DEBRE BIRHAN UNIVERSITY ASRAT WOLDEYES HEALTH SCIENCE CAMPUS SCHOOL OF NURSING AND MIDWIFERY

DEPARTEMENT OF NURSING

ASSESSMENT OF PRACTICE AND FACTORS AFFECTING SUNLIGHT EXPOSURE OF INFANTS AMONG MOTHERS IN DUNAWOREDA, HADIYA ZONE, SOUTHERN ETHIOPIA, 2023.

BY: MELKAMU KEBEDE

JUNE, 2023

DEBRE BERHAN, ETHIOPIA.

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ASSESSMENT OF PRACTICE AND FACTORS AFFECTING SUNLIGHT EXPOSURE OF INFANTS AMONG MOTHERS IN DUNAWOREDA, HADIYA ZONE, SOUTHERN ETHIOPIA. A CROSS-SECTIONAL STUDY.

BY: MELKAMU KEBEDE (BSc midwife)

ADVISORS:-

ABEBE MIHRET (BSC, MSc, ASS.t prof)

KELEM DESTA (BSC, MSc)

A THESIS SUBMITTED TO DEBERE BERHAN UNIVIRESTY ASRAT WOLDEYES HEALTH SCINCE CAMPUS, SCHOOL OF NURSING AND MIDWIFERY IN PARITAL, FULFILLMENT OF THE REQUREMENT FOR THE DEGREE OF MASTER IN MATERNITY AND REPRODUCTIVE HEALTH NURSING.

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DEBRE BERHAN, ETHIOPIA.

DECLARATION

I hereby declare that this MScN thesis is my original work and has not been presented for a degree in any other university, and all sources of material used for this thesis have been duly acknowledged.

Name: Melkamu Kebede

Signature: _____

Mobile: +251 923407199: **E-mail:** melkemukebe@gmail.com

Place of submission: Department of Nursing, School of Nursing and Midwifery, Asrat Woldeyes Health Science Campus, Debre Berhan University.

Date: _____

ADVISORS' APPROVAL

This is to certify that the thesis entitled "Assessment of practice and factors affecting sunlight exposure of infants among mothers in Duna Woreda, Hadiya Zone, and Southern Ethiopia. A cross-sectional study" submitted in partial fulfillment of the requirements for the degree of Master's with specialization in maternity and reproductive health nursing, the Graduate Program of the Department of nursing, and has been carried out by Melkamu Kebede, Id. No PGR/239/13, under our supervision. Therefore, we recommend that the student has fulfilled the requirements and hence here by can submit the thesis to the department for defense.

ABEBE MIHRET (BSC, MSc, ASS.t prof)

Name of principal advisor _____ _____

Signature Date

KELEM DESTA (BSC, MSc)

Name of co-advisor

_____ _____

Signature Date

SCHOOL OF GRADUATE STUDIES DEBRE BERHAN UNIVERSITY, ASRAT WOLDEYES HEALTH SCIENCE CAMPUS EXAMINERS' THESIS APPROVAL SHEET

We, the undersigned, members of the Board of Examiners of the final open defense by Melkamu Kebede have read and evaluated his/her thesis entitled "Assessment of Practice and Factors Affecting Sunlight Exposure of Infants among Mothers Living in Duna Woreda, Hadiya Zone, Southern Ethiopia, 2023." and examined the candidate's oral presentation. This is, therefore, to certify that the thesis has been accepted in partial fulfillment of the requirements for the degree.

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ABSTRACT

Background: Vitamin D deficiency is a common worldwide problem with its prevalence magnified in infants. Nearly 50% of world population were exposed to vitamin D deficiency from them infants' accounts 7% to 45% due to lack of sunlight exposure. Despite a large part of Africa lying within the tropics and subtropics, poor practice on sunlight exposure is still seen in infants in many African countries including Ethiopia.

Objective: To assess practice and factors affecting sunlight exposure of infants among mothers living in Duna Woreda, Hadiya zone, SNNPR, Ethiopia, 2023.

Methods: A community-based cross-sectional study was conducted among 612 mothers selected by Systematic random sampling technique; from April 18, 2023 up to May 2, 2023. Data were collected by interviewer administered questionnaire. Data were entered using Epi-data version 3.1 and analyzed using statistical product and service solutions, version 25.0. A logistic regression model was used to identify associated factors. Variables at p-value <0.25 in the bi-variable analysis were candidate variables for multi-variable analysis and statistical significance was declared at p-value <0.05.

Results: A total of 582 women were participated in this study making a response rate of 95.0%**.** Of the participants, 372 (63.9%) (95% CI: 59.8%, 68%) had poor sunlight exposure practice. The main factors associated with poor practice of sunlight exposure were maternal age group 18-25(AOR = 2.82 (95%, CI:1.49,5.34)), no formal education (AOR = 6.68 (95%, CI: 3.11,14.38)**)**, family size 1-3 (AOR=0.2 (95%,CI:0.09,0.38)**),** didn't get advice during delivery (AOR=3.05 (95%CI=1.31,7.09)), didn't get advice during antenatal care follow up period, (AOR=2.27 (95%CI=1.39,3.73**)**), poor knowledge level (AOR = 6.68 (95%, CI: 3.11,14.38)**)** and negative attitude about practice of sunlight exposure of infants AOR=4.29 (95%CI=2.85,6.46)).

Conclusion and recommendation: According to the result of this study nearly two third of the mothers had poor sunlight exposure practice of infants. Statistically significant variables also Mothers' age, Family size, Educational status of mother, Advice during delivery, Advice during antenatal care, Attitude, and Level of knowledge.

Keywords: sunlight exposure, mother practice, infants, Duna woreda.

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Table of Contents

LIST OF TABLES

LIST OF FIGURES

ABBREVIATIONS AND ACRONYMS

AAP	American Academy Pediatrics
ANC	Antenatal Care
AOR	Adjusted Odds Ratio
CI	Confidence Interval
COR	Crude Odds Ratio
HEW	Health Extension Worker
PI	Principal Investigator
PNC	Postnatal Care
SA	South Africa
SNNPR	Southern Nations, Nationalities, And People's Region
SPF	Sun Protective Factor
UVB	Ultraviolet B
UVR	Ultraviolet Radiation
VDD	Vitamin D Deficiency
WHO	World Health Organization

1. INTRODUCTION

1.1 Background

Sunlight defined as exposure to incident light from the sun, is a critical practice for preventing rickets and vitamin D deficiency in infants. Ultraviolet B rays are the foremost common type of sun exposure (1). Sun exposure not only accompanies many recreational and dealing outdoor activities but is additionally desired intentionally to promote health and prevent disease (2). Morning sunlight exposure for infants is extremely important practice to stop rickets and fat-soluble vitamin D deficiency (3). Infants exposed to sunlight for about 15-30 minutes in the morning can efficiently provide daily vitamin D requirements (4). Regular exposures of infants to sunlight make an increment of serotonin amount in the body (5).

The healing ability of the sun and its importance in medical treatment (heliotherapy) has goes back into ancient times (6). In 1919, the primary scientifically sounded health benefit of sun exposure was recognized that sunlight used to prevent and cure rickets. This was followed by the invention of an inactive lipid within the diet and skin that converted into anti rickety substance by Ultra violet light in 1924 (7). The evidence within the ancient period explains the source of fat-soluble vitamin has been via the synthesis within the skin from cholesterol after exposure to UV-B light (8). Sunlight was first used for the treatment of neonatal jaundice in 1958 (9). In the modern era, particularly the first half of the 20th century, heliotherapy was widely used in both Europe and North America (10).

Consequences of insufficient sunlight exposure most ordinarily happen in infancy attributable to both poor intake specifically in exclusive breastfeeding infants and not enough skin synthesis (11).Inadequate sunlight exposure which causes Vitamin D deficiency rickets has also common in Ethiopian infants (12).

Today different study around the world demonstrates both beneficial and harmful effects of sunlight exposure (13). Morning exposure to sunlight help stave off "autoimmune diseases, many sorts of cancer, dementia, types 1 and a pair of diabetes, and infections (14).

However, exposure for long period to UV rays in children may lead to increased risk of skin cancers and a few of those is also fatal (15). The Centers for Disease Control and Prevention,

with the support of many organizations including the American Academy of Pediatrics (AAP) and the American Cancer Society, has recently launched a major public health campaign to decrease the incidence of skin cancer by urging people to limit exposure to UV light (16, 17).

Sunlight exposure is influenced by time spent outdoors, the quantity of skin exposed, skin pigmentation, degree of latitude, season, the number of inclemency, the extent of air pollution, the extent of ultra violet B protection including sunscreen and clothing (18-20).

Different studies in Ethiopia revealed that various factors are related to poor sunlight exposure of infants among them the fear of exposing infants to evil eye, cold and pneumonia, low maternal education, lack of treatment, insufficient basic resources, and seasonal variation have variably related to poor sunlight exposure (21-26).

Most of the Ethiopian study conducted on the practice of sunlight exposure showed that lack of sunlight exposure is that the single most important significant causes for rickets in Ethiopian infants (23, 25, 27). Some pioneering studies and also the most up-to-date works suggest that daily exposure to sunshine remains the most affordable, safest, and best method of preventing disease (21, 22, 27, 28). Indeed, health education to alter maternal practices to show infants to sunlight was adopted because the main strategy to combat rickets within the country since the 1960s in Ethiopia (29).

In Ethiopia Integrated management of newborn and childhood illness, 2015 guideline recommends exposure of neonates to sunlight ranging from the primary time period of age. While health education to alter maternal behavior to reveal infants to sunshine was adopted because the main strategy to combat rickets since the 1960s, yet the implementation of this strategy isn't properly applied (30). Based on the advice given from different literature and guideline developed to boost the practice of sunlight exposure of infants like providing health education during antenatal period, incorporating in national pediatric disease control and prevention guideline being done worldwide (26, 31). With sufficient exposure to ultraviolet B (UVB) from sunlight, a healthy person should be able to make all of their vitamin D requirements in their skin (32). However, there is no scientifically validated, safe threshold level of UV exposure that allows for maximal vitamin D synthesis without increasing skin cancer risk.

1.2 Statement of problem

Nearly 50% of world population were exposed to vitamin D deficiency from them infants accounts 7% to 45% due to lack of sunlight exposure (28, 33). Despite an outsized a part of Africa lying within the tropics and subtropics, insufficient sunlight exposure continues to be seen in infants in many African countries (34). In Ethiopia, Vitamin D deficiency rickets is quite prevalent and contributes high burden of illness and death among children below 5 years of age (28, 35). Until recently, little attention has been paid to the practice of sunlight exposure of infants in most countries, but it's clear that rickets has been and remains an issue in Northern Asian countries, the center east and in several countries in Africa including Ethiopia (25).

Worldwide infants could be lost due to diseases caused by lack of sunlight exposure of infants than to those caused by too much (36). Insufficient sunshine expose infants to growth retardation and skeletal deformities , infantile eczema in neonates and may result muscle weakness and bone fractures in infants (18, 37). Recently a study estimated that 4 billion cases of bone disease (rickets, osteomalacia and osteoporosis) and 3.3 billion disability-adjusted life lost globally due to insufficient sunshine that results from reduced Ultraviolet exposure (38).

Lack of sunlight exposure has also a considerable economic burden. The maximum amount as 25% of health care dollars can be saved just by improving the practice of sunlight exposure. Evidence also revealed in the past decade insufficient sun exposure may be responsible for 340,000 deaths in the United States and 480,000 deaths in Europe per year (33). In many rich industrialized countries, the prevalence of disease caused by inadequate sunshine with in the general population decreased after the introduction of dietary supplementation. However, in these countries, disease caused by inadequate sunshine has re-emerged in recent years (39). Rickets, a consequence of in sufficient sunlight exposure, is still widespread in regions, such as northern China where 42% of infants were found to suffer from this disease during the winter/spring period (40).

Several studies in different parts of the globe have shown that poor sunlight exposure is a growing public health concern in which serious attention should be given. The Middle East, Africa despite high rates of sun exposure, has the highest rates of rickets worldwide (19, 41). Insufficiency of sunlight exposure is common across African, with studies in African nation (SA) reporting insufficiency in 19% of under 1-year-old children and vitamin D deficiency in

7 % (42). In Ethiopia, despite there is a copious sunlight throughout the year a review of rickets stated that the prevalence of rickets was highly as 40%, making it one of the highest in the world (43).

A significant disparity exists between knowledge and behavior, this indicates there is a time lag between exposure and the development of skin cancer and features of photo aging, including wrinkling (14). The benefits and risks depend on several variables, including environmental, biological and behavioral factors; thus this makes it impossible to create one simple, clear message for everybody. However, it is important to ensure general messages are consistent. This indicates that government must develop policies and strategies to protect the public from under- or overexposure to sunlight (13).

Previous study done in Ethiopia tries to assess factors associated with the poor practice of sunlight exposure but most of the study focuses on the descriptive way. However, in all studies operational definition for practices is not propely stated because they classify exposure as good and poor not supported by any standard recommendation, rather WHO recommendation shows exposed to neonates to sunlight such as outdoor, daily, unclothed, morning at 8-10 AM and do not apply any lubricants before exposure (44).

In addition, community based studies are few, particularly in the rural area of Ethiopia. Moreover, there is a dearth of study that address sunlight exposure of infants in the study area. Therefore this study aimed to assess the practice and factors affecting sunlight exposure of infants in the rural and urban area of Ethiopia.

So, the current study will be intended to inform a need for credible attention by showing the prevalence of the problem and identifying significant contributors to the maternal practice of sunlight exposure of infants.

1.3 Significance of the study

There are many expected benefits in conducting this study. Among those benefits, findings of the study was an important input for district health care planners to counteract the low sunlight exposure by vulnerable groups of the society like infants.

Health care providers will use this data to increase awareness about the importance of sunlight exposure of infants during antenatal period. Health education should be very important to post-partum mothers to increase awareness about sunlight exposure practice and its beneficial effects. Therefore this study may provide evidence-based information to society to improve the health of infants.

The finding of this research makes clinical policy makers to give attention for the development of guidelines regarding sunlight exposure of infants. One of the Sustainable development goals of the Ethiopian government reducing child mortality. So, this finding is used as one input to reduce child mortality and finally to achieve this goal by improving the vitamin D status of infants and by preventing predisposing risk factors that cause vitamin D deficiency. In addition, the information generated from the study will help as a source of information for other researchers to conduct the same kind of study in different areas of Ethiopia.

2. LITERATURE REVIEW

2.1 Overview of sunlight exposure

Several studies indicate that regular exposure to sunshine is the most effective way of preventing rickets in children (45-47). Even though there is abundant sunny weather in many tropical and subtropical regions of the world, the prevalent of rickets is still high. In Ethiopia, despite there is a copious sunlight throughout the year a review of rickets stated that the prevalence of rickets was highly as 40%, making it one of the highest in the world (43). The main cause of nutritional rickets in Ethiopian children is lack of exposure to sunshine and not adequate intake of vitamin D (29).

2.2 Infant sunlight exposure practices

A cross-sectional study conducted in Sakarya, Turkeye among 396 Caucasian women mothering who have 0-12 month old infants, 87.5% expose their infants to sunlight outdoor (48). Similar study done on turkey demonstrated 82.2%, 45% of study participants expose their infants to sunlight outdoor, expose their babies for more than fifteen minutes respectively (49).

An observational cross-sectional study conducted among Two hundred and forty-five healthy infants in brazil at SaoPaulo stated 74.8%,93% and 57% participants expose infants to sun the, exposed infants before 10 am or after 3 pm and expose their infants to more than 15 minutes (20).

According to a study done in south India city shows that neonates exposed to sunlight playing outdoors for more than 30 minutes a day time which exposing more than 40% of their body surface area have a normal status, among exposed infants, 60% practiced poorly (50).
A community-based cross-sectional study carried out in dale woreda, Sidama region of Ethiopia among children aged 6-23 months reported that out of 170 mother, 41.1% of them were started to sunning of their infant within one month of age, and about 153 (90.0%) children were exposed to sunlight without clothing. Furthermore this study asserted that only 49.4% practiced poorly (21).

An Institutional based cross-sectional study conducted in Farta District, South Gondar Zone asserted that of total respondents 46% of them had poor practice about sunlight exposure. From participants (45.7%) who were exposed their infants to sunlight, Only 15.7% of respondents started to expose their child to sunlight before 10 days and the remaining,84.3% were after 10 days. about 45.7% participants exposed their child to sunlight every day and the remaining 54.3% were 5 - 6 times a week and less. Most of 75% of respondents covered their infant's body when they exposed (23).

An institutional based study was done in Debre Markos Town among 345 mothers who have child less than one year states (55.4%) participants had poor practice about sunlight exposure of their infant. Of those mothers who expose their infant to sunlight only 57.9% were exposed daily, 31.8% of mother started expose from 16-30 days, 30.5% of mothers started after 45 days and 23.4% from 0-15 days. Concerning the place of sunlight exposure 89.4% and 10.6 of participant exposed infants on sunlight outdoor and indoor respectively (25).

According to an institutional study done in Aleta Wondo Health Center, in Sidama Region from 307 mothers showed that 58% of mothers of had good practice of exposing their infants to sunlight. Among exposed infants only 17.6% of mothers were started sunlight exposure of their infants between 0–15 days of neonatal life (24).

Case control study done in Yekatit 12 hospitals Addis Ababa among 270 under five children (91 cases and 179 controls) demonstrates 46.2% of cases and 95% of controls has history of sun exposure (25).

Recent community-based cross-sectional study had been conducted among 105 mothers with infants in Debre Tabor city, 59.44% expose their infants to sunlight adequately. The majority of mothers 95.4 %(59) of mothers exposure their infants to sunlight outdoor and 4.6 % of mothers only expose their infants to sunlight exposure indoor (51).

2.3 Factors affecting sunlight exposure of infant

2.3.1 Socio demographic factors

A study done in Debre Markos Town, East Gojam asserted that maternal age, maternal education, fathers educational status and family size are factors significantly associated with good practice of sunlight exposure of infants (25). A similar study conducted in Jimma town on analysis of pediatric admissions found that unfavorable weather conditions and poor living conditions are the main factors for the mothers not to expose their child for sunlight (52).

According to the cross-sectional study conducted among 378 mothers who visit Ethiop-Swedish children hospital found that marital status is significantly associated with intentional exposure of infant to sunlight. The mother who had marital status of never married, widowed or divorced are more likely to expose their child to sunlight than a married mother (53).

Community-based cross-sectional study done Debre Tabor town among 105 mothers who have infants less than 1 year demonstrates occupation of mother, place of exposure of the respondents, husbands who are educated positively associated with the practice of sunlight exposure (51).

2.3.2 Knowledge of mothers about sunlight exposure for neonates

In Australia and Africa, studies show that mother's limited or poor knowledge about the health benefits of sun is associated with the poor practice of mothers (12, 54).

According to studies done in Aleta wondo and Debre Markos town, mothers had information about the benefits of exposing sunlight for their neonates were associated with the good practice of mothers (24, 25).

Regarding good time exposure for sunlight exposure, the mother who exposed their infants to sunlight exposure sometimes were 3.2 times less for acquiring knowledge than mothers who expose their infants who warm daily (52).

2.3.3 Attitude of sunlight exposure

The cross-sectional retrospective Study among 150 mothers with their children at the maternal Children Hospital done in Saudi Arabia they reported limited sunlight exposure due to negatively attitude about sunlight exposure of infants (55).

A study was done in Sakarya, Turkey, to determine the extent of intentional sunlight exposure of their infant among 376 samples of the Caucasian mother having infants of 0-12 months of age showed that 64.1% believed that sunlight is harmful. Sun causes skin diseases were the most frequently (75.9%) mentioned harm are associated with poor practice about sunlight exposure of infants (48).

According to a study done in Queensland on the topic of the behavior of caregivers to protect their infants from exposure to the sun**,** Australia mothers do not expose their infants to sunlight due to fear of skin cancer (90%) and skin wrinkles (65%). Most of these mothers

would have been exposed to media campaigns and school education to limit sunlight exposure of their children as they were growing up (56).

The community-based cross-sectional study done in Debre Markos town also asserted that the practice of mothers about sunlight exposure of infant is affected by maternal fear of evil eye, fear of cold, Pneumonia accounting 11.90%, 6.40%, 29% correspondingly. Mothers who had no fear of the evil eye were 4.55 times more likely to practice sunlight exposure than mothers who had fear of the evil eye. Mothers who had no fear of cold were 6.19 times more likely to practice sunlight exposure than mothers who had fear of. Mothers who had no fear of pneumonia were 2.9 times more likely to practice sunlight exposure than mothers who had fear of pneumonia (25). Similarly, a study conducted in Dale, Sidama region of Ethiopia reported that the underlying reasons for not sunning are: fear of cold, fear of "evil eye" and fear of sunburn (21).

Institutional based cross-sectional study conducted Aleta Wondo Health Center, Sidama region on Knowledge and practice on adequate sunlight exposure of infants among mothers attending EPI unit asserted that the reasons for not exposing their infants to sunlight were because of (19.9%) fear of cold and (30.7%) fear of evil eyes (24).

Case control study done in Addis Ababa among under five children of 599 cases and 196 controls demonstrates the reasons do not expose their infants to sunlight is fear of bad weather, sun burn (57) .

Another study cross sectional study which is conducted by Ethiop-Swedish hospital in Addis Ababa revealed that attitude, is positively associated with maternal intention of exposing their infant to sunlight (53).

2.3.3 Source of information

A qualitative study was done among Twenty-five female indoor workers with serum 25-hydroxyvitamin D < 50 nmol/L participated in seven focus group discussions (FGDs) in Saudi Arabia demonstrates that lack of knowledge due to misinformation from elders /neighbors about how vitamin D is synthesized upon exposure to sunlight or ultraviolet B (UVB) irradiation is barriers to sunlight exposure of infants or associated with poor practice (58).

Cross-sectional study conducted in Sakarya, Turkey among 396 mothers who have infants most of them 45.7% being advised by a health care professional (midwife/physician) about

beneficial effect of sunlight exposure are positively associated sunlight exposure of infants (48).

Institutional based cross-sectional study done in Aleta wondo in Sidama region Among post-partum mother who attend EPI 288 (92.3%) of the mothers had information about the need of sunlight exposure for their infants from mass media and and health care provider and out of those mothers who had information, half 148 (51.0%) of mothers got the information from neighbors/elders are associated with good practice of sunlight exposure (24).

2.3.4 Health service utilization

Community-based cross-sectional study done Debre Tabor town among 105 mothers who have infants less than 1 year demonstrates that being utilization of antenatal care, postnatal care and delivery services positively associated with practice of sunlight exposure (51).

2.4 Conceptual framework

This conceptual framework was adapted from reviewing different literature (25),(24) (51). The framework reveals independent variables (socio-demographic variables, source of information, knowledge of mothers, Attitude and health service utilization), and outcome variable; the practice of mothers about sunlight exposure of their infants. This framework conceptualizes sunlight exposure of infants with attending mothers as the result of interaction between various factors which are directly related to sunlight exposure.

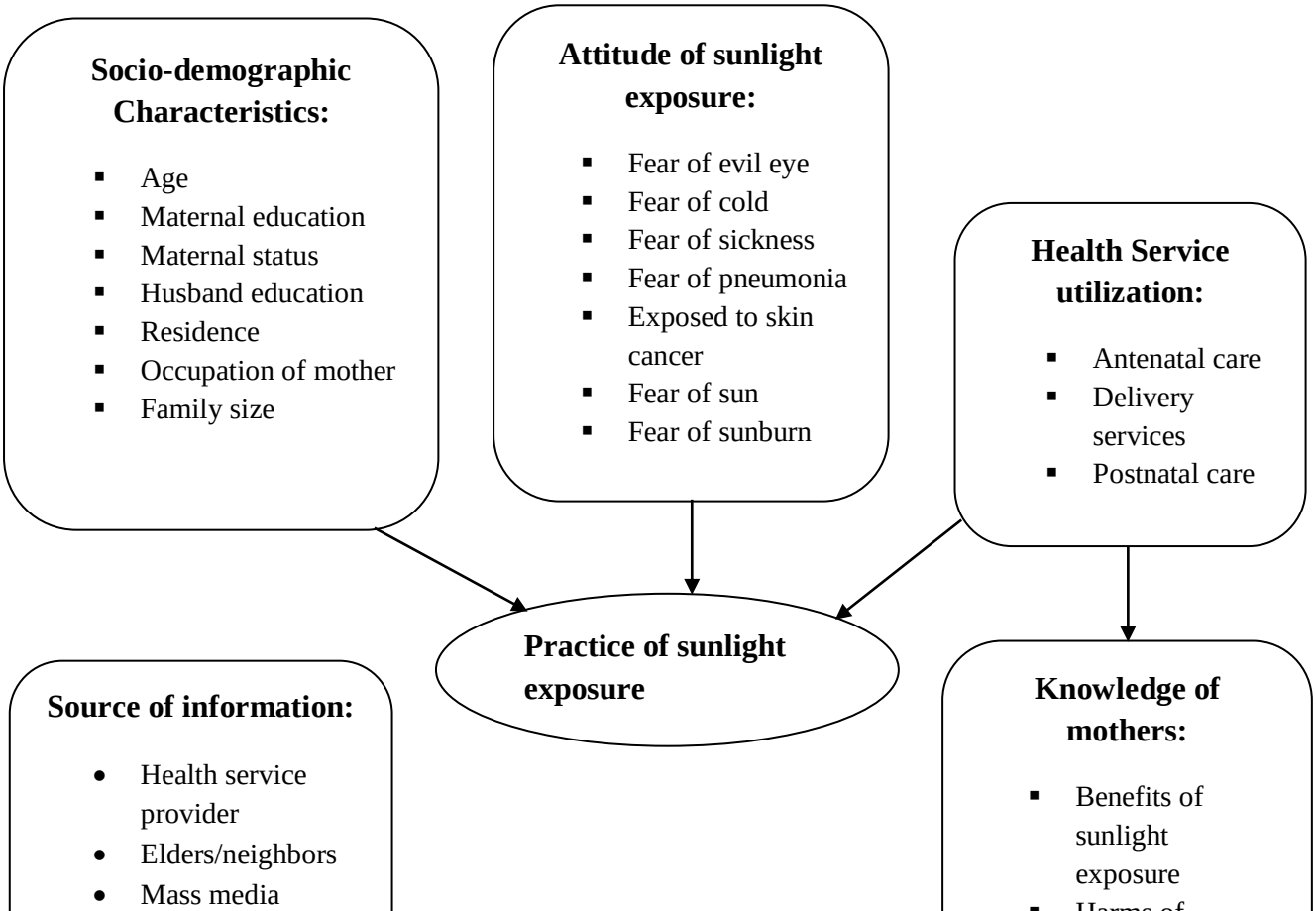


Figure 1: Conceptual frame work of practice and factors affecting sunlight exposure of infants among mothers in Duna Woreda, SNNPR, Ethiopia, 2023.

3. OBJECTIVES

3.1 General objectives

To assess practice and factors affecting sunlight exposure of infants among mothers in Duna Woreda, Hadiya zone, southern Ethiopia, April 18, 2023, up to May 2, 2023.

3.2 Specific objectives

To determine practice status of sunlight exposure of infants.

To identify factor affecting practice of sunlight exposure of infants.

4. METHODS AND MATERIALS

4.1 Study area and Period

The study was conducted in duna woreda. Duna woreda is found in SNNPRs, Hadiya administrative zone at the southern part of Ethiopia. It is located 272km far away from Addis Ababa, the capital city of Ethiopia and 236km from the regional capital city, Hawassa. It is one of the eleven woredas found in the Hadiya Zone.

The woreda has 24 rural and 8 urban kebeles with a total population of 122088. It is bounded by Soro woreda in the North West, Limo woreda in the North East, and Kembata Tembaro Zone in the East and South.

It has purely woinadega agro ecological zone. It is situated at 1800-2950 meters above sea level and has an average temperature ranging from 10oc to 24oc. The annual rain fall is 1250 mm per year. More than 95% of the population is engaged in agriculture.

There are 46 schools of all types in the woreda. In addition to this, the woreda has 36 health institutions of which 32 are health posts and 4 are health centers. There are 8746 infants found in the woreda in the last one year. This study was conducted from April 18, 2023 up to May 2, 2023.

4.2 Study design

Community based cross sectional study design was conducted in Duna Woreda, Hadiya zone, southern Ethiopia.

4.3. Population

4.3.1 Source Populations

All mothers who have child less than 12 months old living in Duna Woreda were the source of population.

4.3.2 Study population

All mothers who have child less than 12 months old living in selected kebeles of Duna woreda were the study population.

4.3.3 Study unit

All selected mothers who fulfill the inclusion criteria and actually involved in the interview were study unit.

4.4 Eligibility criteria

4.4.1 Inclusion Criteria

- All mother who have child less than 12months old and living in Duna Woreda.

4.4.2 Exclusion criteria

- Mother who are not resident **(**who live in the woreda for less than 6 months).
- Mothers who are severely ill.

4.5 Sample size determination

The sample size for the first specific objective was calculated using single population proportion formula by considering previous study done in Debre tabour town, north central Ethiopia, which showed 59.44% prevalence of mothers' practice on sunlight exposure of infants (51). With 95% confidence interval certainty, 5% confidence limits (degree of precision).

Where: **n** = Sample size

p= estimated proportion of mother's practice of at sunning infant =59.44%

d = margin of error of 0.05 with 95% confidence level

$Z_{\alpha/2}$ = standard normal distribution corresponding 95% level significance= 1.96

$$n = \frac{(Z\,\alpha/2)p(1-p)}{d2} = \frac{(1.96)2*0.594*(0.406)}{(0.05)(0.05)} = 371$$

Considering the design effect of 1.5, due to the sampling technique employed, and 10% non-response rate, the final sample size is 612.

Table 1: Sample size determination using associated factors of sunlight exposure of infants among mothers in Duna woreda, Hadiya zone, Southern Ethiopia, 2023.

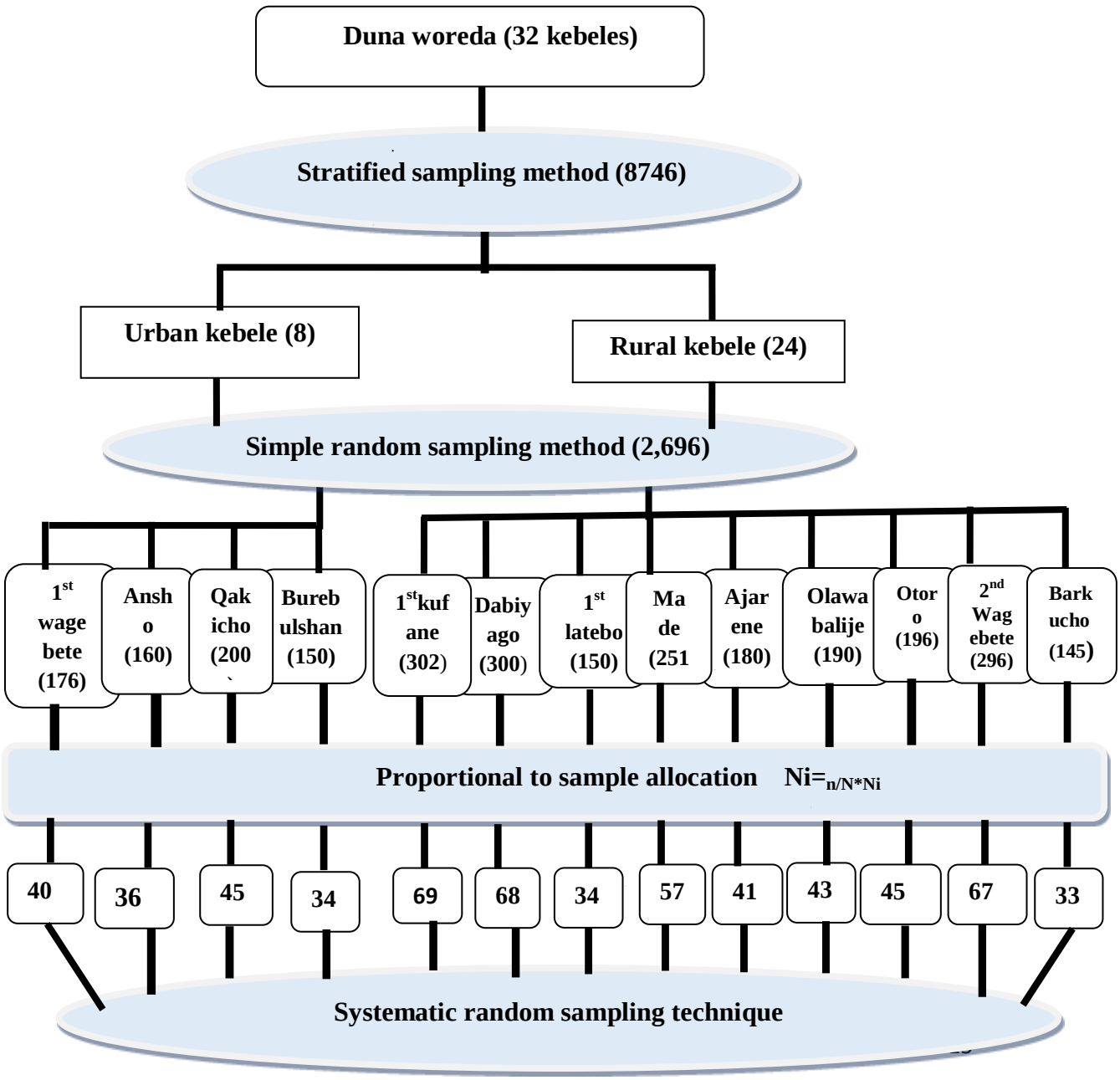
No	Variables	95% CI	power	Percent of Unexposed group	AOR	N	Reference
01	**Maternal age**	**95**	**80**	**19.1**	**2.3**	**270**	**(25)**
02	Family size	95	80	22.3	3.69	182	(25)
03	Private employee	95	80	1.7	0.18	4	(25)

According to the above Calculation, the largest sample size for objectives was taken as a final sample size for the study. The sample size for specific objective three is smaller than objective one (single population proportion formula). The largest sample size was an objective one with the second dependent variable. Therefore, the sample size for this particular study was 612 individuals (25).

4.6 Sampling Procedures

Stratified multistage sampling technique was employed for the study. The total of 32 kebeles found in the woreda was stratified in to urban and rural kebeles settings using naturally existing strata. There are 8 urban kebeles and 24 rural kebeles. Hence, four urban and nine rural kebeles were randomly selected by using lottery method.

Sampling frame which comprises a list of 2,696 mothers was prepared using HEW registration book (family folder). Then the calculated sample size was proportionally allocated to each selected kebeles of the Duna woreda based on the number infant available from health extension worker family folder. Participants in each kebele are selected by using systematic random sampling technique. After wards the first household was selected by lottery methods from the first two household in the selected direction. In case where two care taker of infant is found in one household only the care taker of one infant were selected by lottery method. Revisit of three times was made in case where eligible respondents are not available by the time of the survey and if they are not available after revisit they were considered as non-respondent.



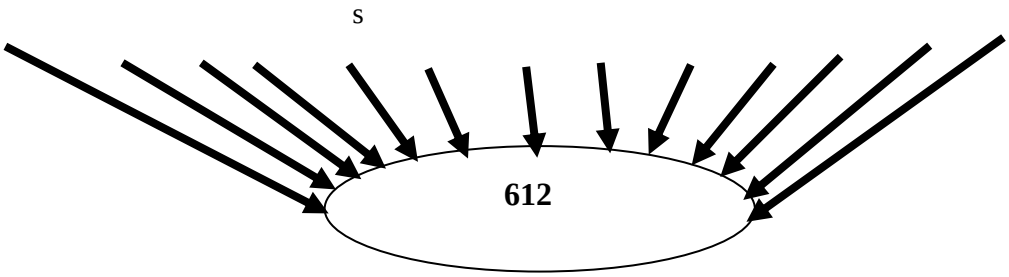


Figure 2: Schematic representation of the sampling procedure followed for participant at Duna Woreda, Hadiya Zone, Southern Ethiopia, and April 2023.

4.7 Data collection tool and data collection procedure

Data were collected by using face to face interview through a structured questionnaire adapted from previous literatures (24, 25, 51). The questionnaire contains mainly closed ended questions, but also incorporates some open ended items. The questionnaire was first developed in English and translated into Hadiyisa by language experts and back to English for consistency. The questionnaire constituted information on socio-demographic, perceived consequence, health service utilization and knowledge of the mother. Thirteen diploma holder health professionals were recruited as data collector and two bachelor degree holder health professionals were as supervisors.

4.8 Study variables

4.8.1 Dependent variables

- Mother's practice of sunlight exposure

4.8.2 Independent variable

- **Socio demographic variable**: age, marital status, religion, residency, educational status of women, educational status of husbands, Occupation of women and Occupation of husbands.
- **Knowledge of mothers:** benefits of sunlight exposure, and harms of sunlight exposure.
- **Perceived consequence of sunlight exposure:** fear of evil eye**,** fear of cold, exposed to pneumonia, exposed to skin cancer, fear of sun burn, strength bone and skin cancer.
- **Source of information**: physician, elders/neighbors, midwife/nurse and TV/Radio.

- **Health service utilization:** antenatal care, delivery service and postnatal care.

4.9 Operational definitions

- ***Knowledge about sunlight exposure practice of infants*:** was assessed using twelve items with "yes" or "no" questions including benefits of sunlight exposure of infants (strength bone, strength teeth, production of vitamin Keep child warm and strength body), Time of sunlight exposure (morning at 8-10 AM, mid-day at 11AM-1PM and 2PM-4PM), afternoon and evening) and Harmful effects of sunlight exposure (causes skin cancer, causes blindness and sterility).Those mothers who score more than mean value were considered as having good knowledge and those mothers who score less than mean value were considered as having poor knowledge (25).
- ***Level of practice:*** was assessed using WHO recommendation contains five standard questions such as place of exposure (outdoor, indoor), frequency of exposure (daily, sometimes), conditions of clothing (unclothed, partially clothed, completely clothed and with diaper and eye protection), time of exposure (morning at 8-10 AM, mid-day at 11AM-1PM and 2PM-4PM) and application of lubrication after exposure (yes or no). Those mothers who score maximum value 5 were considered as good practice and those who score less than 5 were considered as poor practice (44).
- ***Perceived consequence:*** was measured by using clients response on Eight likert scale questions which range from one (agree) to three (disagree). The percentage mean score was calculated. Then mean score of percent mean scores was used as cut-off point to categorize the participants level of perceived consequence as negatively perceived (less than the mean score) and positively perceived for the respondents who responding greater than or equal to mean score (53).
- ***Completely covered:*** Infant wearing clothes that cover the whole body except the face (24).
- ***Unclothed:*** Infant wearing no clothes except pants (24).
- ***Partly covered:*** Infant wearing minimal clothing (pants and vest) and not long shorts such that legs, arms and face are not covered (24).

4.10 Data quality assurance

To ensure the quality of data to be gathered from the study subjects, a range of mechanisms were employed to address major areas of bias introduction during the data collection Period. First, the questionnaire was pre- tested by taking 5% (31women) of the sample size on 2nd

kufane a similar but different setting and necessary modification in the questionnaire was made like category formation and sequencing of questions. The questionnaire was pretested for the flow of questions and validity was checked. Internal consistency and reliability of the items was checked using the pilot study (Cronbach's alpha (α) = 0.79). Data collectors and supervisors were trained for two day about the objective, tools, and process of data collection. Both data collectors and supervisors were fluent speakers of the local language. The principal investigator and supervisors made day-to-day on-site supervision during the whole period of data collection and checked each questionnaire daily for completeness and consistency.

4.11 Data processing and Data analysis

Data were entered into Epidata version 3.1 and analyzed using SPSS version 25. Frequency and percentage were used for the descriptive part and a binary logistic regression model was used to identify significant associated variables. The bi-variable analysis was used to identify candidate determinant factors that are statistically significant with p-value < 0.25 to be used in the multivariate analysis. The odds ratio with a 95% confidence interval was computed to determine the level of significance. The total scores were expressed using the 95% Confidence Interval (CI), and p-values. The Hosmer- Lemeshow goodness fittest was done to check model fitness. The result was summarized and presented using tables, charts, graphs and texts as necessary.

4.12 ETHICAL CONSIDERATION

Ethical clearance was obtained from Institutional review board (IRB) of Debre Berhan University, Asrat Woldeyes Health Science Campus. Official letter was received from the school of nursing and midwifery and submitted to Hadiya Zone Health Office, Duna Woreda Health Office, and finally from study Kebeles. Confidentiality was assured for the information provided since the name of the information provider was not stated on the questionnaire, rather coding system was applied. Verbal consent was taken from every study participant included in the study during data collection time after explaining the objectives of the study. Then data collects from volunteer mothers. Mothers who are not practice sunlight exposure during the data collection period were advised regarding to use of sunlight exposure.

4.13 PLAN FOR DISSEMINATION OF RESULTS

The final finding of this study was submitted to Debre Berhan University, Asrat Woldeyes Health Science Campus, and the findings will also be communicated to the local health planners and other relevant stakeholders at zonal and woreda level in the area to enable them take recommendations in to consideration during their planning process. It can also be communicated to health planners and managers at regional level. Publications in peer reviewed, national or international journals will also be consider.

5. RESULTS

5.1 Socio-demographic characteristic

5.1.1 Socio-demographic characteristics of mothers and their husbands

A total of 612 mothers who have under one year infants in Duna woreda, Hadiya zone were invited into the study. Of these, 582 mothers participated in the study making the response rate 95%. The mean age of the participants was 30.64 (S.D± 5.54) years, mode of 34years, and range of 27 (18-45). Of the participants, 236 (40.5%) were in the age group of ≥ 34 years. Regarding religious status, 472 (81.1%) were Protestant Christian, and the majority 516 (88.7%) of mothers who have infants were married. More than half 330 (56.7%) of mothers had a family size of 4-6. The majority of mothers 268 (46%) have completed primary school and more than half of their husbands 392 (69.5%) completed secondary school and above. Regarding the occupational status of mothers, nearly 517 (88.8) were house wife and 323 (57.3%) husbands were farmers. Regarding residency more than half 429 (73.7%) were rural residents. The majority of mothers 434 (74.6%) monthly income was less than 500 birr. (See table 2).

Table 2: Socio-demographic characteristics distribution of study participant at Duna woreda, Hadiya zone, 2023 (n=582)

Variables	Categories	Frequency	Percent
Mother ‘s age	18-25	110	18.9
	26-33	236	40.5
	>=34	**236**	**40.5**

Religion	Protestant Christian	**472**	**81.1**
	Orthodox Christian	61	10.5
	Catholic	26	4.5
	Muslim	23	4
Current marital status	Single	18	3.1
	Married	**516**	**88.7**
	Widowed	40	6.9
	Divorced /separated	8	1.4
Family size	1-3	163	28
	4-6	**330**	**56.7**
	>6	89	15.3
Educational status of the mother	No formal education	158	27.1
	Primary education	**268**	**46**
	Sec.education and above	156	26.9
Educational status of husband	No formal education	91	16.1
	Primary education (1-8)	81	14.4
	Sec.education and above	**392**	**69.5**
Occupational status of the mother	Government employ	48	8.2
	House wife	**517**	**88.8**
	Others*	17	2.9
Occupational status of husband	Government employ	78	13.8
	Farmer	**323**	**57.3**
	Others**	163	28.9
Residency	Rural	**429**	**73.7**
	Urban	153	26.3
Average household monthly income	<500	**434**	**74.6**
	500-1000	58	10
	>1000	90	15.5

Others*: private employ, self-employed, merchant & daily labourer.

Others**: private employ, self-employed, merchant & daily labourer.

5.1.2 Socio-demographic characteristics of infants

The mean age of the infant was 7.75(S.D ±3.57) months, among which 372(63.9%) were in the 7-12 months age group. The sex of the majority of infants was male 308(52.9%). (See table 3).

Table 3: Socio-demographic characteristics distribution of infants at Duna woreda, Hadiya zone, 2023 (n=582).

Variables	Categories	Frequency	Percent
Age of infants	0-6 months	210	36.1
	7-12 months	**372**	**63.1**
Sex of infants	Male	**308**	**52.9**
	Female	274	47.1

5.2 Practice of mother about sunlight exposure of infants

Out of 582 respondents, 475 (81.6%) of mothers exposed their infants to sunlight. Of these most of the mothers, 263 (55.4%) started sunlight exposure of their neonate within 15 days. Even though, 475(81.6%) of mothers stated that they exposed their infants to sunlight, nearly 346(72.8%) exposed daily. Regarding the place of sunlight exposure, most of them 446 (93.9%) of mothers told that they exposed their infants to sunlight outdoor (outside the house). Most of the study participants 427(89.9) cover their baby during sunlight exposure and the major reason 314(75.8) for covering their infants was to prevent skin damage. The majority 451 (94.9%) of mothers exposed their infants between the time range of 8-10 AM. Regarding clothing condition during exposure, most of 353 (74.3%) mothers exposed their infants to sunlight uncovered. Regarding the time duration of exposure of their infants to sunlight, most of them 199 (41.9%) exposed their infants for 15-30 minutes (Table 4).

Table 4: Practice of mothers on sunlight exposure of their infants in Duna woreda, Hadiya zone, SNNPR Ethiopia, 2023 (N=582).

Variable	Categories	Frequency	Percent
Do you expose your baby to sunlight	Yes	475	81.6
	No	107	18.4
Age to start sunlight exposure	0-15 days	263	55.4
	16-30 days	135	28.4
	31-45 days	53	11.2
	>45 days	24	5.1
How frequently expose	Daily	346	72.8
	Some times	129	27.2
Where do you expose	Out door	446	93.9
	In door	29	6.1
Time of sunlight exposure	Morning 8-10	451	94.9

	AM		
	Mid-day 11 AM-1 PM	1	0.2
	After noon 2-4PM	23	4
Do you cover (screen) infants bodies when you expose	Yes	427	89.9
	No	48	10.1
Reason for cover (screen)	To prevent skin damage	327	76.6
	To prevent the evil eye	100	23.4
Condition of clothing during exposure	Unclothed	353	74.3
	Partially covered	25	5.3
	Completely covered	88	18.5
	With diaper and eye protection	9	1.9
For how many minutes do you expose	5-10 minutes	182	38.3
	10-15 minutes	71	14.9
	15-30 minutes	199	41.9
	Above 30 minutes	23	4.8

5.2.1 Application of lubricants on the infant's body

Regarding the practice of application of lubricants, half of 239 (50.3%) of mothers apply lubricants on the infant's body during the time of sunlight exposure. The majority 197 (82.4%) of mothers apply these lubricants before sunlight exposure and 42 (17.6) of mothers apply after sunlight exposure. From 239 (41.1%) of mothers, 176 (73.6%) of mothers, apply Vaseline and 54 (22.6%) of mothers apply baby lotion on the infant's body (figure 3).

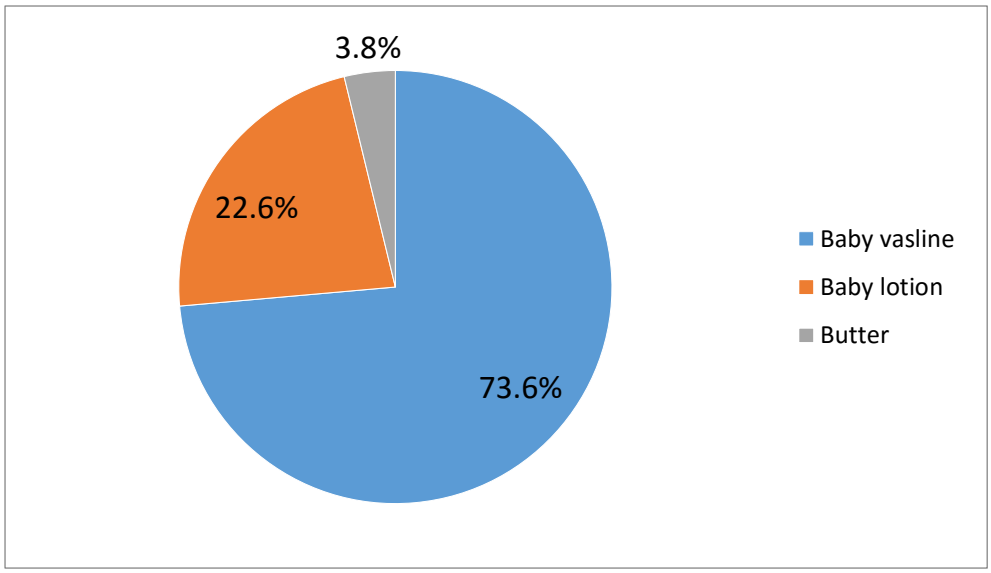


Figure 3: Application of lubricants on the infants' body in Duna woreda, Hadiya zone, SNNPR Ethiopia, 2023.

5.2.2 Mothers' Level of practice about sunlight exposure of infants

Out of 582 respondents, 63.9% (95% CI: 59.8%, 68%) of respondents (place of exposure, frequency of exposure, conditions of clothing, time of exposure and application of lubrication after exposure) scored less than five. Therefore, 63.9% of mothers had poor practice on sunlight exposure of infants (figure4).

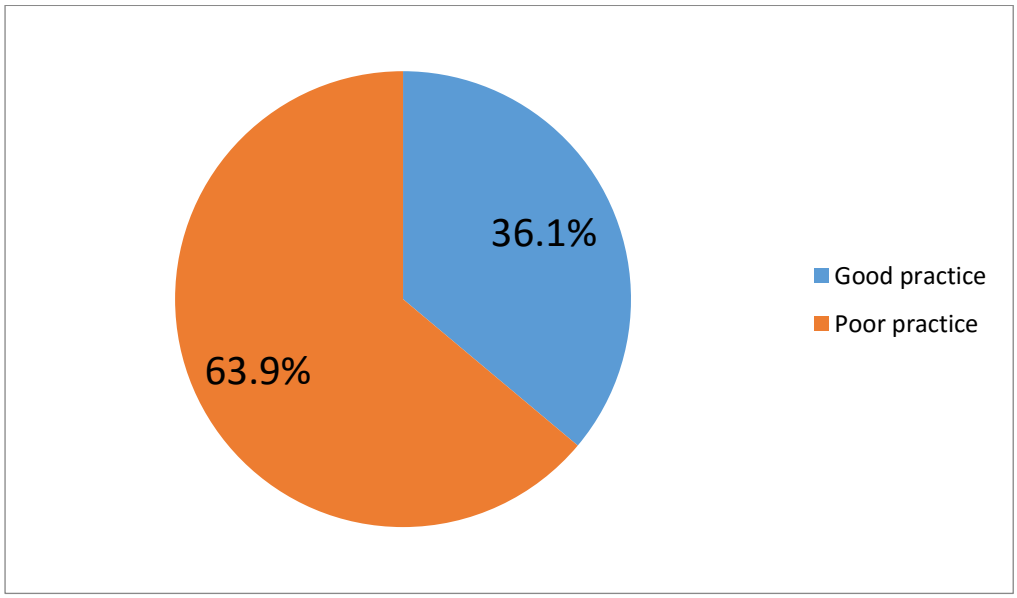


Figure 4: Mothers' Level of practice about sunlight exposure of infants in Duna woreda, Hadiya zone, southern Ethiopia 2023.

5.3 knowledge about sunlight exposure of infants

Most of the respondent 490 (84.2%) in this study have heard about sunlight exposure of infants. Regarding the benefit of sunlight exposure, most of mothers 472 (96.3%) said sunlight exposure was beneficial for infants, and from these 316 (66.9%) mentioned sunlight exposure was useful to strengthen bone, 223 (47.2%) mention sunlight exposure was useful to strength body and 322 (68.2%) mention sunlight exposure was useful for vitamin D production, sun strengthens teeth and the sun warms a body were also indicated by the respondents as a benefit of sunlight exposure.

Regarding the harmful effect of sunlight exposure, most 367(74.9 of the mothers) said that sunlight exposure harmful for the infant and the majority 215(58.6%) mentioned that the harmful effect of sunlight exposure was skin cancer. About the time of sunlight exposure, the majority 466(95.1%) of mothers said a good time to expose infants to sunlight was in the morning (Table 5).

Table5: Knowledge of mothers about sunlight exposure of their infants in Duna woreda, Hadiya Zone, SNNPR Ethiopia, 2023.

Variables	Categories	Frequency	Percent
Do you have heard about sunlight exposure of infants	Yes	490	84.2
	No	92	15.8
Mentioned sunlight exposure was beneficial	Yes	472	96.3
	No	18	3.7
Mentioned strengthen bone as a benefit of sunlight exposure	Yes	316	66.9
	No	156	33.1
Mentioned strengthen teeth as a benefit of sunlight exposure	Yes	314	66.5
	No	158	33.5
Mentioned keep child warm as a benefit of sunlight exposure	Yes	240	50.8
	No	232	49.2
Mentioned vitamin D production as a benefit of sunlight exposure	Yes	322	68.2
	No	150	31.8
Mentioned strengthen the body as a benefit of sunlight exposure	Yes	223	47.2
	No	249	52.8
Mentioned sunlight exposure had a harmful	Yes	367	74.9

effect	No	123	25.1
Mentioned skin cancer was a harmful effect of sunlight exposure	Yes	215	58.6
	No	152	41.4
Mentioned blindness was a harmful effect of sunlight exposure	Yes	208	56.7
	No	159	43.3
Mentioned sterility was a harmful effect of sunlight Exposure	Yes	144	39.2
	No	223	60.8
Good time to expose infants to sunlight	Morning	466	95.1
	After noon	24	4.9

5.3.1 Mothers source of information about sunlight exposure of infants

Out of the total 582 respondents, 490 (84.4%) of the mothers had information about Sunlight exposure of infants. Most of mothers 539(92.6) had mass media and the majority 315 (64.3%) of mothers got this information from midwives/nurses and 100(20.4%) from neighbors/elders (figure5).

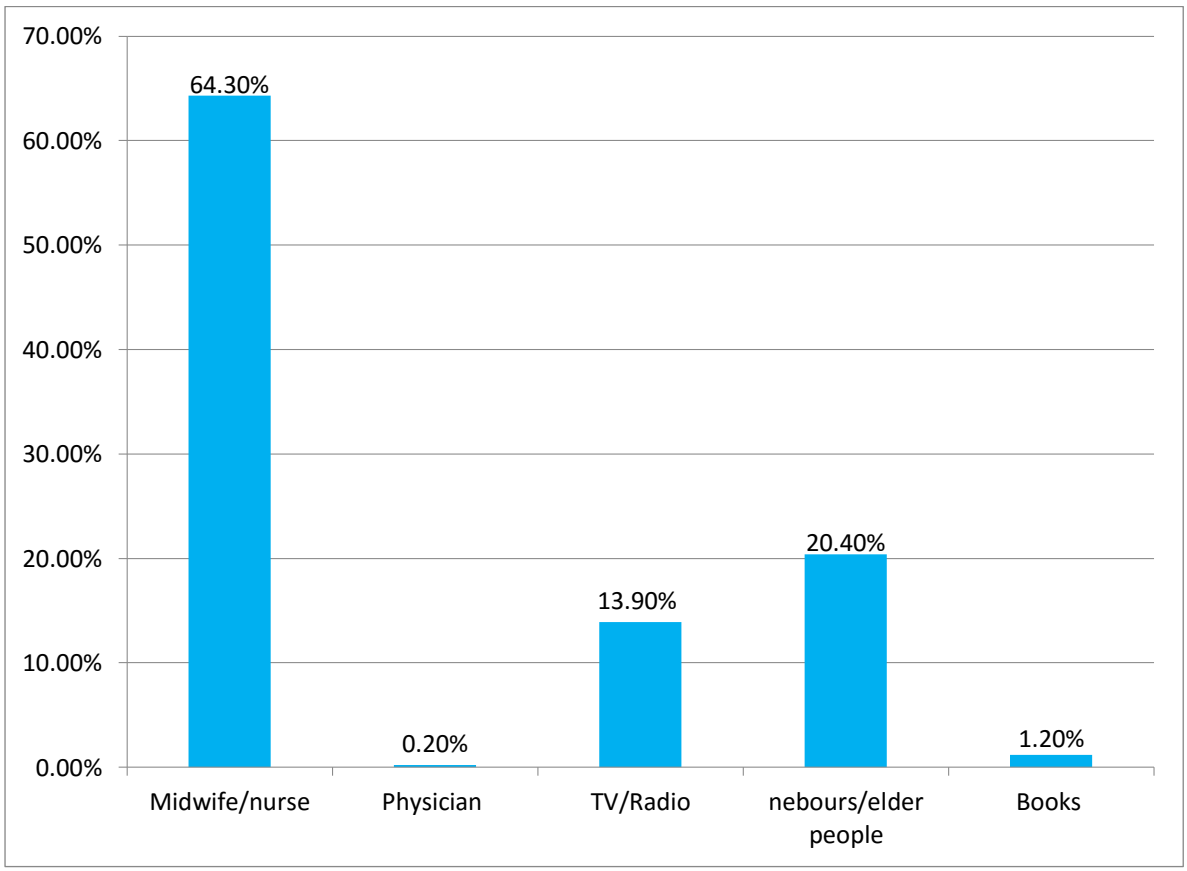


Figure5: Source of information about sunlight exposure in Duna woreda, Hadiya zone, southern Ethiopia, 2023.

5.3.2 Mothers' knowledge level about sunlight exposure of infants

Out of 582 respondents, 476(81.8%) respondents scored less than mean value 8. Therefore, 81.8% of mothers had poor knowledge about sunlight exposure of infants.

5.4 Health service utilization

Out of 582 total respondents, 496(85.2) mothers delivered their child at health institution. Of them 235(47.4%) were advised about sunlight exposure of infants by health professionals during delivery. Regarding antenatal care follow up, the majority 542(93.1%) mothers follow antenatal care during pregnancy, from them more than half 284(52.4%) were advised about sunlight exposure of infants. Most of the respondents 537(92.3%) follow postnatal care, of whom more than half 307(52.7) of the mothers were advised about sunlight exposure of infants (Table6).

Table 6: Health service utilization among mothers in Duna woreda, Hadiya zone, southern Ethiopia, 2023.

Questions	Categories	Frequency	Percent
Have you delivered your child to a health institution delivery	Yes	496	85.2
	No	86	14.8
Do you advised about sunlight exposure of infants during delivery	Yes	235	47.4
	No	261	52.6
Antenatal care follow up	Yes	542	93.1
	No	40	6.9
Do you advised about sunlight exposure of infants during ANC follow up	Yes	284	52.4
	No	258	47.6
Postnatal care follow up	Yes	537	92.3
	No	45	7.7
Do you advised about sunlight exposure of infants during PNC follow up	Yes	307	57.2
	No	230	42.8

5.5 Attitude about sunlight exposure of infants

Out of 582 respondents, 488(83.8) agree with the statement "exposing infants to sunshine makes their infants healthier" and 474 (81.4%) agree with the statement "exposing infants to

sunshine makes their infant bone stronger". Most of the mothers 438(75.3%) agree with the idea of "exposing the infant to sunshine helps their infant grow faster" and 479(82.3%) agree with the statement "sunlight exposure of infants helps their baby to sleep well". More than half of respondents 378(64.9%) disagree with the idea of "exposing the infant to sunshine to expose their infant to cold" and 420(72.2%) disagree with the statement "exposing infants to sunshine exposes to pneumonia" (Table7)

Table 7: Attitude about sunlight exposure of infants in Duna woreda, Hadiya zone, southern Ethiopia, 2023.

Variables	Agree, N (%)	Neutral, N (%)	Disagree, N (%)
Sunlight exposure makes my infant healthier	488 (83.8)	35 (6.0)	59 (10.2)
Sunlight exposure makes my infant bone stronger	474 (81.4)	20 (3.4)	88 (15.1)
Sunlight exposure helps my infant grow faster	438 (75.3)	35 (6)	109(18.7)
Sunlight exposure helps my infant sleep well	479 (82.3)	19 (3.3)	84 (14.4)
Sunlight exposure expose my infant to cold	114 (19.6)	90 (15.5)	378 (64.9)
Sunlight exposure expose my infant to pneumonia	108 (18.6)	54 (9.3)	420 (72.2)
Sunlight exposure causes squinting of eye	109 (18.7)	40 (6.9)	433 (74.4)
Sunlight exposure expose my infants to evil eye	101 (17.4)	39 (6.7)	442 (75.9)

Status of the attitude of sunlight exposure of infants

Out of 582 respondents, 452(77.7%) scored less than mean value 11. Therefore, 77.7% of mothers have negatively attitude about sunlight exposure of infants.

5.6 Reasons not to expose their infants to sunlight

107(18.4%) of mothers in this study area had a fear to expose their infants to sunlight. The highest fear of mothers' in this study was 54(50.4%) fear of cold and 25(23.4%) fear of sickness (figure6).

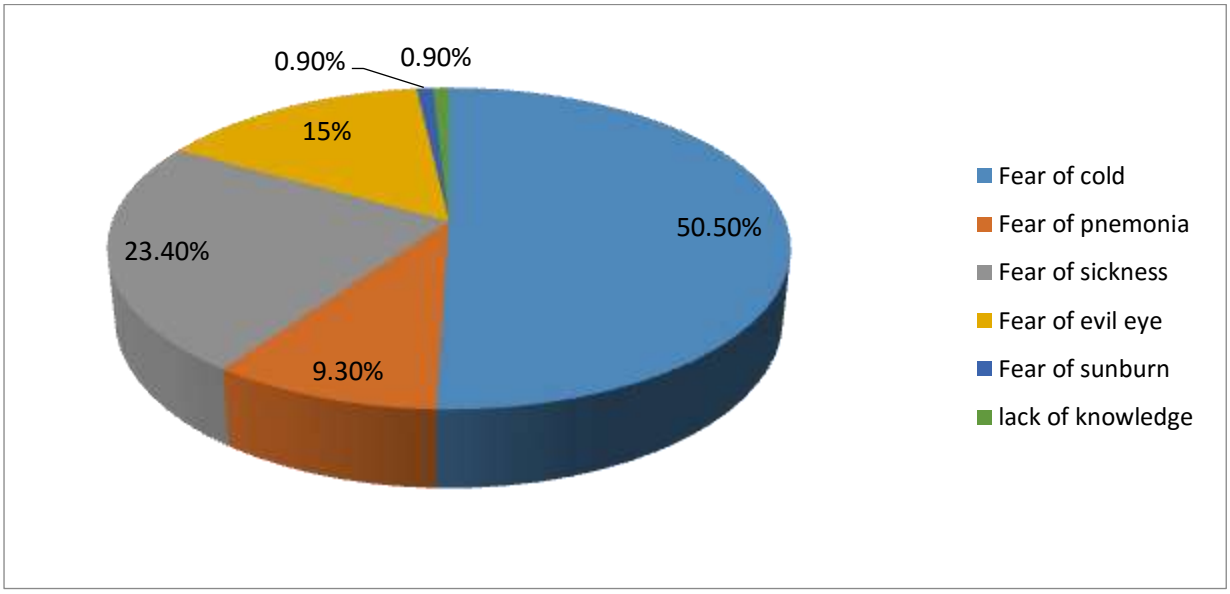


Figure 6: Reasons not to expose their infants to sunlight in Duna woreda, Hadiya zone, southern Ethiopia, 2023.

5.7 Factors associated with practice of mother on sunlight exposure of infants.

5.7.1 Bi-Variable Logistic Regression

In bivariable logistic regression analysis using p-value < 0.25 cut off points; maternal age, maternal education, occupational status of the mother, occupational status of the husband, income of house hold, family size, knowledge level, attitude, fear of cold, postnatal care, advice during postnatal care, advice during the antenatal period about sunlight exposure of infants, delivery in health institution and advice during delivery were candidate variable for multi-variable logistic regression analysis.

5.7.2 Multi-Variable Binary Logistic Regression Analysis

In multivariable analysis; mothers' age, educational status of the mother, family size, and advice during delivery, advice during ANC, attitude, and level of knowledge were found to be statistically significant at $p \leq 0.05$.

The odds of poor sunlight exposure practice of infants among mothers with age group 18-25 was about 2.82 times more compared with those age group ≥34.(AOR = 2.82(95%, CI:1.49,5.34)).

The odds of poor sunlight exposure practice of infants among family size of 4-6 was about 80% lower compared to those family size 1-3 (AOR = 0.2 (95%, CI: 0.09, 0.38)**).**

The odds of poor sunlight exposure practice of infants among mothers with no formal education were about 6.68 times higher compared to those mothers completed secondary school and above (AOR = 6.68 (95%, CI: 3.11,14.38)**).**

Another important finding of this study was that the odds of poor sunlight exposure practice of infants among mothers who didn't get advice about sunlight exposure practice of infants during delivery were about 3.05 times higher compared to those mothers who got advice during delivery times.(AOR=3.05(95%CI=1.31,7.09)) and the odds of poor sunlight exposure practice among mothers who didn't get advice about sunlight exposure practice during antenatal care follow up were about 2.27 times more compared to those mothers who got advice during ANC follow up(AOR=2.27(95%CI=1.39,3.73**)**).

The odds of poor sunlight exposure practice of infants among mothers who had negatively attitude about sunlight exposure of infants were about 4.29 times higher compared to those mothers who had positively attitude. (AOR=4.29(95%CI=2.85, 6.46)).

The odds of poor sunlight exposure practice of infants among mothers who had poor knowledge about sunlight exposure practice of infants were about 6.59 times more compared to those mothers who had good knowledge. (AOR=6.59(CI=3.97, 10.94)). (See table8).

Table*8: Bivariate and multivariate analysis to identify factors associated with the practice of mothers on sunlight exposure of infants in Duna woreda, Hadiya zone, southern Ethiopia, 2023(N=582).*

Variable	Categories	**Practice of sunlight exposure**		**COR(95% CI)**	**AOR(95%CI)**	**p-value**
		Poor (%)	**Good (%)**			
Mothers' age	18-25	92(83.6)	18(16.4)	3.82(2.17,6.74)	**2.82(1.49,5.34)**	**0.001**
	26-33	145(61.4)	91(38.6)	1.19(0.83,1.72)	1.03(0.68,1.55)	0.895
	>=34	135(57.2)	101(42.8)	1	1	
Family size	1-3	136(83.4)	27(16.6)	1	1	

	4-6	161(48.8)	169(51.2)	0.19(0.12-0.30)	**0.2(0.09,0.38)**	**0.000**
	>6	75(84.3)	14(15.7)	1.06(0.53,2.15)	1.56(0.57,4.25)	0.390
Educational status of mother	Noformal education	140(88.6)	18(11.4)	5.56(3.10,9.97)	**6.68(3.11,14.38)**	**0.000**
	Primary education	141(52.6)	127(47.4)	0.79(0.53,1.18)	0.89(0.53,1.49)	0.663
	Sec.education and above	91(58.3)	65(41.7)	1	1	
Occupational status of mother	Government employ	22(45.8)	26(54.2)	0.45(0.25-0.81)	0.49(0.12,2.04)	0.328
	House wife	338(65.4)	179(34.6)	1	1	
	Others*	12(70.6)	5(29.4)	1.27(0.44-3.67)	1.09(0.31,3.82)	0.889
Income of house hold	<500	281(64.7)	153(35.3)	1.40(0.89,2.23)	1.03(0.57,1.86)	0.070
	500-1000	40(69)	18(31)	1.70(0.85,3.41)	1.86(0.78,4.41)	0.759
	>1000	51(56.7)	39(43.3)	1	1	
Fear of cold	No	307(61.2)	195(38.8)	1	1	
	Yes	65(81.3)	15(18.7)	2.75(1.53-4.96)	1.83(0.95,3.52)	0.073
Institutional delivery	Yes	308(62.1)	188(37.9)	1	1	
	No	64(74.4)	22(25.6)	1.78(1.06-2.98)	1.75(0.95,3.25)	0.075
Advice during delivery	Yes	102(43.4)	133(56.6)	1	1	
	No	206(78.9)	55(21.1)	4.88(3.29,7.24)	**3.05(1.31,7.09)**	**0.01**
Advice during ANC	Yes	136(47.9)	148(52.1)	1	1	
	No	208(80.6)	50(19.4)	4.53(3.07,6.66)	**2.27(1.39,3.73)**	**0.001**
Post natal follow up	Yes	339(63.1)	198(36.9)	1	1	
	No	33(73.3)	12(26.7)	1.61(0.81,3.18)	1.07(0.48,2.36)	0.871
Advice during PNC	Yes	171(55.2)	139(44.8)	1	1	
	No	182(74.3)	63(25.7)	2.23(1.54,3.23)	1.41(0.65,3.07)	0.431
Attitude	Negatively perceived	270(74)	95(26)	3.20(2.25,4.57)	**4.29(2.85,6.46)**	**0.000**
	Positively perceived	102(47)	115(53)	1	1	
Level of knowledge	Poor	334(70.2)	142(29.8)	4.21(2.7,6.55)	**6.59(3.97,10.94)**	**0.000**
	Good	38(35.8)	68(64.2)	1	1	

(= a statistically significant variable at p< 0.05 in multivariable logistic regression analysis)*

Others*: private employ, self-employed, merchant & daily labourer.

6. DISCUSSION

This study aimed to assess practice and factors affecting sunlight exposure of infants among mothers in Duna woreda, Hadiya zone, southern Ethiopia. The current approach of the Ethiopian government is decreasing child morbidity and mortality. Therefore, assessment of

practice and factors affecting the practice of sunlight exposure of infants among mothers is one important aspect in maintaining children's health.

In this study, the Majority of 81.6% (95%CI=78.7, 84.7) mothers exposed their infants to sunlight. It is in line with the same study done in Alta wondo which was 80.1% of mothers exposed their infant to sunlight(24) but it is lower than the similar study done in Debre Markos, Jimma town, and Sakarya which were 93%,100% and 87.5 respectively (27, 48, 59). The reason for the difference might be the difference in socio-cultural factors like fear of illness, fear of evil eyes, and level of appropriate information concerning sunning the baby. It was also greater than the study done in Dale woreda, Farta district, Debre tabor which were 41.1%, 51.98%, and 61.9% respectively (21, 23, 51). A possible explanation for this difference may be due to cultural differences between populations and may be the community had more information about the practice of sunlight exposure of infants.

The majority (93.9%) of mothers exposed their infants outside the house (outdoor). This finding is in line with the same study done in Debre Markos, Jimma town, and Sakarya which were 89.4%,92.16%, and Sakarya respectively (27, 48, 59). This was higher than the same study done in Aleta wondo and Debre tabor which was 63.6% and 61.5% respectively(24, 51). Most of the mothers (94.9%) were exposed to their babies between the time range of 8–10 a.m. This finding is similar to the same study done in Aleta wondo which was 90.8% (24) and the reported time of exposure was higher than the same study done in the Farta district which was 73.2%(23). In this study, 74.3% and 41.9% of mothers were sunning their babies without clothing and with a time duration of 15–30 min as recommended, respectively. This finding was higher than the study done at Aleta wondo on exposing without clothing and time of exposure which accounts for 54.8% and 26.8%, respectively. The possible reason for the difference is the difference in awareness about effect of sunlight exposure, educational status of individuals.

Out of 582 respondents, 18.4% of mothers had feared exposing infants to sunlight. Among these, (50.5%) of mothers didn't expose their infants to sunlight due to fear of cold. This finding was lower than the same study done in Debre Markos and Farta district which were 38.3% and 36.5% respectively(23, 59). This may be due to the reason that most mothers living in Duna woreda may have poor knowledge about benefit of sunlight exposure rather than harmful effect of sunlight exposure.

Regarding practice level of sunlight exposure, 63.9% (95%CI=59.8, 68) mothers practice level were poor. This finding was lower than the study done in Debre Markos, Aleta wondo, and Debre tabor which was 44.6%,58%, and 59.44% respectively (23, 24, 51). A possible explanation for this difference may be due to cultural differences between populations and differences in a study setting in Duna woreda; the majority of respondents were residing in rural areas, whereas in the study done in Debre Markos, Alta wondo and Debre tabor participants were residing in urban areas, which may have contributed to the observed difference and this study used WHO recommendation to assess practice level it also contributes for this difference because they use1 median or mode to assess practice level.

The result of this study revealed the age of the mother, maternal education, family size, and advice during delivery, advice during ANC follow up, attitude, and level of knowledge had statistical association with the practice of sunlight exposure in multivariate analysis. The study revealed that maternal age is associated with the practice of sunlight exposure of infants. The odds of poor sunlight exposure practice of infants among mothers with age group 18-25 were almost three times more compared to those age group $\geq$34. (AOR = 2.82(95%, CI:1.49,5.34)).This finding is similar to a study done in Debre Markos and Townsville, Australia(59, 60). This could be explained as follow; the majority of them in this age group were prim parous women who are less experienced, new to pregnancy, birth, and postpartum life.

In the current finding, maternal education showed association with the practice of sunlight exposure, the odds of poor sunlight exposure practice of infants among mothers with no formal education were about 6.68 times higher compared to those mothers completed secondary school and above. This finding is consistent with other studies done in Debre Markos and Addis Ababa. The reason behind those mothers with no formal education is less likely visit health institution, more likely to give birth at home, less likely to seek information about sunlight exposure of infants than those mothers completed secondary school and above.(53, 59).

In this study, the odds of poor sunlight exposure practice of infants among family size 4-6 were about 80% lower compared to those family size 1-3. This finding is consistent with the study done by Debre Markos, Townsville, Australia, and Addis Ababa. The possible reason could be when family size decreases mothers have less likely visit the health care system and they didn't have more information about the practice of sunlight exposure of infants (9, 53, 54, 59).

The odds of poor sunlight exposure practice of infants among mothers who didn't get advice about sunlight exposure practice of infants during delivery were about 3.05 times higher compared to those mothers who got advice during delivery times and the odds of poor sunlight exposure practice among mothers who didn't get advice about sunlight exposure practice during antenatal care follow up were about 2.27 times more compared to those mothers who got advice during ANC follow up. The possible reason may be the mothers who didn't visit health institution during pregnancy and delivery decrease the chance of getting information about the practice of exposing the infant to sunlight with WHO standard.

Attitude and level of knowledge strongly associated with sunlight exposure of infants. The current finding revealed the odds of poor sunlight exposure practice of infants among mothers who had negatively attitude about sunlight exposure of infants were about 4.29 times higher compared to those mothers who had positively attitude. This is in line with findings reported in previous studies done in Addis Abebe and Sakarya Turkey (48, 53). The possible reason may be mothers who had negative thinking and a bad attitude about sunlight exposure of infants were less practiced than mothers who had positive thinking and good attitude about sunlight exposure of infants.

Finally in the current study the odds of poor sunlight exposure practice of infants among mothers who had poor knowledge about sunlight exposure practice of infants were about 6.59 times more compared to those mothers who had good knowledge. This finding is consistent with the same study done in Australia, India, Aleta wondo, and Debre Markos (24, 50, 59, 60). The reason might be explained as follow mothers who had poor knowledge and insuffient information are less practiced than mothers who had good knowledge and enriched information about sunlight exposure of infants. In addition mothers who didn't get information about the practice of sunlight exposure from different sources of information like health workers, neighbors'/elders, radio, and television contributes for poor sunlight exposure practice.

7. STRENGTHS AND LIMITATIONS OF THE STUDY

7.1 Strengths of the study

The current study had tried to incorporate infants found in both rural and urban areas who were given less attention in previous studies that have focused on urban centers only. This study also tried to assess the practice of sunlight exposure of infants according to WHO recommendations who were given less attention in the previous study. It is also a community-based study. In addition, since there was no similar study conducted in the zone, it could be a good input for the zone.

7.2 Limitation of study

In this study, sunlight exposure practice was assessed using a structured questionnaire for self-report which might be affected by social desirability bias that would underestimate the result.

8. CONCLUSION AND RECOMMENDATIONS

8.1 Conclusion

- Mother's age, educational status, family size, advice during delivery and advice during ANC about practice of sunlight exposure of infants, Attitude, and level of knowledge had a significant association with mothers' practice of sunlight exposure of infants.

8.2 Recommendation

- **Recommendation to the community**
- The community as a whole and mothers, in particular, should involve and engage in activities that promote the level of practice of exposure of the infant to sunlight. The community should apply and share information provided by health care workers and other information sources about sunlight exposure of infants.
- **Recommendations for government regulatory agencies and nongovernmental organization**
- The policymakers, the Ministry of health, SNNP regional health office, Hadiya Zone health office and Duna Woreda health office should create awareness about the benefit of sunlight exposure of infants among mothers and health workers to resolve

the problem of infants that results from lack of sunlight exposure by giving continuous health education program focusing on WHO recommendation.

- Non-governmental organizations should give involve to give training for mother to mother groups about the benefit of sunlight exposure of infants especially by focusing on WHO recommendations.

❖ **Recommendation for mass media**

- Mass Media like radio and television should create awareness about the practice of sunlight exposure in the community by giving health education to the community.

❖ **Recommendation for researcher**

- Lastly, further study is better conducted by researchers to identify knowledge, attitude, and practice of mothers about sunlight exposure of infants at a large scale with qualitative design.

REFERENCES

1. khan A. 5 Amazing Benefits of Sunlight for Newborn Babies August 8, 2019 [updated Last Updated on June 4, 2020].

2. Hamilton K, Cleary C, White KM, Hawkes AL. Keeping kids sun safe: Exploring parents' beliefs about their young child's sun-protective behaviours. Psycho-Oncology. 2016;25(2):158-63.
3. Lai NM, Lee SWH, Wai SX, Teh ZW, Chan MY, Lim YS, et al. The Choice of Population and Outcomes in Neonatal Trials on Hyperbilirubinemia: Are They Relevant? An Analysis of Cochrane Neonatal Reviews. Neonatology. 2020:1-7.
4. Berti C, Agostoni C, Davanzo R, Hyppönen E, Isolauri E, Meltzer HM, et al. Early-life nutritional exposures and lifelong health: immediate and long-lasting impacts of probiotics, vitamin D, and breastfeeding. Nutrition reviews. 2017;75(2):83-97.
5. Tehrani FR, Behboudi-Gandevani S. Vitamin D and Human Reproduction. Critical Evaluation of Vitamin D: Basic Overview. 2017:247.
6. Wunsch A. Lichtbiologie und lichtpathologie. Erfahrungsheilkunde. 2006;55(07):361-9.
7. Albert MR, Ostheimer KG. The evolution of current medical and popular attitudes toward ultraviolet light exposure: part 1. Journal of the American Academy of Dermatology. 2002;47(6):930-7.
8. Rajakumar K. Vitamin D, cod-liver oil, sunlight, and rickets: a historical perspective. Pediatrics. 2003;112(2):e132-e5.
9. Harrison S, Buettner P. Why do mothers still sun their infants? Journal of paediatrics and child health. 1999;35(3):296-9.
10. Fitzpatrick TB, Pathak M. Part IV: basic considerations of the psoralens: historical aspects of methoxsalen and other furocoumarins. Journal of Investigative Dermatology. 1959;32(2):229-31.
11. Nair R, Maseeh A. Vitamin D: The “sunshine” vitamin. Journal of pharmacology & pharmacotherapeutics. 2012;3(2):118.
12. Green RJ, Samy G, Miqdady M, El-Hodhod M, Akinyinka O, Saleh G, et al. Vitamin D deficiency and insufficiency in Africa and the Middle East, despite year-round sunny days. SAMJ: South African Medical Journal. 2015;105(7):603-5.
13. Alfredsson L, Armstrong BK, Butterfield DA, Chowdhury R, de Gruijl FR, Feelisch M, et al. Insufficient sun exposure has become a real public health problem. International Journal of Environmental Research and Public Health. 2020;17(14):5014.
14. Hoel DG, Berwick M, de Gruijl FR, Holick MF. The risks and benefits of sun exposure 2016. Dermato-endocrinology. 2016;8(1):e1248325.
15. Balk SJ, Health CoE, Dermatology So. Ultraviolet radiation: a hazard to children and adolescents. Pediatrics. 2011;127(3):e791-e817.
16. Glanz K, Saraiya M, Wechsler H. Guidelines for school programs to prevent skin cancer. 2002.
17. Gartner LM, Greer FR, Breastfeeding So, Nutrition Co. Prevention of rickets and vitamin D deficiency: new guidelines for vitamin D intake. Pediatrics. 2003;111(4):908-10.
18. Wacker M, Holick MF. Sunlight and Vitamin D: A global perspective for health. Dermato-endocrinology. 2013;5(1):51-108.
19. Mendes MM, Darling AL, Hart KH, Morse S, Murphy RJ, Lanham-New SA. Impact of high latitude, urban living and ethnicity on 25-hydroxyvitamin D status: a need for multidisciplinary action? The Journal of steroid biochemistry and molecular biology. 2019;188:95-102.
20. Almeida ACF, de Paula FJA, Monteiro JP, Nogueira-de-Almeida CA, Del Ciampo LA, Aragon DC, et al. Do all infants need vitamin D supplementation? PloS one. 2018;13(4):e0195368.

21. Tezera F, Whiting S, Gebremedhin S. Dietary calcium intake and sunlight exposure among children aged 6-23 months in Dale woreda, southern Ethiopia. African Journal of Food, Agriculture, Nutrition and Development. 2017;17(3):12427-40.
22. Kaleab Sisay1 FM TG, Berhe Gebremichael4*. Rickets and Its Associated Factors among Under-Five Children in Selected Public Hospitals in Eastern Ethiopia. . 2019;3(2):23-4. East African Journal of Health and Biomedical Sciences. 2019;3(2):23-4.
23. Gedamu H, Tafere Y. Assessment of Knowledge, attitude, and practice of sunlight exposure of infants among mothers attending in governmental health facilities in Farta district, South Gondar zone, North West Ethiopia, 2018. International Journal of Reproductive Medicine. 2019;2019.
24. Bedaso A, Gebrie M, Deribe B, Ayalew M, Duko B. Knowledge and practice on adequate sunlight exposure of infants among mothers attending EPI unit of Aleta Wondo Health Center, SNNPR, Ethiopia. BMC research notes. 2019;12(1):1-7.
25. Abate A, Murugan R, Gualu T. Assessment of practice and factors affecting sunlight exposure of infants among mothers attending governmental health facilities in debre markos town, East Gojjam, Ethiopia, 2015. American journal of nursing science. 2016;5(1):30-6.
26. Abegaz NT, Berhe H, Gebretekle GB. Mothers/caregivers healthcare seeking behavior towards childhood illness in selected health centers in Addis Ababa, Ethiopia: a facility-based cross-sectional study. BMC pediatrics. 2019;19(1):1-9.
27. Getaneh T, Assefa A, Taddese Z. Rickets and the knowledge and practice of exposure to sunlight in Jimma town. The Ethiopian Journal of Health Development. 1998;12(1).
28. Wondale Y, Shiferaw F, Lulseged S. A systematic review of nutritional rickets in Ethiopia: status and prospects. Ethiopian medical journal. 2005;43(3):203-10.
29. Aust-Kettis A, Björnesjö K, Mannheimer E, Cvibah T, Clark P, Debele M. Rickets in Ethiopia. The Occurrence and Clinical Picture of the Disease in the Experiences of a Pediatric Clinic in Addis Ababa. Ethiopian Medical Journal. 1965;3(3):109-21.
30. Ministry of health. Integrated management of newborn and childhood illness. Addis Ababa, Ethiopia 2015.
31. WHO. Vitamin D supplementation in infants 2019.
32. Hayward J. 6 ways sun exposure can brighten your health. . Published on September 22, 2017 Updated on January 16, 2018. 2018.
33. Wharton B. Diseases of Children in the Subtropics and Tropics. Archives of Disease in Childhood. 1991;66(11):1367.
34. Pettifor JM. Vitamin D &/or calcium deficiency rickets in infants & children: a global perspective. Indian Journal of Medical Research. 2008;127(3).
35. Kenenisa C, Ewnetu H, Sime H. Retrospective analysis of prevalence of rickets and associated factors among children admitted to pediatric ward in Jimma University specialized hospital. J Pediatr Neonatal Care. 2014;1(7):00044.
36. Lucas RM, McMichael AJ, Armstrong BK, Smith WT. Estimating the global disease burden due to ultraviolet radiation exposure. International journal of epidemiology. 2008;37(3):654-67.
37. Holick MF, editor High prevalence of vitamin D inadequacy and implications for health. Mayo Clinic Proceedings; 2006: Elsevier.
38. Tønnesen R, Hovind PH, Jensen LT, Schwarz P. Determinants of vitamin D status in young adults: influence of lifestyle, sociodemographic and anthropometric factors. BMC Public Health. 2016;16(1):1-11.
39. Prentice A. Nutritional rickets around the world. The Journal of steroid biochemistry and molecular biology. 2013;136:201-6.
40. Holick MF. Vitamin D: importance in the prevention of cancers, type 1 diabetes, heart disease, and osteoporosis. The American journal of clinical nutrition. 2004;79(3):362-71.
41. El-Hajj Fuleihan G, Adib G, Nauroy L. The middle east & Africa regional audit, epidemiology, costs & burden of osteoporosis in 2011. International Osteoporosis Foundation. 2011:102011-5000.

42. Poopedi MA, Norris SA, Pettifor JM. Factors influencing the vitamin D status of 10-year-old urban South African children. Public health nutrition. 2011;14(2):334-9.
43. Prentice A. Vitamin D deficiency: a global perspective. Nutrition reviews. 2008;66(suppl_2):S153-S64.
44. Silva AA. The shadow rule, the UV index, and the 5S steps in the tropics. Health Physics. 2020;119(3):358-62.
45. Lulseged S. Severe rickets in a children's hospital in Addis Ababa. Ethiopian medical journal. 1990;28(4):175-81.
46. Lulseged S, Fitwi G. Vitamin D deficiency rickets: socio-demographic and clinical risk factors in children seen at a referral hospital in Addis Ababa. East African medical journal. 1999;76(8):457-61.
47. Ekbote V, Khadilkar A, Mughal M, Hanumante N, Sanwalka N, Khadilkar V, et al. Sunlight exposure and development of rickets in Indian toddlers. The Indian Journal of Pediatrics. 2010;77(1):61-5.
48. Cinar ND, Filiz TM, Topsever P, Ucar F, Akgul S, Gorpelioglu S. Intentional sun exposure in infancy in Sakarya, Turkey. Saudi medical journal. 2006;27(8):1222.
49. Nihal A, Tuncay M, Pinar T, Suleyman G. Knowledge and behaviour of parents concerning sunning their babies. BMC Pediatrics. 2006;6:27.
50. Harinarayan CV, Holick MF, Prasad UV, Vani PS, Himabindu G. Vitamin D status and sun exposure in India. Dermato-endocrinology. 2013;5(1):130-41.
51. Feleke DG, Mesfin E, Mekete G. Assessment Of Knowledge, Attitude And Practice Of Mothers On The Effects Of Sunlight Exposure And Its Associated Factors Among Infants Found In Debre Tabor Town, North Central Ethiopia, 2018. 2020.
52. Eshetu M. Analysis of paediatric admissions to Jimma Hospital paediatrics ward: a three year retrospective study. Ethiopian Journal of Health Sciences. 1994;4(1):1-11.
53. Lulseged S, Deste C. Behavioural intention and factors influencing intention of Ethiopian mothers to expose infants to sunshine. Ethiopian Journal of Health Development. 2002;16(1):31-40.
54. Harrison S, Nowak M, Devine S, Saunders V, Smith A, Buettner P. An intervention to discourage Australian mothers from unnecessarily exposing their babies to the sun for therapeutic reasons. Journal of tropical pediatrics. 2013;59(5):403-6.
55. Alsuwat FS, Jafer Alzahrani N, Alsofyani MAA, Alshamrani RM, Ahmed NA, Babi SM, et al. Knowledge and attitude practice (KAP) of rickets disease among mothers in KSA. The Egyptian Journal of Hospital Medicine. 2018;72(6):4582-5.
56. Lowe JB, McDermott L, Stanton W, Clavarino A, Balanda K, McWhirter B. Behavior of caregivers to protect their infants from exposure to the sun in Queensland, Australia. Health Education Research. 2002;17(4):405-14.
57. Chali D, Enquselassie F, Gesese M. A case-control study on determinants of rickets. Ethiopian medical journal. 1998;36(4):227-34.
58. Christie FT, Mason L. Knowledge, attitude and practice regarding vitamin D deficiency among female students in Saudi Arabia: a qualitative exploration. International journal of rheumatic diseases. 2011;14(3):e22-e9.
59. Abate A, Murugan R, Gualu T. Assessment of Practice and Factors Affecting Sunlight Exposure of Infants Among Mothers Attending Governmental Health Facilities in Debre Markos Town, East Gojjam, Ethiopia, 2015. American Journal of Nursing Science. 2016;5(1):30.
60. Vu LH, van der Pols JC, Whiteman DC, Kimlin MG, Neale RE. Knowledge and attitudes about vitamin D and impact on sun protection practices among urban office workers in Brisbane, Australia. Cancer Epidemiology and Prevention Biomarkers. 2010;19(7):1784-9.

ANNEXS

Annex 1: Information sheet (English version)

Title of the research proposal: Assessment of Practice and Factors Affecting Sunlight Exposure of Infants among Mothers Living in Duna Woreda, Hadiya Zone, Southern Ethiopia, 2023. Community Based Cross-Sectional Study.

Introduction: For centuries, sunlight has been used for therapeutic purposes. Parents still expose their infants to sunlight to treat neonatal jaundice, mostly to supply vitamin D for bone development as a consequence of health beliefs.

Purpose: The purpose of this study is to assess Practice and Factors Affecting Sunlight Exposure of Infants among Mothers Living in Duna Woreda, Hadiya Zone. Your participation in this study will contribute government and other concerned bodies for future planning and take appropriate intervention.

Procedure and participation: Your particular participation is affirmed by probability sampling technique, which will be carried out based on chance, and the interview will take maximum of 30 -40minutes. You will be asked to participate in this research because the trustful information, which you will provide, is important for the understanding of the proposed study. You will be asked about your socio-demographic, perceived consequences, income, and other related questions that are very important for the fulfillment of the research. And also your participation is completely voluntary.

Confidentiality: The information you provide will be kept confidential so that any of your personal identifications including name or phone numbers was not be recorded. Rather codes will be assigned to your data for processing. Moreover, the original data will be locked in cabinets until processing and no person other than the principal investigator and supervisors‟ access. The use of information for any purpose other than that to which participants consented is unethical. The information you provide will not be disclosed in a way it identified your characteristics and privacy rather aggregate findings will be reported.

Benefit: The research does not have a short-term financial, health care and capacity building benefit to the research participant as an individual or as a group However, in the long run, different stakeholders will use the evidence for future planning and take an appropriate intervention.

Risk: The research does not have any inhuman treatment, physical and psychological harm, social discrimination, and economic loss on the participants. Your participation or refusal in the study will not interrupt or affect your current treatment or care in any way.

Results dissemination: The researcher is responsible for dissemination of findings and fully accountable to provide feedback to the concerned health departments and districts in the area. Besides, presentations at national and international scientific conferences and publications in the reputable scientific journal of the findings will be attempted.

Freedom to withdraw: If you do not want to participate in the study, you have full right to with draw from the study any time you wish. This would have no effect at all on your health benefit; nobody will enforce you to explain the reason of withdrawal.

Person to contact: The participant has the right to ask information that is not clear about the research context and content before and/or during the research work. You can contact the principal investigator via the addresses provided below.

Principal investigator: Melkamu Kebede

Phone number: +251923407199

E-mail address: melkemukebe@gmail.com

Annex 2: Consent form English version

Good morning or Afternoon.

My name is _____Am working as data collector for the study being conducted in Duna woreda, Hadiya Zone by Melkamu Kebede, who is studying for his Master's degree in maternity & reproductive health nursing at Debre Berhan University and he is conducting his study on practice and factors affecting of sunlight exposure of infants among mothers who give birth within last 12 month. I would like to ask you a few questions regarding your practice of sunlight exposure of infants. The interview would take 30-40 minutes of your time. The purpose of this study is to assess Practice and Factors

Affecting Sunlight Exposure of Infants among Mothers Living in Duna Woreda, Hadiya Zone. Your participation in this study will contribute government and other concerned bodies for future planning and take appropriate intervention. Your participation is completely voluntary. You can refuse to answer any question and/or withdraw from the study at any time without a problem to you. All your responses will remain strictly confidential and your responses will not be linked to your identity at any time. I would like to inform you that there is no potential risk that can harm you and there is no payment for participating in this study.

A. Are the information or objectives clear?

1. Yes 2. No explain again

B. Would you be willing to participate?

1. Yes continue the interview

2. No Stop and go to the next woman

Thank him/her

C. The respondent has given yes. Interviewer's signature certifying that, the informed

Consent.

Name_____ Signature _____ Date_____

Declaration of informed voluntary consent:

It was read to me the participant information sheet. I have clearly understood the purpose of the research, the procedures, the risks and benefits, issues of confidentiality, the rights if participating and the contact address for any requires. I have been given the opportunity to ask questions for things that may have been unclear. I was informed that I have the right to withdraw from the study at any time or not to answer any question that I do not want.

Therefore; I declare my voluntary consent to participate in this study with my initials (signature) as indicated below.

Signature of participant: _____

Signature of data collector: _____

N.B: This is to be signed face to face in the presence of data collector

Thank you for your cooperation!

Annex 3: Questionnaire English version

Questionnaire ID ——————————————

Name of kebele ——————————————

Date of interview ——————————

Name and signature of interviewer ——————————————————

Name and signature of supervisor ——————————————————

General Background Information (Socio Demographic and Socioeconomic Characteristics)

Q. No	Questions	Options/responses	SKIP
101	Mothers' age	——————— (by years)	
102	Infants' age	——————— (by months)	
103	Number of children	——————— (in number)	
104	Sex of infants	1. Male 2. Female	
105	Your current marital status	1.Never married 2.Married 3.Widowed 3.Separated/Divorced	
106	To which religion do you belong?	1.Orthodox Christian 2.Protestant 3.Catholic 4.Muslim 5. Others specify …..	

107	What is your highest level of education Completed?	1. Never attended formal school (illiterate). 2.Primary school(1-8) 3.Secondary school(9-12) 4.Collage and above	
108	What is your husband's highest level of education Completed?	1.Never attended formal school/Illiterate 2.Primary school (1-8) 3.Secondary school (9-12) 4.Collage and above	
109	What is your main occupation?	1.Government employ 2.House wife 3.Daily laborer 4.Merchant 5. Other (specify….)	
110	What your husband's occupation?	1.Government employ 2. Farmer 3. Daily laborer 4.Merchant 5. Other (specify….)	
111	Residency	1.Rural 2.Urban	
112	What is average your monthly income?	1.<500 2.500-1000 3.>1000	

Practice of mothers on sunlight exposure of their infants

Q. No	Questions	Response/options	Skip
201	Did you intentionally expose your baby to direct sunlight?	1.Yes 2.No	If no skip to Q. 212
202	At what age of infant do you start to expose?	————————	
203	How frequently do you expose?	1.Daily 2.Sometimes	

204	Place where expose the baby to sunlight	1.Indoor 2.Out door	
205	At what time of the day do you expose your baby outdoors?	1.Morning 8-10 AM 2.Mid-day 10AM-2 PM 3.Afternoon 2-4 PM	
206	Do you cover infant bodies when you expose?	1.Yes 2.No	
207	Condition of clothing during exposure?	1.Unclothed 2.Partially covered 3.Completely covered 4. With diaper and eye protection only.	
208	For how many minutes do you expose your infants to sunlight outdoorly?	_____	
209	Do you apply lubricants/lotion on your baby's body during sunlight exposure?	1.Yes 2.No	
210	If you apply, when do you apply? (circle more than one)	1.Before exposure 2.During exposure 3.After exposure	
211	Which type of lubricant, you would use?	1.Vaseline 2.Baby lotion 3.Butter 4.Oil 5. Other …….	
212	Why do not expose infants?	1.Fear of cold 2.Fear of evil eye 3.Fear of sickness 4.Fear of pneumonia 5.Fear of sunburn 6.Fear of skin cancer 7.Lack of knowledge	

Attitude of sunlight exposure

Q.NO	Questions	Response /options	Skip
301	Sunlight exposure makes my infant healthier	1. Agree 2.Neutral 3.Disagree	
302	Sunlight exposure makes my infant bone stronger	1. Agree 2. Neutral 3. Disagree	
303	Sunlight exposure helps my infant grow faster	1.Agree 2.Neutral 3.Disagree	
304	Sunlight exposure helps my infant sleep well	1.Agree 2.Neutral 3.Disagree	
305	Sunlight exposure expose my infant to cold	1. Agree 2.Neutral 3.Disagree	
306	Sunlight exposure expose my infant to pneumonia	1.Agree 2.Neutral 3.Disagree	
307	Sunlight exposure causes squinting of the eye	1.Agree 2.Neutral 3.Disagree	
308	Sunlight exposure expose my infant to the evil eye	1.Agree 2.Neutral 3.Disagree	

Knowledge of mothers about sunlight exposure

Q.N o	Questions	Options /response	Skip
401	Do you hear sunlight exposure of infants?	1.Yes 2.No	If no skip to Q.501
402	Do you have mass media?	1.Yes 2.No	
403	Source of information hear sunlight exposure of infants?	1.Nurse /midwife 2.Physician 3.Mass media 4.Nabors/elders 5.Others	
404	Does sunlight exposure beneficial?	1.Yes 2.No	If no skip to Q.405
405	Mention the benefit of sunlight exposure?	1.Strengthen bone 2.Strengthen teeth 3.Keep child warm 4.Produce vitamin D 5.Strengthen body 6.Others	
406	Does sunlight exposure harmful?	1.Yes 2.No	If no skip to Q. 408
407	Mention harmful effect of sunlight exposure?	1.Skin cancer 2.Sterility 3.Blindness 4.Others	

408	Good time to expose infants on Sunlight	1.Morning 2.Afternoon 3.Evening	

Health service utilization

Q. No	Questions	Response/options	Skip
501	Have you deliver your child in health facility?	1.Yes 2.No	If no skip to Q.503
502	Have you been advised to expose your child to sunlight?	1.Yes 2.No	
503	Did you have an antenatal follow-up?	1.Yes 2.No	If no skip to Q.505
504	Have you been advised to expose your child to sunlight?	1.Yes 2.No	
505	Did you have a postnatal follow-up?	1.Yes 2.No	
506	Have you been advised to expose your child to sunlight?	1.Yes 2.No	

Annex 4: Hadiyissi xamichuwa (Questionnaire).

Cakishi 1: Xamibo (Information) uwimmi woraqata (Hadiyyisi tiratto).

Sarayyimina (Sorobimina) Horori Wosha:- Dabubi Ethiope'i Hadiyi zonanne duni woradane he'oo amo'i, qacalli cilluwa Ellinichi Cammane Hinikide Fissamoda'e, Odimi Ellinichi Cammane fissamo be'isina horoki mashikauwa.

Agaa: - Gasinissemi asherate ellinichi Camma,a fayya'omina Mani araqissa awaxami he'ukko, odimi kadollenemi minadabi hararissa awaxolla. Ebikina qacalli cilluwa dali'i cammane fissimi Jaundice (ci'ii jabo) yakami jabbo fayisohane, Vitamin-D uwohane, Miqewi lio.isinna odimi qoxo'isinnami haramohane.

Horori wosha: - Ka sarayyimi horori woshi Hadiyi zona Duna worada Helami Amo'ie, Qacalli Cilluwa Ellinichi Cammina Fisimina horo'o luwa, Odimi mashika'uwa sorobiminate. Ku quxxi adili gasanomi, ku quxxi mo'o kenomi, odimi mulikenomi edohane ihubikina, ka quxxone hunidemi Mani xasibella agimine, lasaginami qodo'o qodimine tocho afissimi baxo,o baxokko.

Takisha & Awanacho: - Kino'ikki annani awanimi jalanigenemi (agaxame'ene) sample (kobilla aimmi) technolojeine la'amakohane, kuki agaxame'ene qodamakohane, odimi xamichina 20-30 daqiqa afebe'e masoko. Ka sorobimmi worone awanito'isina hanisomo, mashika'omimi ati hinicallo,o haniqo'i naqashi (Information) qodamube'i sorobimina hasisohane, odimi kino'i awanimi kino'i Eyitomane ogoramakohane.

Maxaqomma:-Sumi te'im siliki quxurami (xigomi) eda mulli kenime, gagi xalle'e cakisso quxuwi hunidimi maxaqomma egerukosami yo'oko. Code odimmi Naqashi (Information) agisimina awadoko. Muleki hasissoki naqashi (Information) xufamokoki Kabinets until processing yakamaninete, odimi ee beyo hinicokoki wana'i Sorobohane, luwa egerohane bagani mulli mani hinicobe'ane. Awanani Naqasha (Information) qodamukani mulli qodina fissa awaximi maxaqomma egerimi hogimma mo'isoko. Hinicalliti naqashi ki.i gaqi

maxaqomma cakiso,isinete odimi maxaqomi horiyemi hunidemi mateyomi (Reported) ase,amoko.

Awado: - Ku sorobimi gunidi amanene birrine, faya'omma egejine, malayye qoxishinami sorobohaninami, odimi mullaninami lule'omanem haramo haramati he'oyyo. Ehona bagani, qeralli amanommi worone ka quxina hasiso manine maqiremi ihimine, odimi sodina qodo'o qodimine xasibella agimi baxo baxokko.

Jori Luwwa (Risk**)**:-Ka sorobimine waro'o te'imi afisso hawaji mahimi he'oyo. Kb:- Amaxane, anichi gagane (physical and psychological), Mateyomma he'chane….Mk. ka sorobimi worone anigga edimi te'imi awanima hogimmi, kaba uwinomi faya'omi egejane afisso hawaji mahimi be'anne.

Misha Cakisha: - Sorobanichi siduki misha cakishi danomi yoko,o. Kb: - hegegone yokki faya'omma egechi minewina, woradinna, Odimi Ethiope,ene, Heri ullane(International scientific conferences) cakishane mateyomane la'anito'o lachi manine (scientific journal) kitabisimina yakitte issinomo.

Firimi Wolabano: - Ka sorobimane awanimi, awanimi hogimi xanamohane. Mashika,omimi ki'i faya'omanemi afisso hawaji mahimi be'ane. Mahina utta fititto yaa quqokoki be'ane.

Edanisso Manicho: - ka sorobimane cakube'i luwi yolasse hiniki amanemi xamimi xanamoko.

Kanni worone yokki beyo cakisanine sorobanicho sidakena xanitakamo.

Sorobanich Sumi- Melkamu Kebede

Siliki Xigo- +251923407199

E-mail Address*:* melkemukebe@gmail.com

Cakishi 2: La'aqanichi (Itanichi) Sagara Uwaqanicha

Xumma Gatta/ Xumma Hossaha

Ihi sumi_____,Hadiyi Zonane Duni Woradane sorobamukuya yokki sorobimina naqasha wixa,anichi ihate baxumuya yomoki Melkamu Kebede Master's degree in Maternity & Reproductive Health Nursing At Debre Berhan University losano lossimane yomo, odimi Qacalli Cilluwa Ellinichi Cammina Fisimina Horo,o Luwa, Odimi

Mashika,uwa Sorobimanete. Higuki 12 aganise worini qaruki amo'i lamibe,ene cilluwi maxaranichi , qacalli cilluwa Ellinichi Cammina fisimi lossano mo'oisine hoffi qaxxi xamicha xamena hasomo. Xamicha xamimina 30-40 daqiqa masoko. Ka sorobimiki horori woshi Hadiyi Zonane Duni Woradane he'illami amo'ie qacalli cilluwa Ellinichi cammina fissimina horo'o luwa,a, odimi mashika'uwa sarayima. Ka sorobimi worone anigi ejja adilli gasonemi ku quxxi mo'o kenomi, odimi mulli kenomi edohane ihubikina kaquxone hunidemi mani xasibella agimine lasaginami qodo'o qodiminne tocho'o afissimi baxo baxokko. Kino'i anigi ejji horiyomami gaqi hasanone (shene'ene) shohamakohane. Hiniki amanemi agube'i xamicha xamimi xanamoko. Odimi xamichina uwitako'i dabachi hiniki amanemi maxaqommi egeramakohane. Kino'i hawajina afisso luwi, odimi bito,o miqisso luwi mahimi ka sorobimi worone be'ane. Ka sorobimina haramoki xamicha xaminomi amane uwitakami dabachina araqa galaxinomo.

A. Naqashi te'im horori woshomi cakkahene?

1. Eyya, 2. Odimi kure'e (chakise)

B. Aniga ejjina hasohoniye?

1. Eyya, yitolasse xamimma ashere

2. Eyayo yitolas, ulle, odimi awanitami amanne higge'e.

Galaxinomo!!

C. Dabbacha uwanichi eyyite uwulassi, xamanichii oddimi furima'ine la'isoko.

Suma ———————————————— Furima'a ————————.Balla ————————

Naqashani hanene asheramuki eyyiti ittanicha cakisha

Aniga ejji naqashi (information) woraqatta qanana'amukoki, Sorobimikki horori woshi, quxuwwi, baxxi ogolluwi (the procedures), odimi mishewi, maxaqi quxewwi…..M.k, danamissa agako, (cakako). Cakube'i te'im agube'i xamichuwa xamimi sammi egeramakohane. Hiniki amanemi ka sorobimise (xamicha dabarimise) fittena xanitoto, odimi ati hasiti xamicha dabatenami, odimi dabarima sabenami xanito'isa kuramo.

Ehe bikina kanni worone cakukki ogorine ka sorobimane luxani ihate (furima'ine) anigi ejjine ih'i eyyita'a cakisomo.

Anigi ejjanich furima'a ————————————

Naqasha wixa’anichi furima’a ———————————

Sawihe: - Ku naqashi wixa’anichi yokki illi illagene faramamokko. Isitako’i haramaxi bikina galaxinomo.

Chakishi 3: Xamichuwa (Questionnaire)

Xamichuwa Enikino’i xigo ———————————

Qabale’i suma ———————————

Xamichi balla ———————————

Xamanichi suma ——————————— Furima’a ———————

Dadessanchi suma ——————————— Furima’a ———————

Gatti Ogorra Cakisha

Xigo	Xamicha	Dolo’o/Dabacha	Callo’o
101	Ami umura	——————— Hinicho	
102	Ciili umura	——————— Agana	
103	Ossi xig me’o	———————	
104	Cilluwi alibacha	1. Gonicho 2. Menitichote	
105	Kaba yoki mini isaqanichi duha’i	1. Mini isumibe’ane. 2. Mini issamohane. 3. Bubessanichote. 4. Mini isaqama he,numo kaba ananihamo.	

106	Hiniki amanato awanitotoki (agotoki)?	1. Orthodoxy. 2. Protestants. 3. Muslim. 4. Catholic. 5. Muleka…..	
107	Ki'i losani gabali hinikana?	1. Mahami tamarumoyo. 2.1-8 Baxanicha. 3. 9-12 Baxanicha. 4. Collejja, ehani hananete.	
108	Ki'i manichiki losani gabali hinikana?	1. Mahami tamarukoyo. 2.1-8 Baxanicha. 3.9-12 Baxanicha. 4. Colleja, ehani hananete.	
109	Kiki horori (wana'i) baxi maricho?	1. Adilli baxanichote, 2.Mini amate, 3.Balli baxo baxanicho, 4. Dadaranichote. 5. Muleka….	
110	Ki'i manichi baxxo baxi maricho?	1.Adilli baxanicho, 2.Abulanicho, 3. Dadaranicho, 4. Bali baxo baxanicho, 5.Muleka……	
111	Hechi beyyi hano?	1. Haxi Ulla, 2. Bero,o.	
112	Agani sixo'i me'o (hinikana)?	**1.** <500, **2.** 500-100, **3**.>1000	

Amo'i Qacalli Cilluwa Ellinichi Cammane Fissimina Isamoki Boraja.

Xigo	Xamicha	Dolo,o/Dabacha	Chalo,o
201	Qacalli Cillicho elinichi cammina fissita laqo'o?	1.Eyya 2. Eyayo	Calamubelas e xamichi

			xigo. 212
202	Hinikani'i aganane ellinichi cammina fissima ashetito, o?	_____	
203	Hinikani amane ellinichi cammina fissitakamo?	1. Balina balina. 2. Mati mati amane	
204	Qacalli Cillicho Elinichi cammina fissitakami beyi hano?	1. Mini'i worone. 2. Nafarane (qeqane).	
205	Qacalli Cillicho mini,i birra,a elinichi cammina fissitaka,a lasage hinikani amane ibisakamo?	1.Dara 2 - 4AM 2.lamibe'i ballane 4AM-8PM 3.Maro'i ballane 8PM-10 PM.	
206	Qacalli Ciilicho birra,a fissitakami amane oracho ifissakamone?	1. Eyya 2. Eyayo.	
207	Birane fissitakami amane edessimi duha,i hinikidete?	1. Edesomo. 2. kolli oracho edesomo. 3. Hunidemi orachomi edessomo. 4. Ille egeranicho issomo,o. 5. Shumma egeranichi xale.e edesomo.	
208	Qacalli Cillicho ellinichi cammane hinikani daqiqa afusitakamo?	_____	
209	Qacalli cillicho ellinichi cammane fissitakami amane oracho hanene [oracho lilisanicho) qibatta (loshina] labakamone?	1. Eyya 2. Eyayo	
210	Eyya yakolasse, cillichi orachone hinikki amane labakamo? [Mati (1) lobi dabacha xaxe]	1.Cammane Fissimi gasitaka'a 2.Eehi amanemi 3.Cammane fisitaka'a lasage	
211	Hiniki hagari qibata (oracho lilisanicho) labakamoki?	1.Bazililla 2. Cilluwi loshinna 3.Buro'o 4. Zayita	

		5. Mulekame	
212	Mahinate qacalli cillicho ellinichi cammina fissitakami be,eki?	1.Kirato badimine 2.Gorimota badimine 3.Afali jabbo(micha,a) badimine 4.Ellinichi ibba badimine 5. Qida,a badimine. 6. Lachi billoma.	

Ellinichi Cammane Fissimi Afisoki Hawaja.

Xigo	Xamicha	Dolo'o/Dabacha	Callo'o
301	Qacalli Cillicho ellinichi cammina fissimi faya,oma uwoko, yokki sawitene	1. Ittamomo 2. Muqicho 3. Ittamomoyo	
302	Qacalli Cillicho ellinichi cammane fissimi cillichi miqe qoxisohane, yokki sawitene	1.Ittamomo 2. Muqicho 3.Ittamomoyo	
303	Qacalli Ciillicho ellinichi cammane fisimi qaqiso li'oisinna haramohane, yokki sawitene	1.Ittamomo 2. Muqicho. 3. Ittamomoyo.	
304	Qacalli Ciillicho ellinichi cammane fissimi danami diricha diriro.isinna haramoko, yokki sawitene	1.Ittamomo 2. Muqicho. 3.Ittamomoyo	
305	Qacalli Cillicho ellinichi cammane fissimi qixi,i hawajina (jabina) affisoko, yokki sawitene	1.Ittamomo 2. Muqicho. 3.Ittamomoyo	
306	Qacalli Cillicho ellinichi cammane fissimi afalli jabina (Michina,a) afissokko, yokki sawitene	1. Ittamomo 2. Muqicho. 3. Ittamomoyo	
	Qacalli Cillicho ellinichi cammane	1. Ittamomo	

307	fissimi ille ifiso'isina isoko,yokki sawitene	2. Muqicho. 3. Ittamomoyo	
308	Qacalli Cillicho ellinichi cammane fissimi jori luwi (gorimmoti) sido.isina issoko, yokki sawitene	1. Ittamomo 2. Muqicho. 3. Ittamomoyo	

Cilluwa Amo,i Ellinichi Camane Fisimi QorommaS

Xigo	Xamicha	Dolo'o/Dabacha	Callo'o
401	Cilluwa ellichi camane fisimmi bikina macessa laqo,o?	1.Eyya 2. Eyayo	Eyyayo yulase Q.501 calle,e.
402	Xamibo macesiso luwi yohone?	1.Eyya 2.Eyayo	
403	Cilluwa ellinichi camane fisimi bikina macesitoki (qositoki) mahisete?	1.Midwifery/ Nursise 2.Doctoluwise 3.Radio/Tv 4.Lobi manise / Ola'isse 5. Mulli luwise.	
404	Cillicho Ellinichi cammane fisimi awado (misha) uwo,isa laqohone?	1.Eyya 2.Eyayo	Eyyayo yulase Q.405 calle,e.
405	Eyya yulase, cillicho ellichi cammina fisimi hinikido'i awadi (mishi) yokko?	1.Miqqi qoxima ebokko 2.Orachi qutima horokko 3. Oracho qoxisoko 4. Vitamin D uwokko 5.Mulikenomi…. 6. La'omoyo.	

406	Cillicho ellinichi cammina fisita lasage yoki hawaja laqo,o?	1.Eyya 2. Eyayo	Eyyayo yulase Q.408 calle,e.
407	Cillicho ellinichi cammane fisimi afisso hawaji maricho?	1. Hanni omachi cancera ebisokko. 2. Alicellano. 3. Elli qoqimame afisokko 4. Mulekame	
408	Cillicho ellinichi cammane fisimina danami Amani hiniki amane?	1.Daridara 2.saxi lasage 3. Maro balla.	

Fayya'omi Awado'o Awaxima

Xigo	Xamicha	Dolo'o/Dabacha	Callo'o
501	Cillichi qaramukoki faya'omi mineneteniye?	1.Eyya 2. Eyayo	Eyyayo yulase Q.503 cale,e.
502	Eyya yakolase, hanani yoki xamichina cillicho ellichi cammane fisito'isina sogamma (kurama) he'ukkone?	1.Eyya 2.Eyayo	
503	Qarimmi gasitate fayya'omi mine [ANC (antenatal care) follow-up] awanitami (matami) helitone?	1.Eyya 2.Eyayo	Eyyayo yulase Q.505 cale,e.
504	Eyya yakolase, hanani yoki xamichina cillicho ellichi cammane fisito'isina sogamma (kurama) he'ukkone?	1.Eyya 2.Eyayo	
505	Qata lasage faya'omi mine [PNC (postnatal care) follow-up] matahene?	**1**. Eyya **2**. Eyayo	

506	Eyya yakolase hanani yoki xamichina cillicho ellinichi cammina fisito’isina sogamma he’ukkone?	1.Eyya 2. Eyayo	