

## Research

## Sunlight exposure practice and associated factors among mothers of infants in Raya Kobo district, Ethiopia

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### Abstract

**Introduction:** Inadequate sunlight exposure causes vitamin D deficiency which in turn causes bone and musculoskeletal effects like rickets and Osteomalacia. Sunlight exposure of infants is important for skin synthesis of vitamin D but little research is done on sunlight exposure practices and associated factors among mothers of infants in Raya kobo district, Ethiopia

**Objective:** This study aimed to assess sunlight exposure practice and associated factors among mothers of infants in Raya Kobo district, Ethiopia, 2022

**Methods:** A community-based cross-sectional study was conducted in Raya Kobo district. Six kebeles were randomly selected. Data were collected using a pre tested structured and interviewer administered questionnaire. Data were entered on to EPI data version 3.1 and analyzed using SPSS version 23. Descriptive statistics and multivariable logistic regression analyses were performed. Goodness of fit was tested using Hosmer and Lemnshow test. Statistical significance was considered at p value <0.05.

**Results:** Of 399 mothers of infants, 360(90.2%) participants exposed their child to sunlight. Two hundred one (50.4%) had good practices of sunlight exposure of infants. Factors significantly associated with good practice of sunlight exposure of infants were Being Muslim religion follower(AOR=1.975 95% CI,1.044,3.734), being house wife (AOR =2.249 95 % CI, 1.082,4.673), attending antenatal checkup (AOR =1.947 95% CI, 1.088,3.483), giving birth at private clinic ( AOR=0.252 95 % CI 0.075,0.849), having information from family (AOR =2.243 95% CI 1.096,4.592) and maternal knowledge about sunlight exposure of infants ( AOR= 11.385 95 % CI, 6.073,21.343).

**Conclusion and recommendation:** Almost all of the mothers participated in the study exposed their infants and nearly half of them had good practices of sunlight exposure. It is better to give information on the advantage of sunlight exposure to pregnant and lactating mothers during antenatal and postnatal checkups. It is also better to involve the Ethiopian orthodox religious leaders, family of mothers and private health workers in health education and information dissemination.

**Key words:** Mothers practice, sunlight exposure, cross-sectional, Raya kobo, Ethiopia

## Introduction

Vitamin D is a micro nutrient required for optimal bone health and essential for overall health. It is found in two forms as vitamin D2 which is found in dietary supplements such as liver, beef veal, milk and milk products and vitamin D3 which is produced in the skin in response to sunlight exposure [1].

Vitamin D is important to maintain calcium homeostasis by increase intestinal calcium absorption, increase urinary calcium reabsorption and regulation of parathyroid hormone which control both intestinal absorption and urinary reabsorption by feedback mechanism and bone metabolism [2]. Vitamin D prevents rickets in child and ostiomamasia in adults(1). In addition, Vitamin D is important for signal transduction and gene transcription, help to improve blood clotting, good level of serotonin which is important for mood balance, help to improve jaundice [3].

The prevalence of nutritional rickets appears to be greatest in Asia, the Middle East, and Africa, ranging from 1% to 24% in children. However, nutritional rickets has recently reemerged in high-income countries due to immigrants and refuge [4].

In Ethiopia Sunlight exposure practice of infants vary from 44% to 58 % [5, 6].

Sunlight exposure of infants were affected by maternal educational status, family size, fear of cold, practices about sunlight exposure, marital status of the mother, educational level of mothers, occupation of the mother, husband's educational status, and place of exposure of the respondents [5–7].

Although sunlight exposure of infants is important for skin synthesis of vitamin D little is known on sunlight exposure practices and associated factors among mothers of infants in

Raya kobo. Furthermore, all studies did not consider the effect of on grandmothers on sunlight exposure practices. But they have influence on mother's decision of exposing their infant. Most of the previous studies conducted in Ethiopia were conducted in health institutions community based study is needed to get more representative data.

## Methods and Materials

### Study Period and Area

The study was conducted in Raya Kobo district from June 8-22, 2022. The district is one of the fourteen districts in North Wollo Zone, which is located in 570 kms North East of Addis Ababa. The district is bounded by Tigray National Regional State in North, Afar National Regional State in the East, Gidan district in the West, Habru and Gubalafto district in the South.

The total area of Raya Kobo district is approximately 2312 square kilometers. The average temperature of the district is 28 0C with rainfall of 750-800 mm/year. There are 45 kebeles (smallest administrative units in Ethiopia) under Raya kobo district. The total populations of the district are 245531 out of these 7636 are infants. There are 9 governmental health centers and 45 health posts in the district.

### Study design

A community based cross sectional study was conducted.

### Sample size determination

Sample size was determined by using single population proportion formula. Proportion of good sunlight exposure practice of mother's infant in Ferta district (p) was 0.457 [6].

Confidence level 95%, Margin of error 0.05

$$n = \frac{\left(z \frac{\alpha}{2}\right)^2 p(1-p)}{d^2}$$

$n = (1.96)^2 * 0.457 * 0.543 / (0.05)^2$   $n = 381$  by adding 10 % of the sample size for considering non response rate  $381 + 38.1 = 420$

### Sampling techniques and procedures

From the total of 45 kebeles in Raya kobo district, eight kebeles were excluded from the study due to insecurity. Then, of 37 remaining kebeles 6 kebeles were selected by simple random sampling (lottery method). Each kebele is administratively clustered in to three sub kebeles. One sub kebele from one selected kebele was selected by lottery method from three sub kebeles. Other sub kebeles were selected by an interval of three from the selected sub kebele of first sub kebele. All mothers of infants from randomly selected sub kebeles were included in the study. However, if mothers had more than one infant, the youngest infant was selected. If mothers had twin infants, one infant was selected by lottery method.

### Operational definitions

**Adequate sunlight exposure:** Those mothers who exposed their infants directly to sunshine daily in morning 8–10 a.m. for 15–30 minutes without applying ointment [5,7,8]

**Good knowledge:** those mothers who scored more than the mean value of response for knowledge related questions [5,7,8].

**Good attitude:** Those mothers that will respond to attitude questions and scored above the mean [5,8].

**Good Practice:** Those mothers who scored more than the mean value of response for practice related questions [5,7,8].

### Data collection instruments and procedures

Data were collected using structured interviewer administered questionnaire which was adapted from different literatures [5,6,8–10]. Before the actual data collection the questionnaire was pre tested. Six health professionals BSC nurses and health

officers were involved as a data collectors and one health officer was assigned as a supervisor. The data collectors and supervisors were trained for two days about how to collect the data. The supervisor and the principal investigator closely control overall activities of data collection.

### Data quality control measures

Data were collected after translating the questionnaires from English to Amharic and re translated to English by independent persons to check its consistency or distortion in the meaning of words and concepts. The study participants were selected randomly. Pretest was done in Hara the place where similar socio cultural characteristics with Raya kobo district with 5% of sample size which is important for appropriate modification of questionnaires for its clarity, completeness, and content and study period determination. Health professionals (Health officers, BSC nurses) assigned for both as data collectors and as a supervisor got necessary training before data collection.

### Data processing and analysis

After checking completeness, Data were entered into Epi Data version 3.1 and then it was exported and analyzed using SPSS version 23. Descriptive analysis was done by computing mean, standard deviation, percent, and frequencies. The association between each independent variable and dependent variable was assessed by using bi-variable and multi-variable logistic regressions. Variables with p value  $< 0.25$  in bi-variable logistic regression will enter into final model of multi-variable logistic regression in order to control all confounders. Goodness of fit was test by using hosmer and lemshow statistical test. Adjusted odds ratio at 95% CI was commuted and p value  $< 0.05$  was considered as statically significant association associated with sunlight exposure practice by using multivariable analysis.

**Ethical consideration**

Ethical clearance was obtained from institutional review board (IRB) of Woldia University. For getting cooperation from kebele leader’s permission letter was obtained from district health office. The participants were informed about the purpose of the study, how their confidentiality was maintained and the right to refusal or withdraw any time during data collection.

**Results**

**Socio demographic characteristics of participants**

Out of 420 mothers who have infants and selected for the study 399 (95%) of mother were voluntary to participate in the study. The mean ages of the infants were 6.68+3.07. The mean ages of the mothers were 28.88+6.09 years. From those mothers who participated in the study 287(71.7%) were Ethiopian orthodox Christian, 379(95%) of mothers were married and 176(44.1%) were farmer (Table 1)

Variables	categories	Frequency	percent %
Infant sex	Male	182	45.6
	Female	217	54.4
Religion	Orthodox	286	71.7
	Muslim	113	28.3
Education	unable to read and write	114	28.6
	able to read and write	98	24.6
	primary school	111	27.8
	secondary school	51	12.8
	collage and above	25	6.3
Occupation	Farmer	176	44.1
	government employee	21	5.3
	Merchant	25	6.3
	house wife	165	41.4
	Other	12	3
Marital status	Single	7	1.8
	Married	379	95
	Widowed	1	0.3
	Divorced	12	3

Mass media	No	198	49.6
	Yes	201	50.4
Radio	No	99	48.8
	Yes	104	51.2
Television	No	96	47.3
	Yes	107	52.7
Other	No	199	98.5
	Yes	3	1.5
Age of mother of infant	<19	13	3.3
	20-29	205	51.4
	30-39	156	39.1
	40-49	25	6.3
Number of children	1child	83	20.8
	2-5 children	280	70.2
	6-10 children	36	9
Husband education	unable to read and write	108	28.5
	able to read and write	97	25.6
	primary school	71	18.7
	secondary school	43	11.3
	college and above	60	15.8
Husband occupation	Farmer	250	66
	government employee	54	14.2
	Merchant	47	12.4
	daily laborer	7	1.8
	Other	21	5.5

**Table 1:** Socio demographic characteristics of the participants of study of practice and associated factors in Raya kobo district, 2022

### Practices of mothers

Three hundred sixty (90.2%) of mothers were exposed their infant to sunlight. Out of those mothers who exposed their

child to sunlight 205(51.4%) of mothers exposed their child daily. Of them 90(25%) of mothers started to exposed the child within 15 days after birth, 354 (98.3%) were exposed

their infants before or at 10 AM, 240(66.7%) were exposed their child to sunlight for 15-30 minutes duration.

From 360 mothers who exposed their infant to sunlight 238(66.1%) were covered their infants during exposure of their infants, and 226(62.8%) of mothers were applied

ointment while exposing their child to sunlight. Nearly all 352(97.5%) of mothers were exposed their child out door. From the total 399 mothers participated in the study, 201(50.4%) of mothers who responded more than the mean value of practice related questions had good practices of sunlight exposure of infants. (Table 2)

Variables	categories	frequency	Percent
Do you exposed your infant	No	39	9.8
	Yes	360	90.2
Did you cover the baby the body while exposing the infant to sunlight?	prevent skin damage	158	66.4
	prevent evil eye	64	26.9
	Other	31	13
Do you apply ointment while exposing the infant to sunlight?	Vaseline	123	54.4
	Lotion	18	8
	Butter	98	43.4
	Other	3	1.3
Place of exposure	Indoor	9	2.5
	Outdoor	352	97.5
Number of days your child exposed in a week	1-6 days	155	48.6
	7days	205	51.4
Starting date of exposure to sunlight from birth	<=15 days	90	25
	16-30 days	37	10.3
	31-45 days	199	55.3
	>=46 days	34	9.4
Time of exposure of exposure of infants to sunlight	<=10 AM	354	98.3
	11 AM-1 PM	0	0
	2 PM-4 PM	6	1.7

Duration exposure of exposure of infants to sunlight	<15 minutes	104	28.9
	15-30 minutes	199	55.3
	31-45 minutes	24	6.7
	>=46 minutes	33	9.2
Practices of mothers	Poor(<5)	198	49.6
	Good(>=5)	201	50.4

**Table 2:** Practices of mothers about sunlight exposure of infants in Raya kobo district, 2022

**Reason for the mothers not to exposed their infants to sunlight exposure**

Thirty nine (9.8%) mothers were not exposed their infants to sunlight. of them 13 (33.3%) not exposed to sun light due to fear of blackness 11(29.7%) of mothers were not exposed their

child due to lack of knowledge ,7(18.9%)were due to fear of evil eye(13.5%)were due to fear of pneumonia 11(29.7%) were due to grandmothers involvement 9(23%)of mothers were not exposed to sunlight due to lack of time and other reasons.(Table 3)

Variables	categories	Frequency	Percent%
Fear of blackness	No	26	66.7
	Yes	13	33.3
Lack of knowledge	No	26	70.3
	Yes	11	29.7
Fear of evil eye	No	30	81.1
	Yes	7	18.9
Fear of pneumonia	No	32	86.5
	Yes	5	13.5
Lack of time	No	36	97.3
	Yes	1	2.7
Grandmother involvement	No	26	70.3
	Yes	11	29.7

Age less than the mother's perceived starting date	No	29	78.4
	Yes	8	21.6

**Table 3:** Reason for not exposing the child for mothers who do not exposed their child in Raya kobo district, 2022

### Factors affecting sunlight exposure of infants

After bi-variable logistic regression was done, variables with p value less than 0.25 in bi-variable logistic regression were included in the final model of multi variable logistic regression. In bi-variable logistic regression religion of mothers, maternal educational status, maternal occupation, husband educational, husband, husband occupational, presence of antenatal care, place of delivery, source of information from health professionals, source of information from family, knowledge about sun light exposure and attitude

of mothers about sunlight exposure were significantly associated with sunlight exposure practices of mothers with p value <0.05.

In multi -variable logistic regression religion of mothers, maternal occupation of house wife, antenatal care, giving birth at private clinics, information from family, and maternal knowledge about sunlight exposure were significantly associated factors with sunlight exposure practices [6] (Table 4).

Variables	Categories	Practice of sunlight exposure		COR(95% CI )	AOR(95% CI)
		Poor	Good		
religion of mothers	Muslim	41	72	0.468(0.299,0.733)	1.975(1.044,3.734)*
	Orthodox	157	129	1	1
Maternal education	Collage and above	6	19	4.681(1.737,12.613)	1.797(0.226,14.271)
	Primary school	49	62	1.870(1.102,3.176)	1.247(0.521,2.896)
	Unable to read and write	68	46	1	1
Occupation of mothers	Government employee	5	16	4.622(1.620,13.185)	7.010(0.731,0.264)
	House wife	74	91	1.776(1.156,2.729)	2.249(1.082,4.673)*
	Farmer	104	72	1	1
Husband education	Collage and above	21	39	2.918(1.514,5.627)	1.438(0.189,10.919)
	High school	17	26	2.403(1.166,4.955)	1.071(0.345,3.330)



	Unable to read and write	66	42	1	1
husband occupation	government employee	19	35	2.128(1.155,3.922)	0.187(0.25,1.408)
	Farmer	134	116	1	1
Antenatal care	Yes	81	112	1.818(1.222,2.704)	1.947(1.088,3.483)*
	No	117	89	1	1
Place of delivery	Governmental institutions	66	85	2.028(1.007,4.082)	1.985(0.756,5.209)
	Private clinic	13	7	0.588(0.226,1.527)	0.252(0.075,0.849)*
	Home	119	109	1	
Information from health professionals	Yes	27	63	2.369(1.421,3.948)	0.776(0.357,1.685)
	No	134	132	1	1
Information from	Yes	115	115	0.575(0.368,0.898)	2.243(1.096,4.592)*
family	No	46	80	1	1
Maternal knowledge	Good	53	150	8.047(5.146,12.583)	11.385(6.073,21.343)*
	Poor	145	51	1	1
Maternal attitude	Good	174	191	2.634(1.225,5.666)	1.826(0.534,6.239)
	Poor	24	10	1	1

\*significant variables at p value <0.05

**Table 4:** Factors affecting sunlight exposure practice of mothers of infants in Raya kobo district, 2022

## Discussion

The aim of this study was assess sunlight exposure practice and associated factors among mothers of infants.

In this study 90.2% of mothers exposed their infants to sunlight which is consistent with the study conducted in Debre Markos [5], which was 93% but higher than the study conducted in Ferta district where 80.1% of mothers exposed

their infants to sunlight. This difference was due to the difference in the socio- demographic characteristics of the two populations.

According to this study 50.4% of mothers had good practice of sunlight exposure of their infants. The finding is in contrary to study undertaken 44.6% in the study conducted in Debremarkos [5] and Aleta wondo [7], which was 44.6% and 58 % respectively. The discrepancy might be due to in study

setting. For example, a study conducted in Aletawondo was facility based cross-sectional study while in this study community based cross-sectional study undertaken.

Regarding sunlight exposure practices, in this study, 56.6% of the mothers exposed their child to sunlight daily. Likewise, a study conducted in Debre Markos [5] showed that 57.9% of mothers exposed their child to sunlight daily basis. The finding is in contrary to a study undertaken in Ferta [6], which was 45.7%. The discrepancy might be due to difference in study period. Accordingly, a study undertaken in Farta district a study period was about 40 days while in this study 15 days.

According to this study, 26% of mothers start to expose their infant to sunlight within 15 days after birth. The finding is in accord to a study conducted in Debre Markos [5], but it is less than the result of the study in Ferta [6], which was 53.3%. the possible explanation for discrepancy may be due to difference the study setting mothers who came to health facility may differ from the community

66.7% of mothers respond that they were exposed their infants to sunlight for 15-30 minutes, which is higher than the study of Debremarkos (25.5%) [5]

Sixty one percent (61.1%) of the participants of this study responded that they were covered their infants while exposing their infants to sun which is nearly equal to the result of study in Debremarkos [5] which was 58.6%.

About 62.8% of mothers were applied ointment while exposing their infants this is less than the study conducted in Debremarkos [5] which was 98.4%.

Regarding factors affecting sunlight exposure practice, in this study the study mothers who had good knowledge about sunlight exposure were 11 times more likely exposed their child to sunlight than their counterpart. The finding is in line with study conducted in Dejen district [9] showed that mothers

who had good knowledge about were 8 times more likely exposed their infants to sunlight.

According to the result of this study house wife mothers were about 2 times more likely exposed their infants to sun than farmers. This is consistent with the result of the study conducted in Debre Berhan [10] which showed occupational status of house wife were about 3 times more likely exposed their infants to sunlight.

According to the result of this study mothers who got information from family were about 2 times more likely exposed their infants to sun light but the study conducted in Debre Berhan [10] showed than mothers who got information from health professionals were two times more likely exposed their infants to sunlight.

Mothers who had ANC follow up were about two times more practiced sunlight exposure of their infants this might be due health information about sunlight exposure during ANC.

Muslim mothers were about two times more practiced good sunlight exposure of their infants than orthodox followers; this difference might be due difference in religious rules.

Mothers who give birth at private clinic were 72% decrease in good sunlight exposure practice this difference is due to private clinics were more concerned about curative care are than prevention.

## Conclusion

Majority of the study participants expose their infants to sunlight and nearly half of them had good practices of sunlight exposure. Factors affecting sunlight exposure practices were Muslim, being house wife, presence of ANC follow up, getting information from family, and good knowledge of mothers were increasing the practice of sunlight exposure and giving birth at private clinics were decrease the good practice of sunlight exposure.

## Recommendation

The regional health bureau are develop manuals that guides the health workers about how to counsel about sun light exposure; that should clearly give direction about when to start, for how many days, at what time and duration of exposure and how to expose the infants to sun. The regional health bureau should also develop strategies to integrate information about sunlight exposure with other obstetric and child care services to give information for the mothers at any point she visits the health institution. It is also better to monitor and evaluate methods to insure weather the mothers get enough information about sunlight exposure or not and facilitate training for health workers.

Health workers and health extension workers is better to provide health information about sunlight exposure of mothers during ANC, delivery, PNC and other child care services. During provision of health information health workers should include parents. Health workers should disseminate information via religious leaders. Health workers and HEWs should integrate with private clinics as many mothers visit them during pregnancy and postpartum period.

**Consent for Publication:** not applicable.

**Availability of Data and Material:** the datasets during and/or analyzed during the current study is available from the corresponding author on reasonable request.

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**Competing interest:** The authors declare that they have no competing interest.

## Author's contribution

BZ: Consult the research proposal, conducted the research, and analysis and wrote the manuscript.

FE: Involved in the write up of the methodology of proposal, did data entry and research work. All are equally contributed.

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