Journal of Women Health Care and Gynecology
2025 Volume 5, Issue 6
DOI: 10.59657/2993-0871.brs.25.102

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Knowledge and Practice of Mothers on Exposure of Sunlight of Their Infants and Its Associated Factors in Jimma Town, Southwest Ethiopia: 2023

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Abstract

Background: Exposure to sunlight is essential for the growth and development of children. Poor knowledge and practice of sunlight exposure in a country where there is no supplementation of vitamin D will result in deficiency status which is associated mainly with growth problems, bone pain, muscle weakness, and limb, and pelvic deformities. In the long term, rickets could lead to osteomalacia, Low bone mass in adulthood, and narrowing of the pelvic outlet, as well as cardiovascular disease, autoimmune diseases, and adult-onset diabetes mellitus.

Objective: To assess the knowledge and practice of mothers on exposure of sunlight of their infants and its associated factors in Jimma town, southwest Ethiopia, 2023.

Methods: A community-based cross-sectional study design with both quantitative and qualitative methods was conducted in Jimma Town on 413 mothers. A simple random sampling technique was employed for the quantitative study and a purposive sampling technique was used for the qualitative study. Data were collected by using semi-structured and structured questionnaires and In-depth interviews and analyzed by SPSS 26. Bivariable and multivariable logistic regression analyses were done to identify factors associated with outcome variable and qualitative data was analyzed and summarized manually by thematic approach and presented in triangulation with the quantitative findings.

Results: 413 mothers were interviewed with a 98.3% response rate. Out of 413 mothers, 63% of mothers are knowledgeable about sunlight exposure and 43.1% of them had poor practice about sunlight exposure. In multivariable logistic analysis mother's educational status (AOR=4.20, 95% CI: 1.17, 9.82) and advise to expose the child to sunlight during delivery (AOR=2.41, 95% CI: 1.02, 5.76) were significantly associated with the knowledge of mothers. Whereas age, (AOR=2.45; 95% CI: 1.08-5.54) and 2.72 times (AOR=2.72; 95% CI: 1.09-6.72), mother's occupational status (AOR=3.19, 95% CI: 1.34-7.63) and knowledge about children's sunlight exposure (AOR=1.70, 95% CI: 1.04, 2.78) were significantly associated with the practice of infants' sunlight exposure and for qualitative part Six major themes were used.

Conclusion: Even though the majority of mothers in the study area had good knowledge, half of the respondents had poor practice of infants' sunlight exposure. Therefore, interventions focusing on these findings are required to improve the knowledge and practice of mothers on sunlight exposure.

Keywords: mothers 'knowledge and practice; sunlight exposure; vitamin D deficiency

Introduction

Vitamin D is one of the fat-soluble vitamins. Approximately 90% of its requirement comes from sunlight exposure and the remaining from diet and/or dietary supplements. In addition to having an important role in calcium homeostasis, vitamin D has several other functions in the body, such as inhibition of cell proliferation, stimulation of differentiation of cells of different strains, modulation of the immune system, and inflammation [1]. To achieve a blood level of at least 30 ng/ML would require ingesting 2000 IUs of vitamin D daily, which would be equivalent to 25% of the body surface exposed to 0.5 MEDs 2-3 times a week [2].

Humans produce 80-90% of their vitamin D in their skin because of exposure to sunlight. However, there are several variables to take into account to obtain this level of vitamin D, including the amount of time spent outside, skin pigmentation, latitude, season, amount of cloud cover, level of air pollution, amount of exposed skin, and level of ultraviolet B protection, such as clothing and sunscreens. Regular exposure of bare skin (without the use of sunscreen and/or clothes) to the available UVB radiation is advised for the efficient generation of vitamin D. The midday sun is when UVB (short-wave ultraviolet radiation) is most prevalent. Thus, between 10 a.m. to 2 p.m., just

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before solar noon, is the greatest period of day for vitamin D production [3].

Studies globally identify lack of sun exposure as the main cause of rickets. Rickets is a major public health problem in several countries of the world. It is most commonly seen in children from countries in Africa, the Middle East, and Asia, although many of these countries are in the tropics with abundant sunshine. In many rich technologically advanced countries, the prevalence of rickets in the overall population reduced after the introduction of dietary supplementation [4].

Vitamin D deficiency rickets have also been common in Ethiopian children, particularly in 6-24 months of age infants [5]. Health education to change maternal behavior to expose infants to sunshine was adopted as the main strategy to combat rickets in Ethiopia. However, the implementation of the strategy has remained inconsistent and health messages lack focus on factors that influence maternal practice excluding infants from getting adequate sunshine.

Methods and Materials

Study Area and Period

The study was conducted in Jimma town, southwest Ethiopia, from June 20-July30, 2023.Jimma town is the capital and administrative center of the Zone and is located 352 km south-west of Addis Ababa. The town has a total population of 224,000, of whom males account for 112,896 females 111,104 according to the 2023 GC Jimma zone health bureau population projection report. There are 42,742 households in the town. Jimma town has 17 administrative kebeles, and there are 8530 under 1-year children in the town there is one referral hospital, one public hospital and four health centers.

Study Design

Community-based cross-sectional study design was employed with both quantitative and qualitative data collection methods.

Source Population

- *For Quantitative:* All mothers who have a child less than one year living in Jimma town.
- *For Qualitative Study:* health care providers in selected institutions, and HEW's.

Sample Size Determination

The sample size was calculated by using EPI Info version 7.2.5.0 by considering different assumptions. To determine the prevalence was 44.8%, a 95% confidence interval, a 5% margin of error, and a 10% nonresponse rate 416.

For IDI, health care providers and HEW's were selected purposively and interviewed on the issue until saturation of ideas.

Variables

- *Good knowledge:* Those mothers who responded to knowledge questions and scored above the mean value [6].
- *Poor knowledge:* Those mothers who responded to knowledge questions and scored below the mean value [3,6].

Data Collection Tool, Personnel, and Procedure

A structured interviewer-administrated questionnaire was used to collect the data. The questionnaire was adapted by reviewing different literature [6-10] and from that it was modified depending on the situation and the research objectives. It included all the relevant variables to meet the objectives. Part-I socio-demographic questions contain 10 questions, part-II knowledge questions contain 9 questions, part-III practice questions contain 10 questions part-IV factors affecting the practice of sunlight exposure questions contain 13 questions and part-V attitude questions contains 9 questions using the Likert scale. Ten health professionals (10 diploma nurses) and two supervisors (Bsc midwives) participated in the data collection.

For Qualitative Data: a semi-structured questions interview guide was developed. The interview was initiated with a general question followed by a probing question, and then to the specific question as the data collection progresses and was provided by the principal investigator and two data collectors.

Data Quality Management

To ensure data quality, emphasis was given to designing the data collection instruments, which were then translated to the Afaan Oromo and Amharic languages by language experts, after which they were translated to English by another person to check consistency. Before the actual data collection, a pretest was conducted on 5% of the sample in (20 mothers) among mothers in Ginjogudru kebele in Jimma town, which has similar culture to other kebeles and this kebele was not selected for the actual study, and the feedback was incorporated accordingly. The data collectors and supervisors were trained for one day on the objective of the study, the data collection tool, the approach to the interviewees. At

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the end of each day, the questionnaires were reviewed and crosschecked, and corrective measures were taken.

For IDI, the trustworthiness of the qualitative data was ensured through their credibility, transferability, dependability and conformability through the triangulation of findings, the use of field notes, careful transcription, translation, and rich descriptions of the study methods. To ensure the validity of the translation, another person, proficient in both languages, checked and commented on it to incorporate changes into the report. All the recorded interviews were transcribed into a composed text for qualitative analysis.

Data Analysis Procedures

For Quantitative: The data was collected and entered using KoboToolBox version 4.4 and was checked for completeness, identified errors were corrected, and after being coded, the data was exported to SPSS version 26. Analysis was done with descriptive statistics by using frequency; percentage mean and Standard deviation, crude ratio, and adjusted odds ratio were calculated. Bivariable logistic regression analysis was determined to assess the association between independent and dependent variables. All variables with p-value < 0.25 were taken into the multivariable analysis, confidence interval was calculated for statistical significance after Hosmer and Lemeshow checked for model fitness. Multi-collinearity test was used to identify the correlation between independent variables. Those variables with p-value < 0.05 were considered statistically significant, and the results were reported with adjusted Odds Ratio and 95% CI.

For qualitative data, the recorded IDIs were transcribed verbatim (word for word) in the local language Amharic and then translated into English by the principal investigator together with the person with experience conducting qualitative research. The transcriptions and translations were then carefully reread, line by line and repeatedly, to carry out the coding process that the researcher deemed important. Later, the quest for themes is carried out by combining previously coded, similar data.

Declarations

Ethical Consideration: Ethical clearance was obtained from the Institutional Review Board (IRB) of the Jimma University College Public Health. An official support letter from the School of Public Health was written to Jimma Health Bureau. After the objectives of the study was explained. Permissions were secured from each selected kebele used as a data collection site. The objectives of the study were explained to the study participants. Potential harms (such as taking their time for the interview) and benefits of the study were explained to each respondent and finally written informed consent was obtained. The respondents got an explanation of the possibility of withdrawing from the interview at any time they wished and participation must be voluntary. Permission to audio-record for the in-depth interview was also obtained. The data obtained was held confidential. No personal identifiers, such as names, were used during data collection, analysis, or report writing also explained to the participants. During the training of data collectors and supervisors' ethical issues were addressed privacy and confidentiality were ensured throughout the process of the study.

Results

Socio-Demographic Characteristics

A total of 413 mothers were involved in this study with a 98.3% response rate. Of those respondents, 160 (38.7%) were between the age of 26 and 30 years.235 (56.9%) mothers had infants less than or equal to six months old. The mean age of the mothers was 28.15 (±5.02) years and the mean age of the children was 6.25 (±3.5) months (Table 1).

Table 1: Socio-Demographic Characteristics of Mothers in Jimma town, South west, Ethiopia 2023 (n=413).

Variable	Frequency	Percent
Mothers Age (Years)		
< 20	41	9.9
21-25	120	29.1
26-30	160	38.7
≥31	92	22.3
Total	413	100
Infants age		
0-6 Months	235	56.9
7-12 Months	138	43.1
Total	413	100

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Religion		
Orthodox	125	30.3
Muslim	145	35.1
Protestant	83	20.1
Catholic	46	11.1
Others	14	3.4
Total	413	100
Marital Status		
Married	390	94.4
Divorced	13	3.1
Widowed	10	2.4
Total	413	100
Ethnicity		
Oromo	183	44.3
Amhara	116	28.1
Gurage	38	9.2
Tigre	40	9.7
Other	36	8.7
Total	413	100
Maternal Educational Status		
No Formal Education	59	14.3
Grade 1-8	74	17.9
Grade 9-12	119	28.8
Technical /Vocational	75	18.2
Higher (Diploma & Above	86	20.8
Total	413	100
Mother's Occupation		
House Wife	154	37.3
Government Employee	95	23.3
Private Employee	56	13.6
Merchant	52	12.6
Daily Laborer	34	8.2
Student	22	5.3
Total	413	100
Family Size		
1-2	102	24.7
3-4	107	25.9
≥ 5	204	49.4
Total	413	100
Husband's Educational Status		
No Formal Education	10	2.4
Grade 1-8	68	16.5
Grade 9-12	90	21.8
Technical /Vocational	81	19.6
Higher (Diploma and Above)	141	34.1
Total	390	100
Husband's Occupational Status		
Governmental Employee	125	30.3
private Employee	113	27.4
Merchant	104	25.7
Daily Laborer	48	11.6
Total	390	100

*Others *Joba witnese, Traditonal beliefs, Other** Wolayta, Kefa, Dawero*

Knowledge of Mothers about Sunlight Exposure

Of the total respondents 413 (97.2%) of mothers responded that they knew about infant sunlight exposure. Out of these 255 (46.2%) mothers heard from elders and neighbors and 132 (23.9%) heard information from health professionals (midwives and nurses). Four hundred two (97.2%) of mothers

mentioned that infant sunlight exposure is beneficial and 330 (33.8%), and 224 (23%) of them mentioned that it is beneficial to strengthen the bone and strengthen the body respectively and 279 (28.6%) of mothers mentioned that it is beneficial to keep a child warm. Out of 192 (47.7%) mothers who knew the harmful effect of sunlight exposure 138 (22.6%) of them said that it exposes infants to blindness. Of the respondents 262 (63.4%) knew of a good time to expose infants in the morning and fifty-six (13.6%) knew about exposing infants daily. Two hundred seven (50.1%) knew infants being exposed to sunlight between 2-4 weeks 132 (32.0%) mothers do not know about the Consequence of inadequate sunlight exposure and 130 (31.5%) of mothers said that it will affect infants' bone (Table 2).

Table 2: knowledge of mothers on sun light exposure of their infants in Jimma town south west Ethiopia, 2023 (n=413).

Variable	Categories	Frequency	Percent
Do you have knowledge about sunlight exposure?	Yes	402	97.2
	No	11	2.7
	Total	413	100
Source of information about sunlight exposure?	Physician	45	8.2
	Midwife/Nurse	132	23.9
	Television/Radio	120	21.7
	Neighbors\Elder People	255	46.2
	Total	555	100
Do you think sunlight exposure is beneficial?	Yes	402	97.2
	No	11	2.7
	Total	413	100
Benefit of Sunlight exposure?	Strengthen Bone	330	33.8
	Strengthen Teeth	43	4.4
	Keep Child Warm	279	28.6
	Produce Vitamin D	99	10.2
	Strengthen Body	224	23
	Total	975	100
Do you think sunlight exposure is harmful?	Yes	192	47.7
	No	216	52.3
	Total	413	100
Harmful effect of sunlight exposure?	Skin Cancer	57	12.5
	Blindness	138	22.6
	Sterility	101	22.2
	Evil Eye	60	13.2
	Sickness	88	19.3
	Cold	82	18.4
	Total	526	100
Good time to expose infants on sunlight?	Morning	262	63.4
	Afternoon	43	10.4
	Daily or Almost Daily	56	13.6
	Weekly	31	7.5
	Total	392	94.9
At what age should a child start to be exposed to sunlight?	Within 2 Weeks	72	17.4
	Within 2-4 Weeks	135	32.7
	Within 4-6 Weeks	132	32
	Within 8 Weeks	55	13.3
	Total	394	95.4
What is the Consequence of inadequate sunlight exposure	I Do Not Know	132	32
	No Strong Bone	130	31.5
	Become Weak	29	7
	Not Able to Do Activity	23	5.6
	Limit Growth	23	5.6
	Affect Their Growth	20	4.8
	No Effect	29	7
	Total	386	93.5

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Practice of Mothers about Sunlight Exposure

392 (94.9%) of mothers exposed their infants to sunlight. From these, 207 (48.9%) of them started by the age of 16-30 days, 79 (19.1%) started exposure above the age of 45days, 57 (13.8%) started by the age of 0-15 days, and 55 (13.3%) of them expose their infants by the age of 31-45 days of those mothers who exposed their babies to sunlight, 151(36.2%) exposed every other day and 128 (31.2%) expose daily. Regarding where they expose their baby most, 350 (90.6%) of them exposed their babies outdoors, and regarding the time of exposure, 253 (59.7%) of respondents exposed their babies in the morning from 8 AM-10 AM and 70 (16.9%) of mothers exposed their babies at10AM. Regarding the condition of clothing during exposure, 169 (40.9%) was exposed without wearing any cloth, and 99 (24.0%) wearing diapers and eye masks. Regarding to duration of exposure of their infants to sunlight, 145 (35.1%) of them were exposed for 10-15 minutes, and 105 (25.4%) of mothers were exposed for 15-30. Regarding to practice of application of lubricants, 297 (71.9%) of them applied during exposure and most of mothers 191 (46.2%) applied butter (Table 3).

Table 3: Practice of mothers on sun light exposure of their infants in Jimma town, southwest Ethiopia, 2023 (n=413).

Variable	Categories	Frequency	Percent
Do you expose your baby intentionally to direct sunlight?	Yes	392	94.9
	No	21	5.1
	Total	413	100
Age of the child at the start of sunlight exposure	0-15 Days	57	13.8
	16-30 Days	207	48.9
	31-45 Days	55	13.3
	45 Days and above	79	19.1
	Total	393	95.2
How frequently do you expose your child?	Once Daily	128	31
	Every Other Day	151	36.2
	Weekly	80	19.4
	When There is A Sun Light	34	8.2
	Total	393	95.2
Where do you expose your child sunlight?	Out Doors	350	90
	Indoors	43	10.9
At what time of the day do you expose your child outdoors	Morning 8-10 AM	235	59.7
	Morning 10 AM	70	13.9
	Mid-Day 10 AM-2PM	34	8.6
	Afternoon 2-4PM	29	7
	When There is a Sun Light	25	6
	Total	393	95.2
How do you expose your infant on sunlight?	Without Wearing Cloth	169	40.9
	Wearing Diaper and Face Mask	99	24
	Partially Wearing	88	21.3
	Fully Clothed	37	9
	Total	393	95.2
For how much minutes you expose your infant on sunlight?	5-10 Minute	120	29.2
	10-15 Minute	145	35.1
	15-30 Minute	105	25.4
	30 Minutes and above	23	5.6
	Total	393	95.5
Do you apply lubricants on your child body during sunlight exposure?	Yes	359	91.3
	No	34	8.7
	Total	393	100
If you apply, when do you apply?	Before Exposure	24	5.8
	During Exposure	297	71.9
	After Exposure	56	13.6
	Total	377	91.3
What things do you apply?	Baby Vaseline	163	39.5
	Baby Lotion	23	5.6
	Butter	191	46.2
	Total	377	91.3

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Health Service Utilization Factors Related to Sunlight Exposure

In this study, 383 (92.7%) mothers had ANC follow-up, and only 57 (13.8) of them had advice about sunning their infants. Of all mothers, 413 (100%) had delivered in the health facility but only 54 (13.1%) of them had advice about sunning their infants. All 413 (100%) had PNC follow-up only 63 (15.3%) of mothers had advised about sunning their infant (Table 4).

Table 4: Health service utilization factors of mothers in Jimma town, south west Ethiopia, 2023 (n=413).

Variables	Categories	Frequencies	Percent
Have you delivered your child in a health facility?	Yes	413	100
	Total	413	100
If yes, have you been advised to expose your child to sunlight?	Yes	54	13.1
	No	359	86.9
	Total	413	100
Did you have antenatal follow up?	Yes	383	92.7
	No	30	7.3
	Total	413	100
If yes, have you been advised to expose your child to sunlight?	Yes	57	13.8
	No	356	86.2
	Total	413	100
Did you have postnatal follow up?	Yes	413	100
	Total	413	100
If yes, have you been advised to expose your child to sunlight?	Yes	63	15.3
	No	350	84.7
	Total	413	100

Factors Associated with Knowledge of Infant Sunlight Exposure

In bivariate analysis, educational status, occupation of mother, family size, husband's educational status, husband's occupation, information from physician, information from television/radio, information about rickets, believe about advantage of sunlight exposure, opinion about sunlight exposure, fear of exposing to sunlight, believe of effect on skin, and advised to expose the child to sunlight during delivery were associated significantly at p-value < 0.25 and selected as a candidate variables for multivariable logistic regression (Table 7 in Annex III). Model fitness was checked by the Hosmer and Lemeshow test and the p-value was 0.208, which shows that it is greater than 0.05, then fails to reject the null hypothesis, and it is stated that the logistic model is good for the data set.

Then the result of the multivariate logistic regression analysis showed that educational status (AOR=4.20; 95% CI: 1.17-9.82), information from Television/Radio (AOR=1.98; 95%CI: 1.04-3.76), information about rickets (AOR=2.13; 95%CI:1.19,3.81) and advised to expose the child to sunlight during delivery (AOR=2.41; 95%CI: 1.02-5.76) was significantly associated with the knowledge of mothers on exposure of sun light of their infant in Jimma town.

Diploma and above educated mothers were 4.20 times (AOR=4.20, 95% CI: 1.17, 9.82) more likely to have good knowledge about infant sunlight exposure than uneducated mothers. Those mothers who got advice in the health facility on the day of delivery about infant sunlight exposure were 2.41 times (AOR=2.41, 95% CI: 1.02-5.76) more likely to have good knowledge about infant sunlight exposure than those who did not get advised.

In addition, the result of this study showed that those mothers who had information about infant sunlight exposure from Television/radio 1.98 times (AOR=1.98, 95% CI: 1.04, 3.76) were more likely to have good knowledge about infant sunlight exposure than those mothers who hadn't have information about infant sunlight exposure from Television/radio. Similarly, those mothers who had information about rickets were 2.13 times (AOR=2.13, 95% CI: 1.19, 3.81) more likely to have good knowledge about infant sunlight exposure than those mothers who hadn't information about rickets (Table 7).

Table 5: Bivariate and multivariate logistic regression analysis of factors associated with the knowledge of mothers on exposure of sun light of their infants in Jimma town, south west Ethiopia, 2023 (n=413).

Variable	Category	Knowledge		COR (95%CI)	AOR (95%CI)
		Good	Poor		
Educational Status	Uneducated	38(64.4)	21(35.6)	1	1
	Primary (1-8)	36(48.6)	38(51.4)	.524(.260,1.06)	.823(.321,2.11)
	Secondary (9-12)	76(63.9)	43(36.1)	.977(.509,1.88)	1.01(.422,2.37)
	Technical/Vocational	33(44.0)	42(56.0)	.434(.215,.88)	.424(.169,1.06)
	Higher (Diploma and Above)	77(89.5)	9(10.5)	4.73(1.97,11.31)	4.20(1.17,9.82)*
Occupation of Mother	House Wife	102(66.2)	52(33.8)	1	1
	Government Employee	71(74.7)	24(25.3)	1.51(.852,2.67)	.541(.188,1.55)
	Private Employee	29(51.8)	27(48.2)	.548(.294,1.02)	.715(.300,1.71)
	Daily Laborer	20(58.8)	14(41.2)	.728(.341,1.56)	1.32(.468,3.74)
	Merchant	29(55.8)	23(44.2)	.643(.339,1.22)	.838(.386,1.82)
	Student	9(40.9)	13(59.1)	.353(.142,.88)	.377(.093,1.54)
Family Size	2-Jan	52(51.0)	50(49.0)	1	1
	4-Mar	73(68.2)	34(31.8)	2.06(1.18,3.63)	1.96(.860,4.48)
	Five and above	135(66.2)	69(33.8)	1.88(1.16,3.06)	1.31(.676,2.53)
Husband's Educational Status	Uneducated	7(70.0)	3(30.0)	-	1
	Primary (1-8)	40(58.8)	28(41.2)	.612(.146,2.57)	.700(.145,3.39)
	Secondary (9-12)	93(66.0)	48(34.0)	.830(.205,3.36)	.660(.129,3.39)
	Technical/Vocational	34(42.0)	47(58.0)	.310(.075,1.28)	.660(.116,3.76)
	Higher (Diploma and Above	80(88.9)	10(11.1)	3.43(.762,15.42)	4.55(.608,9.06)
Husband Occupation	Governmental Employee	88(70.4)	37(29.6)	1	1
	Daily Laborer	24(50.0)	24(50.0)	.420(.212,.84)	1.49(.382,5.82)
	Private Employee	63(55.8)	50(44.2)	.530(.311,.91)	1.61(.577,4.47)
	Merchant	79(76.0)	25(24.0)	1.33(.735,2.40)	2.54(.762,8.44)
Information from Physician	No	237(65.8)	123(34.2)	1	1
	Yes	23(51.1)	22(48.9)	.543(.291,1.03)	.792(.326,1.92)
Information from Television/Radio	No	174(61.1)	111(38.9)	1	1
	Yes	86(71.7)	34(28.3)	1.61(1.02,2.57)	1.98(1.04,3.76)*
Information about Rickets	No	55(44.0)	70(56.0)	1	1
	Yes	205(71.2)	83(28.8)	3.14(2.03,4.86)	2.13(1.19,3.81)*
Believe about Advantage of Sunlight Exposure	No	50(49.0)	52(51.0)	1	1
	Yes	210(67.5)	101(32.5)	2.16(1.37,3.41)	1.52(.841,2.74)
Opinion about Sunlight Exposure	No	213(61.4)	134(38.6)	1	1
	Yes	47(71.2)	19(28.8)	1.55(.876,2.77)	1.86(.876,3.93)
Fear of Exposing to Sunlight	No	160(57.8)	117(42.2)	1	1
	Yes	100(73.5)	36(26.5)	2.03(1.29,3.19)	1.49(.774,2.89)
Believe of Effect on Skin	No	220(66.9)	109(33.1)	1	1
	Yes	40(47.6)	44(52.4)	.450(.277,.74)	.522(.240,1.14)
Advised to Expose the Child to Sunlight during Delivery	No	214(59.8)	144(40.2)	1	1
	Yes	46(83.6)	9(16.4)	3.44(1.63,7.25)	2.41(1.02,5.76)*
ANC Follow Up	No	13(43.3)	17(56.7)	1	1
	Yes	247(64.5)	136(35.5)	2.37(1.12,5.04)	1.22(.471,3.17)

**Indicates Significance at 5% Level, COR: Crude Odd Ratio, AOR: Adjusted Odd Ratio, Reference Categories, CI: Confidence Interval*

Factors Associated with Practice of Infant Sunlight Exposure

In bivariate analysis, Age, educational status, occupation of the mother, family size, Information from television/radio, neighbors\elder, information about rickets, fear of exposure to sunlight, antenatal follow-up, believe of effect on the skin, and knowledge were associated significantly at p value<0.25 and

selected as a candidate for multivariable logistic regression (Table 8 in Annex IV). Model fitness was checked by the Hosmer and Lemeshow test and the p-value was 0.251, which shows that it is greater than 0.05, then fails to reject the null hypothesis, and it is stated that the logistic model is good for the data set. Then the result of the multivariate logistic regression analysis showed that age, occupational status, family size, and knowledge about children's sunlight exposure were significantly associated with the good practice of infants' sunlight exposure in Jimma town. Mothers in the age group of 26 to 30 and thirty and above were 2.45 times (AOR=2.45; 95% CI: 1.08-5.54) and 2.72 times (AOR=2.72; 95% CI: 1.09-6.72) more likely to expose their infants to sunlight than mothers in the age group of under 20 years old, respectively. Similarly, mothers who had higher family size (5 and above) were 1.83 times (AOR=1.83, 95% CI: 1.03-3.23) more likely to expose their infants to sunlight than mothers who had a family size of one to two.

Mothers who had an occupational status of government employee were 3.19 times (AOR=3.19, 95% CI: 1.34-7.63) more likely to practice good infant sunlight exposure than a house wife. Again, the result of this study showed that those mothers who have good knowledge regarding infant sunlight exposure were 1.70 times (AOR=1.70, 95% CI: 1.04, 2.78) more likely to practice infant sunlight exposure than those who have poor knowledge (Table 8).

Table 6: Bivariate and multivariate logistic regression analysis of factors associated with the practice of mothers on exposure of sun light of their infants in Jimma town south west Ethiopia, 2023 (n=413).

Variable	Category	Practice		COR (95%CI)	AOR (95%CI)
		Good	Poor		
Age	Under 20	14(34.1)	27(65.9)	1	-
	21-25	61(50.8)	59(49.2)	1.99(.953,4.17)	1.47(.633,3.39)
	26-30	96(60.0)	64(40.0)	2.89(1.41,5.94)	2.45(1.08,5.54)*
	30 and Older	64(69.6)	28(30.4)	4.41(2.01,9.65)	2.72(1.09,6.72)*
Educational status	Uneducated	35(59.3)	24(40.7)	1	-
	Primary (1-8)	28(37.8)	46(62.2)	.417(.207,.85)	.487(.203,1.17)
	Secondary (9-12)	77(64.7)	42(35.3)	1.257(.662,2.38)	1.14(.521,2.48)
	Technical/Vocational	40(53.3)	35(46.7)	.784(.393,1.56)	.553(.241,1.27)
	Higher (Diploma and Above	55(64.0)	31(36.0)	1.217(.616,2.40)	.377(.132,1.07)
Occupation of mother	House Wife	81(52.6)	73(47.4)	1	-
	Government Employee	66(69.5)	29(30.5)	2.051(1.196,3.51)	3.19(1.34,7.63)*
	Private Employee	34(60.7)	22(39.3)	1.393(.747,2.59)	1.63(.772,3.43)
	Daily Laborer	20(58.8)	14(41.2)	1.287(.607,2.73)	1.33(.557,3.17)
	Merchant	28(53.8)	24(46.2)	1.051(.560,1.97)	1.36(.666,2.77)
	Student	6(27.3)	16(72.7)	.338(.126,.91)	.859(.269,2.74)
Family size	2-Jan	41(40.2)	61(59.8)	1	-
	4-Mar	70(65.4)	37(34.6)	2.815(1.605,4.93)	1.46(.715,2.99)
	Five and above	124(60.8)	80(39.2)	2.306(1.419,3.74)	1.83(1.03,3.23)*
Information from Television/Radio	No	155(54.4)	130(45.6)	1	-
	Yes	77(64.2)	43(35.8)	1.502(.967,2.33)	1.39(.825,2.33)
Information from Neighbors\Elder	No	92(60.9)	59(39.1)	1	-
	Yes	140(54.9)	115(45.1)	.781(.518,1.17)	.724(.449,1.17)
Information about Rickets	No	60(48.0)	65(52.0)	1	-
	Yes	175(60.8)	113(39.2)	1.678(1.099,2.56)	1.09(.647,1.86)
Fear of Exposing to Sunlight	No	151(54.5)	126(45.5)	1	-
	Yes	84(61.8)	52(38.2)	1.348(.887,2.04)	1.41(.852,2.33)
Antenatal Follow Up	No	12(40.0)	18(60.0)	1	-
	Yes	223(58.2)	160(41.8)	2.091(.980,4.46)	1.84(.777,4.36)
Believe of Effect on Skin	No	182(55.3)	147(44.7)	1	-
	Yes	53(63.1)	31(36.9)	1.381(.843,2.26)	1.01(.530,1.93)
Knowledge about Exposing to Sunlight	Poor	70(45.8)	83(54.2)	1	-
	Good	165(63.5)	95(36.5)	2.06(1.37,3.09)	1.70(1.04,2.78)*

**Indicates Significance at 5% Level, COR: Crude Odd Ratio, AOR: Adjusted Odd Ratio,1: Reference Categories, CI: Confidence Interval*

Discussion

The finding of this study showed that about 63% of the mothers had a good knowledge of infant sunlight exposure. The finding is consistent with the report from Aleta Wondo, in which 62.8% of enrolled mothers were found to be knowledgeable [11]. A report from Debre Markos town (60%) is in agreement with the current finding [12]. The result was nearly the same as the study done in Mettu District, South West Ethiopia, which shows about

66.2% of the mothers, had a good knowledge of infant sunlight exposure [13].

However, the report of the present finding is higher than Yirgalem Hospital 54.5% [14]. The higher finding of the current study may be related to the time gap between the studies and the study area. Moreover, we found a lower prevalence of mothers having a good knowledge of infant sunlight exposure as compared to the study done in St. Paul's Hospital (86.1%) [15]. The variation could be due to the differences in socio-demographic (employment status), and cultural and weather conditions.

This study is also supported by Qualitative findings some participants reported that mothers have enough knowledge about sun light exposure.

In this study, the finding of good practice of infant sunlight exposure was 56.9%. This finding is in line with the study conducted in Yirgalem Hospital 35. which showed 54.5% had good practice and study done in Debra Markos town which was 55.4% of mothers had poor practice of infant sunlight exposure [12].

But it is lower than the result of a study done in Debre Berhan town which shows 65.7% of mothers had a good practice [3] and Wolkite which shows 67.3% of mothers had good practice in infants' sunlight exposure [16]. This difference might be due to the study setting. Another reason for this discrepancy was the source of information and the coverage of advice given for mothers with infants during ANC, PNC, and on the day of delivery in the facility was much lower than the result of Debra Berhan, and Wolkite town. Our finding is also lower compared to the study findings from Kenya where the prevalence of sunlight exposure practice was 84.4% [17]. The observation difference might be due to culture, awareness, government attention, education level, and socio-demographic variations between Kenya and Ethiopia.

The finding of this study is higher as compared to the finding of similar study done in Debre Markos 40.6% [12], Farta District 45.7% [18]. The possible reason for this difference might be participants in Debre Markos and Ferta district were rural residence but in this study the participant were urban residence that might have information about the importance of sunlight exposure.

This study finding is also supported by qualitative findings, most of the participant reported the challenges mothers face when it comes to practicing exposing their children to sunlight. It has been evident that while many mothers have knowledge about the importance of sunlight exposure for their children, there is a significant gap between their knowledge and their actual practice. Some participant said that it is due to various factors, such as busy schedules of the day, lack of awareness about the proper duration and timing of sun light exposure and Some participant said that mothers find it challenging to accept the recommendation of exposing their children without applying any lubricant and this suggests a contradiction between what healthcare professionals advise and what mothers are willing to implement and additionally Despite possessing knowledge about the importance of sunlight exposure, many mothers struggle to maintain a consistent routine.

In this study, maternal education was significantly associated with knowledge of sunlight exposure. That is mothers who have educational level diploma and above had more knowledge about sunlight exposure than mothers who can read and write. This finding is in line with a study conducted in Egypt [8], A study conducted at Jimma University Ethiopia [9], and Debre-Markos Town Ethiopia [12]. The possible reason might be participants were urban residence and urban residents are much more likely to be educated than rural residents and education is an important factor that influence an individual's attitudes and opportunities.

This study finding is also supported by qualitative findings most of the participant reported that mothers with a high level of education have a more comprehensive understanding of the benefits of sunlight exposure and make informed choices regarding their infants and educated mothers possess more information and are better equipped to make sound decisions.

This study showed that those mothers who have information about infant sunlight exposure from Television/radio were more likely to have a good knowledge about infant sunlight exposure than those mothers who hadn't have information about infant sunlight exposure. This result was supported by study done in Wolkite [16] shows that mothers who got information were more likely to have sunlight exposure knowledge and practice than mothers who did not get information. This is the fact that, mothers who get information have better knowledge about sunlight exposure practice and it indicates that mothers getting information plays significant role in meeting appropriate exposure of infant's body to sunlight.

This study finding is also supported by qualitative findings most of the participants reported that urban mothers generally have better access to information through various channels such as television, radio, and phones, which equip them with a more comprehensive understanding of sunlight exposure. In contrast, rural mothers often have limited access to information and technology, leading to a noticeable knowledge gap.

The finding of this study also showed that mothers who got advice in the health facility on the day of delivery about infant sunlight exposure are more likely to have good knowledge about infant sunlight exposure than those who did not get advice. The result was supported by a study done in Mettu District [13], which showed that mothers who got advice about the importance of infant sunlight exposure from health professionals and HEWs during delivery had good knowledge about infant sunlight exposure. Similarly, a study in Adami Tulu Jido Kombolcha Woreda, East Shoa Zone [6], showed that mothers who have not been advised in the health facility on the day of delivery about infant sunlight exposure are less likely to practice and to have knowledge about infant sunlight exposure than those who got advice. This implies that advising mothers regarding infant sunlight exposure in the health facility on the day of delivery is pivotal.

This study's findings are supported by qualitative findings most of the participants explained that they did not give advice to mother's when they came to the health center because of a lack of protocol and guidelines about the topic and there is little attention given to the topic. They recommend the need for comprehensive health education and advice regarding sunlight exposure for infants. Most participants emphasized the importance of including sunlight exposure topics in morning health education sessions and providing individualized education during visits to the outpatient department (OPD) and Maternal and Child Health (MCH) department, especially during antenatal care (ANC), delivery, and postnatal care (PNC) follow-ups. Detailed advice should be given regarding the importance of morning sunlight exposure, the benefits of natural sunlight over supplementation, and how and when to properly expose infants to sun light. This helps mothers to improve their knowledge concerning sunlight exposure.

This study also showed that the age of mothers was significantly associated with practices of sunlight exposure. Mothers in the age group 26 to 30 and older 30 were more likely to expose their infants to sunlight than mothers in the age group below 20 years. This finding is in line with the study conducted in Bahir Dar City Public Institution [17] and Debre-Markos Town Ethiopia [12]. This is may be due to having awareness of sunlight exposure through long years of experience and a better understanding of the importance of sunlight exposure for their infants because of more exposure to health education and information regarding the benefits of sunlight and they have more chance to practice sunlight exposure.

This study finding is supported by qualitative findings that participants said particularly those with larger families and mothers that have prior childbirth experiences, tend to possess better knowledge about sunlight exposure for their infants. These mothers have the advantage of learning from their own experiences and of elder family members and neighbors. Such peer-to-peer information sharing significantly enhances their understanding of sunlight exposure practices.

In addition, the odds of having good practice among government-employed mothers were more likely than those of mothers who were housewives. This is in line with the report of Debre Birhan [3] and Mettu District [13]; which showed that mothers who were government employees were 5 times more likely to practice good sunlight exposure for their infants than the unemployed. The finding is contradictory to the report of Yirgalem; unemployed women were 4.7 times more likely to expose infants to sunlight when compared with the employed [14]. The possible reason might be governmental employed mothers were more educated they have good knowledge of sunlight exposure and tends to practice more than uneducated mothers.

This study finding is supported by qualitative findings that participants said that mothers with higher socioeconomic have more care and responsibility for their infants, displaying an interest in receiving and comprehending information related to sunlight exposure. Whereas, mothers with lower socioeconomic have limited time and attention to spare for such matters due to their busy lives and other home responsibilities. Family size is also significantly associated with practices of sunlight exposure in this study. This result was supported by a study done in Mettu [13], show that mothers with six or more children were 40% more likely to practice than mothers with three or fewer. The justification

could be explained as; birth experiences could improve prior preparedness and awareness of mothers toward infant sunning.

The result of this study showed that those mothers who have good knowledge regarding infant sunlight exposure were more likely to practice infant sunlight exposure than those who have poor knowledge. This finding is in line with the result of a study done in Addis Ababa on neonatal sunlight exposure and a study done in Adami Tulu Jido Kombolcha Woreda, East Shoa Zone [6], which showed that having good knowledge about infant sunlight exposure was more likely to experience good practice of infant sunlight exposure.

Conclusion

According to the research finding approximately 63% of the mothers demonstrated a good knowledge of the importance of sunlight exposure for infants, and their actual practices were lower, with only 56.9% following recommended practices. Maternal education, access to information through media channels, and receiving advice from healthcare professionals were found to significantly influence knowledge. Whereas age, mother's occupational status, family size, and knowledge about children's sunlight exposure were significantly associated with the practice of infants' sunlight.

Based on the qualitative findings, there is a significant knowledge-practice gap. This gap is attributed to misconceptions, the influence of family and neighbors, resistance to change that does not align with recommended guidelines. In addition, the information given about sunlight exposure during healthcare visits was not comprehensive. Lack of awareness about optimal exposure duration and timing, and concerns about applying sunlight without any lubricant, Therefore, this study concludes that the knowledge and practice of sun light exposure of infants remains a challenge. So, it is better to put further effort towards improving knowledge and practice of mother in exposing their infants to sun light.

Abbreviations

IDI: In-Depth Interview
ANC: Antenatal Care
ODK: Open Data Toolkit
MCH: Maternal and Child Health

Declarations

Data Sharing Statement

The dataset for the current study is available from the corresponding authors upon reasonable request.

Ethics Approval and Consent to Participate

Ethical clearance was obtained from the Institutional Review Board (IRB) of the Jimma University College Public Health. An official support letter from the School of Public Health was written to Jimma Health Bureau. After the objectives of the study was explained. Permissions were secured from each selected kebele used as a data collection site. The objectives of the study were explained to the study participants. Potential harms (such as taking their time for the interview) and benefits of the study were explained to each respondent and finally written informed consent was obtained.

Acknowledgments

We express our genuine thanks to all individuals who contributed to the study respondents, the data collectors, and Jimma University.

Author Contributions

All the authors played a significant role in the work reported, whether in the conception, study design, execution, attainment of data, analysis, and interpretation, or in all the areas in which the article was drafted, revised, or critically reviewed, gave final approval of the version to be published, agreed on the journal to which the article has been submitted, and agreed to be accountable for all parts of the paper.

Funding

The research work was funded by Jimma University. The funders had no role in the study design, data collection, analysis, decision to publish, or preparation of the manuscript.

Disclosure

The authors declare no competing interests in this work.

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Cite this article: Getachew B, Tamrat M, Aynalem H. (2025). Knowledge and Practice of Mothers on Exposure of Sunlight of Their Infants and Its Associated Factors in Jimma Town, Southwest Ethiopia: 2023, *Journal of Women Health Care and Gynecology*, BioRes Scientia Publishers. 5(6):1-13. DOI: 10.59657/2993-0871.brs.25.102

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Article History: **Received:** October 09, 2025 | **Accepted:** November 14, 2025 | **Published:** November 21, 2025