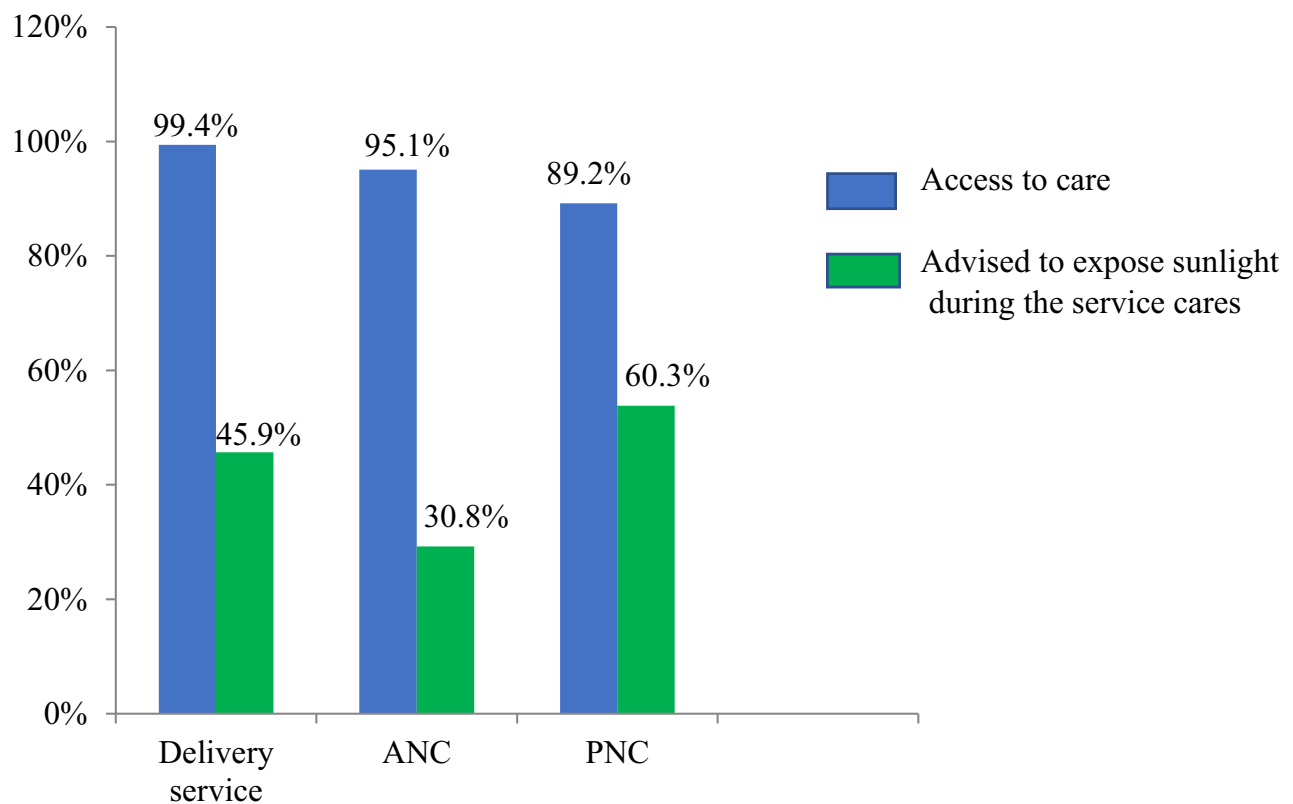
help the child sleep well and to grow faster, maternal perception regarding harmful effect of sunlight exposure, antenatal care, delivered at health facility and

postnatal follow-up were tested on bivariable analysis at p-value < 0.2 to segregate candidate variables for multivariable analysis.

**Table 3** Distribution of Mothers by Their Perception Related to Sunlight Exposure of Infants in Debre Berhan Town, North Shewa Zone, Ethiopia, 2019

Variable	Category	Frequency	Percent
Sunlight exposure is beneficial for infant (n = 530)	Yes	515	97.2
	No	2	0.4
	Not sure	13	2.5
Perceived benefit of sunlight exposure (n = 525)*	To strengthen infant bones	411	79.8
	To get good sleep	333	65.4
	To be healthier infant	265	51.5
	To grow faster	215	41.7
	Other benefit (Closure of fontanel, prevent blurring of vision)	3	0.6
Sunlight exposure has harmful effect	Yes	18	3.4
	No	512	96.6
Perceived harm of sunlight exposure (n = 18)**	Predispose to pneumonia	13	72.2
	Predispose to blindness	4	22.2
	Other harm (fever, ovulities, crossed eye)	5	27.8

**Notes:** \*Each mother did perceive two or more benefits, \*\*Each mother did perceive two or more harms.



**Figure 3** Distribution of mother by health service utilization in Debre Berhan town, North Shewa, Ethiopia, 2019.

**Notes:** ■ Access to care. ■ Advised to expose sunlight during the service care.

Afterwards in multivariable analysis the factors maternal age, occupational status, perceived to strengthen infant bones, perceived to be healthier infant and source of information from health-care professional were found to be significantly associated with maternal practice of infant sunlight exposure. Mothers whose age was 33 and above were 3 times (AOR = 2.97, 95% CI: 1.073, 8.223) more likely at having good practice in sunlight exposure of infant compared with mothers of age 15–20 years. Mother whose occupational status was housewife (Adjusted Odds Ratio (AOR) = 2.29, 95% CI: 1.03, 8.19) and government employee (AOR = 5.10, 95% CI: 1.54, 16.92) were 2 times and 5 times more likely to practice good sunning of infant compared with students, respectively. Furthermore, maternal perception of sunlight exposure as beneficial to strength infant bones (AOR = 2.79, 95% CI: 1.78, 4.37), to make the infant healthier (AOR = 1.83, 95% CI: 1.09, 3.16) and mother's source information for sunning being health-care professionals (AOR = 2.11, 95% CI: 1.09, 4.06) showed statistically significant association with maternal practice of sunlight exposure of infant (Table 4).

## Discussion

This study was carried out to assess practice of mothers and associated factors concerning sunlight exposure of their infant in Debre Berhan town, Ethiopia in the study period. The finding of this study indicated that 34.3% of participants have poor practice in sunlight exposure of infants. This finding supports the fact that insufficient sun exposure is a major public health concern, and health education with particular emphasis for mothers and caregivers of young children should be provided.<sup>3,28</sup>

The finding of this study showed that 99.1% of mothers did intentionally expose their infant to direct sunlight. This is higher than a study done in Debre Markos which was 93%,<sup>23</sup> but slightly lower than a study done in Jimma town which was 100%.<sup>18</sup> This difference might be due to socio-demographic differences of respondents. Furthermore, study done at Townsville in Australia showed that only 20% of mothers intentionally expose their baby<sup>29</sup> which was lower than the finding of this study. The possible reason behind this may be that the Australian cancer prevention society does not recommend infant sunlight exposure because of the high prevalence of skin cancer there and hence fear of skin cancer.

**Table 4** Bivariable and Multivariable Analysis of Maternal Practice Towards Sunlight Exposure of Their Infants in Debre Berhan Town, North Shewa, Ethiopia, 2019

Variables		Practice		95% CI (COR)	95% (AOR)
		Good No. (%)	Poor No. (%)		
Maternal age	15–20 years	15(55.6)	12(44.4)		
	21–26 years	104(58.1)	75(41.9)	1.109(0.491,2.506)	1.23(0.502,3.005)
	27–32 years	104(58.1)	75 (41.9)	1.936(0.862,4.349)	1.87(0.765,4.572)
	33 and above	62(70.5)	26(29.5)	1.908(0.768,4.629)	2.97(1.073,8.223) *
Mother's educational status	No formal education	27(58.7)	19(41.3)		
	Grade 1–8	69(72.6)	26(27.4)	1.868(0.891,3.915)	2.37(0.97,5.78)
	Grade 9–12	90(39.0)	141(61.0)	1.102(0.579,2.099)	1.08(0.49,2.38)
	Diploma and Above	111(70.3)	47(29.7)	1.662(0.843,3.277)	1.76(0.71,4.31)
Occupational status	Student	9(45)	11(55)		
	Housewife	202(66.9)	100(33.1)	2.469(0.991,6.152)	2.29(1.03,8.19) *
	Government employee	75(85.2)	13(14.8)	7.05(2.444,20.345)	5.10(1.54,16.92) *
	Daily laborer	16(66.7)	8(33.3)	2.444(0.719,8.307)	2.98(0.75,11.8)
	Private employee	20(44.4)	25(55.6)	0.978(0.339,2.820)	0.69(0.20,2.39)
	Merchant	26(51)	25(49)	1.271(0.450,3.589)	1.78(0.54,5.87)
Family size	< 3	12(52.2)	11(47.8)		
	3–4	264(64.7)	144(35.3)	1.68(0.723,3.904)	1.53(0.57,4.08)
	≥ 5	72(72.7)	27(27.3)	2.44(0.964,6.196)	2.05(0.69,6.08)
Got information from health professionals	Yes	263(71.1)	107(28.9)	2.024(1.373,2.984)	2.11(1.09,4.06) *
	No	85(54.8)	70(45.2)		
Got information from television/radio	Yes	61(78.2)	17(21.8)	2.0(1.13,3.54)	1.56(0.95,2.56)
	No	287(64.2)	160(35.8)		
Perceived to strengthen infant bone	Yes	291(70.8)	120(29.2)	2.08(1.34,3.23)	2.79(1.78,4.37) *
	No	56(53.8)	48(46.2)		
Perceived to be healthier infant	Yes	199(75.1)	66(24.9)	2.079(1.43,3.03)	1.83(1.09,3.16) *
	No	148(59.2)	102(40.8)		
Exposing infant to sunlight is harmful	Yes	7(38.9)	11(61.1)		
	No	341(66.6)	171(33.4)	3.13(1.19,8.23)	0.33(0.06,1.78)
Had antenatal follow up	Yes	337(66.9)	167(33.1)	2.75(1.24,6.12)	1.23(0.38,4.23)
	No	11(42.3)	15(57.7)		
Had post-natal care	Yes	326(68.9)	147(31.1)	3.53(2.00,6.22)	1.97(0.85,4.54)
	No	22(38.6)	35(61.4)		

Note: \*p-value<0.05.

Abbreviations: COR, crude odds ratio; AOR, adjusted odds ratio; CI, confidence interval.

In this study 85.7% of respondents started to expose their infants to sunlight by the time they were 15 days old. This finding was not in agreement with a study of Debre Markos that showed only 23.4% started within 15 days.<sup>23</sup> This discrepancy might be the study participants' source of information. In this study the majority of respondents got information from health-care professionals and source of information from health-care professionals was positively and statistically significant associated with the practice

level of mothers. Source of information for participants in that study was neighbor/elderly people, which has insignificant association with practice level of sunning of infant. Furthermore, a study done in Kiambu District Hospital, Kenya<sup>30</sup> found that 40.3% infants started sunlight exposure within the second week of age which is lower than this study result. This difference could be due to the fact that Kiambu is nearer to the equator where the intensity of UVR is high compared with Debre Berhan, as

a result mothers in Kiambu might fear this intense ultra-violet ray may harm their infant. This study also uncovered that 60.8% of mothers were sunning their infant on daily basis. This finding is in line with a study done in Debre markos which was 57.9%,<sup>23</sup> but lower than a study done in Jimma town which was 92%.<sup>18</sup> The possible reason for this variation might be climatic differences between the two towns.

This study showed that 97% of respondents exposed their infant to sunlight in the morning before 10 a.m. This implies almost all respondents did not expose their infant at the best time of day for vitamin D production, the time near to solar noon from 10 a.m. to 2 p.m.<sup>5,11,12</sup> Evidence from IMNCI 2015 of Ethiopia indicated that babies need to be exposed to sunlight for 15–20 minutes per day.<sup>24</sup> Moreover anecdotal evidence cited that regular exposure of unprotected skin (without use of sunscreen and/or without clothing) to the available UVB radiation is efficient for the production of vitamin D.<sup>11</sup> In the present study only 55.2% and 32% of respondents were sunning their infant with only diaper/naked and for a duration of 15–20 minutes/day, respectively. Moreover, 41.7% of respondent in this study applied body lotion/lubricants at the time of sunning their infant. This implies that it is crucial to increase the awareness of communities regarding the appropriate practice of sunning of infants for optimal cutaneous vitamin D production.

This study presented that mothers who thought sunlight exposure is beneficial to strengthen infant bones, and will make their infants healthier, were 2.8 times and 1.8 times more likely at having good practice of sunning infants than their counterpart, respectively. This finding is in line with a study conducted in Addis Ababa that verified that maternal perceived consequences of sunlight exposure were significantly associated with maternal intention of exposing their infant to sunlight.<sup>25</sup> This benefit is also clinically supported in that vitamin D is produced owing to sunlight exposure of bare skin. Vitamin D helps in maintaining the plasma concentration of calcium and phosphate in normal physiologic range and interacts with parathyroid hormone to maintain bone mineralization.<sup>6,31</sup>

Finding of this study also revealed that the odds of practicing good sunlight exposure of infant in mothers with age group of 33 and above years were 3-fold more than those in the age group of 15–20 years. Occupational status of mother was significantly associated with their practice of sunlight exposure. Mothers whose occupational status was housewife or government employee were 2

times and 5 times more likely to have good practice in sunning of infants compared with students, correspondingly. Similarly, a study in Debre markos showed that maternal age and occupational status were significantly associated.<sup>23</sup>

## Limitation

Due to scarcity of similar studies, the researcher is faced with a challenge for comparing the result of the study in Ethiopia as well as in an African context. The information was self-reported and no experience of the mother was observed. Due to social desirability bias respondents might respond what they did not experience.

## Conclusion

The finding of this study revealed that 34.3% of participants have poor practice in sunlight exposure of their infant. This low practice level is an indicator that the federal ministry of health, mass media, health care professionals and other concerned body did not give as much attention as is necessary to provide detailed information about the importance of infant sunlight exposure.

Maternal age, occupational status, perceived benefit by mothers on infant sunlight exposure particularly to strengthen infant bones, for the health of their infants, and source of information from health-care professionals were positively associated with maternal practice of infant sunning.

## Recommendations

The federal ministry of health should coordinate concerned bodies for preparing a detail counseling steps on the appropriate practice of sunning of infants and incorporate these in the other health service guidelines. Non-governmental organizations should give attention and integrate this practice with other micronutrient deficiency preventive strategies.

Mass medias and health-care professionals should give more attention to the importance of sunlight exposure, how to practice this and give better information for the mothers. In addition, health-care professionals should prepare a leaflet on the appropriate practice of infant sunning and give it to each mother.

Future researchers are recommended to do further studies to determine the most appropriate way of sunning infants to maintain adequate serum vitamin D based on a study area's ultra-violet index.

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## Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis, and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted, and agree to be accountable for all aspects of the work.

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## Disclosure

The authors declare that they have no conflicts of interest for this work.

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