REVIEW





Practice and factors associated with sunlight exposure of infants among mothers in Ethiopia: a systematic review and meta-analysis

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Abstract

Background Exposure to sunlight aids in the body's production of vitamin D, guards against rickets, and treats newborn jaundice. In Ethiopia, the magnitude of sunlight exposure practice varies across studies. Thus, this study aimed to estimate the pooled practices and factors associated with sunlight exposure of infants among mothers in Ethiopia.

Methods Electronic search was carried out using databases (PubMed, HINARI, Science Direct, electronic databases, and Google Scholar) for relevant articles published from January 1, 2010, to March 27, 2024. The screening process was carried out in accordance with PRISMA guidelines. Articles conducted in English and guantitatively expressed were considered in this review. The quality assessment of included articles was evaluated using the Newcastle-Ottawa Scale. Data analysis was carried out using STATA-14 version software. I2 statistics and Egger's test were used to evaluate heterogeneity and publication bias, respectively. The pooled prevalence with a 95% confidence interval (CI) of the meta-analysis utilizing the random effect model was displayed using forest plots, and adjusted odds ratio (AOR) was utilized to quantify the association.

Results 1171 records, 13 studies were included in the meta-analysis with 5190 study participants that fulfill the inclusion criteria, and all the included studies were cross-sectional in design. The pooled prevalence of sunlight exposure practice among mothers in Ethiopia was 45.38% CI (38.36, 52.4). Good sunlight-related knowledge (AOR; 1.61, 95% CI 1.3, 1.98), maternal formal education (AOR; 1.35, 95% CI 1.08, 1.69), housewife (AOR; 0.7, 95% CI 0.51, 0.95), and husband formal education (AOR; 1.29, 95% CI 1.07, 1.56) were significantly associated with good sunlight exposure practice.

Conclusion The pooled prevalence of good sunlight exposure practice among mothers in Ethiopia was low. Good sunlight-related knowledge, being a housewife, and maternal and husband formal education were the factors that were associated with good sunlight exposure practice. Thus, the government needs to cater further assistance and initiate greater information circulation and follow-up to improve the situation.

Keywords Meta-analysis, Rickets, Sunlight, Sunlight exposure, Vitamin D, Ethiopia

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Introduction

Sunlight is essential to human health, both physically and mentally [1]. Vitamin D, which is necessary for immune system function, blood cell creation, and bone development, is produced by the body when exposed to sunlight [2]. Infants can get the recommended daily intake of vitamin D by spending 30 to 60 min in the morning (8-10 a.m.) daily in the outdoors with 40% of body



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surface exposed to sun [3, 4]. Vitamin D regulates calcium and phosphate balance, which is essential for bone metabolism [5]. The least expensive way to get vitamin D is through sunshine exposure. Skin exposed to the sun will manufacture vitamin D. Sunscreen prevents UV rays from harming the skin, although it does have an impact on the skin's ability to produce vitamin D [6, 7].

There are numerous health advantages for newborns when mothers practice timely and appropriate neonatal sun exposure. Vitamin D deficiency is caused by moms not exposing their newborns to enough sunlight, and jaundice is a major health issue in many underdeveloped nations, particularly in sub-Saharan African nations like Ethiopia [2, 8].

In Ethiopia, a review of rickets stated that the prevalence of rickets was as high as 40%, making it one of the highest in the world, and the main cause is due to inadequate sunlight exposure practice [9, 10]. Rickets is common among Ethiopian children. It contributes to infant mortality and morbidity and carries long-term consequences [11]. In addition to Rickets, vitamin D insufficiency has been associated with a number of nonskeletal problems and musculoskeletal conditions such as bone fractures, osteomalacia, osteopenia, osteoporosis, and muscular weakness. Heart conditions and their risk factors, such as hypertension, myocardial infarction, decreased systolic and diastolic function, peripheral vascular disease, abdominal aortic aneurysm in older men, and congestive heart failure, are examples of non-skeletal consequences [12]. In addition to having long-term effects, it increases newborn mortality and morbidity. In the 1960s, Ethiopia implemented health education as a means of influencing parental behavior around the amount of sunshine that infants receive in order to prevent rickets. This method is still not being used very often, and health messages that could improve maternal behavior and prevent babies from not getting enough sunshine are not being focused on [13].

The magnitude and factors associated with sunlight exposure practice among mothers were reported in different studies. The magnitude ranges from 27 to 67% [14, 15], and the factors were Household education [16–18], Maternal age [15, 17, 19–21], Knowledge [14, 17], Marital status [20, 22] and Maternal occupation [18–22] in Ethiopia.

However, sunlight exposure practice among mothers towards children has continued to be a major public health problem in Ethiopia [11, 23]. Understanding the amount of sun exposure practices and the factors associated with them is necessary for designing and implementing effective interventions to address the issue. The prevalence of sunlight exposure practice among mothers ranges from 27.14% in Addis Ababa [14] to 67.27% in

Wolkite, Ethiopia [15]. Thus, this review aimed to estimate the pooled prevalence of sunlight exposure practice and its associated factors in Ethiopia.

Methods

Registration and reporting

The Preferred Reporting Items for Systematic evaluation and Meta-Analysis (PRISMA) guideline was followed for this study [24].This systematic review was registered in PROSPERO and assigned with CRD number 42023451185.

Data sources and search strategies

A systematic review and meta-analysis of published and unpublished research were performed to assess the practice and factors associated with sunlight exposure of infants among mothers in Ethiopia. Electronic databases such as PubMed, Cochrane Library, Hinari, Google Scholar, CINAHL, and Global Health were used. The following core search terms or phrases were used; "prevalence", "magnitude", "proportion", "Epidemiology", "sunlight exposure", "practice", "sunshine", "rickets", "vitamin D deficiency" "associated factor", "determinates", "factors", "predictors", and Ethiopia by a combination of Boolean operators "AND" or "OR" as applicable, and the search was made by two authors independently (SDA and TH). Articles conducted in Ethiopia and written in English were the only ones taken into account.

Inclusion and exclusion criteria

This review includes all available studies conducted from January 1, 2010 to March 27, 2024. The review included all English language studies, both published and unpublished, on the prevalence of practices and/or factors associated with sunlight exposure among mothers in Ethiopia. We include unpublished studies because they are able to address the magnitude of sunlight exposure practice and also have good quality of study. Nevertheless, the study did not include editorials, conference abstracts, review papers, or qualitative research because they did not quantify the outcome variable (prevalence of sunlight exposure practice).

Study selection, quality appraisal, and data extraction

After exporting all articles found in the chosen databases to Endnote X8, duplicate files were removed. To include the remaining papers and abstracts in the full-text appraisal, two investigators (SDA and TH) screened them. Disagreement was handled by the third party (EN), and the differences between reviewers were managed through conversation. The quality of papers meeting inclusion criteria was assessed using the Newcastle–Ottawa Scale (NOS) study [25] (Additional file 1). Two reviewers independently assessed articles prior to inclusion in the review. Articles with quality scores of fifty and above were considered in the final review (Fig. 1).

Data extraction

Articles included in the final analysis were evaluated by reviewers, and Microsoft Excel 2010 sheet was used for data extraction. The information on the author's name, year of publication, study area, region of study, participants' age, year of study, study design, sample size, study quality score, dependent variable (mean or median value), prevalence and associated variables along with their respective effect sizes (Odds Ratios), and the corresponding 95% confidence intervals were contained in the data extraction tool.

Statistical methods and analysis

The included papers were loaded into a 2016 Excel sheet for data extraction, and after that, they were exported into STATA 14 for analysis. Forest plots were used to present the prevalence of the practice of mothers exposing their children to sunshine in Ethiopia (Fig. 2). The heterogeneity was assessed using the I2 statistics, and it was declared at a p-value of less than 0.05 [26]. Subgroup analyses were performed by different study characteristics, such as study year (before 2020 or 2020 and above), sample size (large or small), region, and study design (institutional-based crosssectional or community-based cross-sectional). Pooled odds ratios (OR) with 95% CI for each determinate factor of sunlight exposure practice were performed using random and fixed effect meta-analysis based on its degree of heterogeneity. Independent variables that were measured and reported in a homogeneous



Fig. 1 Flow chart for study selection (inclusion and exclusion of studies)



Fig. 2 Prevalence of maternal sunlight exposure practice towards to their children in Ethiopia

way were considered to identify whether they have an association or not with the sunlight exposure practice. In order to verify publication bias, the Egger regression asymmetry test was also performed, and confirmed to a p-value of less than 0.05 [27]. Additionally, an estimation of the number of missing papers from the meta-analysis was made using the "trim and fill" method (Fig. 3).

Operational definition

Practice: practice was measured by practice-related questions, and the questions ranged from five to twelve and included the timing, frequency, duration, and condition of sunshine exposure. Practice was defined as good if the respondents scored above the mean or median level.

Knowledge: knowledge was assessed based on ten questions about sunshine exposure that included the benefit, timing, duration, and its drawback. A respondent scored above the mean level from the given question; they were considered knowledgeable about sunlight exposure.

Not formally educated: participants are considered not formal educated if she or he does not start grade one, irrespective of whether she or he reads or writes.

Results

Study selection

This review included both published and studies on the practice of mothers towards sunlight exposure in Ethiopia. From thirteen studies, two unpublished studies conducted at Debre Tabor, Amhara Region, and Adami Tulu Jido, Oromia Region, were included in this review [22, 28]. Electronic database searching turned up a total of 1171 records. Using their titles and abstracts, the remaining 991 articles were filtered out, and 143 duplicate records were eliminated. The eligibility of thirtyseven full-text articles was assessed. Of these, 24 full-text articles were eliminated because the research was done outside of Ethiopia and the relevant results were not properly reported. Finally, thirteen articles were considered for inclusion (Fig. 1).

Characteristics of included studies

Thirteen studies that assessed the sunlight exposure practice were included in this review, and six studies were conducted in the Amhara region [16, 17, 19, 21, 22, 29], four studies from South Nation and nationalities region [15, 18, 30, 31], two studies in Oromia region [20, 32] and one study were conducted in Addis Ababa [14]. The sample size of the studies ranged from 170 (a study done at Dale Woreda, Southern Ethiopia) [30] to 866 (a



Fig. 3 Funnel plot with 95% confidence limit of a simulated meta-analysis

study conducted in Dejen district, Amhara region) [17]. Seven studies were conducted at the institutional level (two studies from specialized hospitals, two studies were conducted both at health centers and specialized hospitals, two studies were conducted at health centers, and one study was conducted at general hospital), and six studies were conducted at the community level. Overall, this systematic review and meta-analysis included a total of 5190 study participants (Table 1).

Socio demographic characteristics of the participants

Four variables (maternal education, husband education, maternal occupation, and current marital status) were measured and were reported similarly in each included study. Husband education and maternal education status of the participants were reported in nine [14–16, 18–20, 22, 29, 31] and twelve studies [14–22, 29–31] respectively. 21.15% of the husbands and 25.66% of the mothers were not formally educated. Likewise, based on eleven

Authors and publication year	Study area	Study design	Child age	Samples included	Prevalence
Abdulhakim Hora 2022	Adami Tulu	Community based cross-sectional	<1 year	567	55.2
Tadesse et al. 2023	Mettu	Community based cross-sectional	<1 year	600	57.67
Ashebir et al. 2022	Addis Ababa	Institutional based cross-sectional	< 28 days	420	27.14
Abebe Abate et al. 2016	Debre Markos	Institutional based cross-sectional	<5 year	345	44.64
Bekalu et al. 2022	Dejen	Community based cross-sectional	<1 year	866	44
Bedaso et al. 2019	Aleta Wondo	Institutional based cross-sectional	<1 year	307	61.22
Teklehaimanot et al. 2021	Debre Berhan	Community based cross-sectional	<1 year	530	65.66
Dejen Getaneh Feleke 2018	Debre Tabor	Community based cross-sectional	<1 year	105	59.44
Mengistu et al. 2022	Wolkite	Institutional based cross-sectional	<1 year	220	67.27
Whiting 2017	Dale Woreda	Community based cross-sectional	< 28 days	170	41.18
Haileyesus Gedamu 2019	Farta	Institutional based cross-sectional	<1 year	339	54.28
Goshiye et al. 2022	Dessie	Institutional based cross-sectional	<1 year	394	41.12
Bezabih et al. 2021	Yirgalem	Institutional based cross-sectional	<1 year	327	54.43

Table 1 Characteristics of extracted studies on practice of mothers towards sunshine exposure of their children in Ethiopia

studies, [14–16, 18–22, 29, 31] 57.3% of the mothers were housewives, and the overall result of eleven individual studies shows 93.85% of mothers were currently in marriage [14–22, 29, 31] (Additional file 2).

Prevalence of sunlight exposure practice

The overall pooled prevalence of good sunlight exposure practice among mothers in Ethiopia was 50.99% (95% CI 44.15, 57.82) and with high heterogeneity, $I^2 = 68.6\%$, p < 0.001 (Fig. 2). Nevertheless, the trim and fill technique of analysis was used to correct for funnel plot asymmetry and modify the final pooled estimate because of the existence of publication bias (Fig. 3). Therefore, the final adjusted pooled prevalence of practice was 45.38% (95% CI 38.36, 52.4). The highest prevalence of good sunlight exposure practice was a 67% [15] study done in Wolkite University Specialized Hospital.

Publication bias

Publication bias was assessed using a funnel plot and the Egger test. The overall prevalence of sunlight exposure practice showed statistical evidence of publication bias. Asymmetrical distribution is shown by the funnel plot as illustrated in Fig. 4, and the Egger tests had a statistically significant P-value of 0.001. In order to determine the number of missing studies from the meta-analysis that

could have contributed to publication bias, the "trim and fill" analysis method was used, and filling was done funnel plot becomes symmetry while four studies are added (Fig. 3).

Sub-group analysis

Even though subgroup analyses were done by using different characteristics of articles (sample size, study design, publication year, and region) to detect the source of heterogeneity, still heterogeneity exists. The prevalence of good sunlight exposure practice among studies conducted after 2020 was 50.81 (95% CI 40.59, 61.03) (Table 2).

Factors associated with sunlight exposure practice in Ethiopia

We have conducted to determine the pooled odds of each factor for good sunlight exposure practice. Overall, maternal knowledge, maternal occupation factors, marital status, maternal educational status, and husband educational were evaluated among thirteen studies.

Accordingly, four studies were included to examine the association between knowledge and mothers sunlight exposure practice [14, 17, 19, 32]. We found that mothers who have good knowledge were 1.61 times higher odds of practicing good sunlight exposure than





Group setting	Subgroup category	Number of studies	Pooled prevalence (95% CI)	Heterogeneity	
				²	p-value
Publication year	2020 and above	8	50.81 (40.59,61.03)	77.6%	0.001
	Before 2020	5	51.37 (43.45, 59.28)	37.4%	0.172
Study design	Community based cross-sectional	6	53.04 (45.32, 60.77)	43.4%	0.116
	Institutional based cross-sectional	7	49.26 (38.47, 60.05)	77.7%	0.001
Region	Amhara region	6	50.67 (43.06, 58.28)	44.3%	0.110
	Sidama and SNNAP	4	55.32 (43.84, 66.79)	60%	0.057
	Others	3	46.11 (25,67.21)	87.1%	0.001
Sample size	500 and above	4	54.9 (45.92, 63.88)	34.7%	0.204

Table 2 Sub-group analysis on good sunlight exposure practice of mothers towards sunshine exposure of their children in Ethiopia

their counterparts (AOR; 1.61, 95% CI 1.3, 1.98), with the absence of heterogeneity I2=4.6 and p-value=0.37 (Fig. 5). The result of Egger's tests shows the absence of publication bias with a p-value of 0.309.

Likewise, the association between maternal occupation and good sunlight exposure practice was assessed using five studies [14, 16, 19–21]. Based on the result, mothers whose occupation was housewife were less practicing sunlight exposure of their child than their counterparts (AOR; 0.7, 95% CI 0.51, 0.95) with heterogeneity of (I2=91.9%; p-value=0.001). The results of the Egger's tests revealed that there was no potential publication bias, with a p-value of 0.59 as seen in Fig. 6.

The association between the marital status of the mother and good sunlight exposure practices was assessed using five studies [14, 16, 18, 20, 22]. The result shows that association between married and good sunlight exposure practice is insignificant (AOR; 1.22, 95% CI 0.66, 2.24) with heterogeneity of 86.4%, p-value=0.001. The Eggers test shows that there is no publication bias (p-value=0.45) as shown in Fig. 7.

In addition, the association between the educational status of the mothers and good sunlight exposure was examined considering six studies [14, 16–18, 21, 22]. We found 1.35 higher odds of good sunlight exposure practice among mothers who have formal education than their counterparts (AOR; 1.35, 95% CI 1.08, 1.69). In addition, we demonstrated high heterogeneity (I2=67.5%, p<0.009). Publication bias was not shown using Egger's tests (p-value = 0.21) (Fig. 8).

Moreover, husband's educational status has an association with good sunlight exposure practice [14, 16, 18, 22]. Those mothers whose husbands have formal education were more likely to practice sunlight exposure than mothers whose husbands haven't formal education (AOR; 1.29, 95% CI 1.07, 1.56), with an absence of heterogeneity of 22.2% and a p-value 0.227. The Eggers test was also used to evaluate publication bias, and the results indicate that there is no publication bias (p-value = 0.91) (Fig. 9).



Fig. 5 Forest plot depicting the pooled odds ratio of the associations between good knowledge of the mother and sunlight exposure practice in Ethiopia



Fig. 6 Forest plot depicting the pooled odds ratio of the associations between housewife and sunlight exposure practice in Ethiopia



Fig. 7 The pooled odds ratio of for associations between married and sunlight exposure practice in Ethiopia

Discussion

Adequate sunlight exposure practice helps the body of infants to produce vitamin D, which enhances calcium absorption [5]. The Turkish pediatricians recommend that all mothers should sun their infant outdoors every morning [2]. The purpose of this review was to assess the prevalence and factors associated with good sunlight exposure practice among mothers by reviewing the findings of available studies. The pooled prevalence of good sunlight exposure practice among mothers in Ethiopia was 45.38% with a 95% CI (38.36, 52.4). This wide confidence interval implies that there is greater variability among included studies and does not provide a precise representation. Thus, additional studies that report the burden of sunlight exposure practice with a large sample size are expected to estimate the actual sunlight exposure practice in Ethiopia.

Maternal knowledge, housewife, maternal educational status, and husband educational status were the factors that have an association with sunlight exposure practice in Ethiopia.



Fig. 8 The pooled odds ratio of for associations between formal education of the mothers and sunlight exposure practice in Ethiopia



Fig. 9 Forest plot shows the association between husband education and good sunlight exposure practice in Ethiopia

The prevalence of good sunlight exposure practice among mothers in this review ranged from 27.14% in Addis Ababa [14] to 67.27% in Wolkite, Ethiopia [15]. Given that most mothers in Addis Ababa lived in condominiums or apartments and may not have had place and/or time to expose their children to certain situations, it is possible that the weaker standard of practice faced there resulted from this; in other words, it might be due to the fact that the outdoor of the condominium is not adequate for sunning their child and/or not exposed to morning sunlight [14].

The prevalence of sunlight exposure practice among mothers towards their children in Ethiopia was 45.38% with a 95% CI (38.36, 52.4). It is higher than the study conducted in Australia, which was 20% [33]. Since skin cancer is more common in tropical regions of Australia, mothers may be afraid of getting it and choose not to expose their babies to sunlight. The Australian Cancer Prevention Society also advises against exposing infants to sunlight. This could be the reason why the study's percentage is higher than that of the Townsville, Australia study. It is lower than the 87.5% of women in research conducted in Sakarya who exposed their babies to sunshine. The reason for this discrepancy could be that moms in Sakarya, as opposed to Ethiopia, had more access to proper information on sunlight exposure practices [34]. More than three-fourths of the Ethiopian community resides in rural areas, and then they have less access to health information and health coverage. This is the reason why a higher burden of rickets occurs in Ethiopia, which is due to insufficient and lack of sunlight exposure [35].

The other reason could be found in the disparities in sociocultural factors, such as the degree of acceptable information regarding newborn sunlight exposure and the fear of disease, evil eyes, and witchcraft. In addition, mothers those have no information about sunlight exposure practice, such as sunning, weaken children's strength and lead to blindness [16, 20]. The most traditional perception, which has higher acceptance by mothers, is that exposing children outside or outdoor is a risk for evil eye and sunburn "Mich" [16, 21, 31].

The other might be that health care professionals counseling practice about health benefits and postnatal care utilization among mothers in Ethiopia is poor [36]. In addition to postnatal counseling services, antenatal care (ANC) counseling practice is also low in Ethiopia. The previous studies show this result [37–40]. Effective or radical change is required among services quality of antenatal and postnatal in giving information about essential new newborn care, including importance of sunshine exposure practice.

Mothers who have good knowledge were 1.61 times higher odds of practicing good sunlight exposure than mothers who have poor knowledge (AOR; 1.61, 95% CI 1.3, 1.98). This might be because it's critical for moms to acquire sufficient information on the benefits of sun exposure and other infant concerns in order to improve their awareness and behaviors with their child.

Mothers whose occupation was housewife were less practicing (by 30%) sunlight exposure of their child than their counterparts (AOR; 0.7, 95% CI 0.51, 0.95). In Ethiopia, the majority of housewives are not educated, and according to the 2016 Ethiopian Demographic and Health Survey report, only 4% of women completed secondary school or went beyond secondary school [41]. It might be that housewives may not use information in a more effective way when sunning their children, be less likely to seek medical attention, and less tends to seek appropriate health care [21, 42].

Mothers who had formal education were 1.35 times higher odds of practicing good sunlight exposure for their child as compared to mothers who had not formal education (AOR; 1.35, 95% CI 1.08, 1.69). Likewise, those mothers whose husbands have formal education were 1.29 times more likely to practice sunlight exposure than mothers whose husbands haven't formal education (AOR: 1.29, 95% CI 1.07, 1.56). It is known that children's health is determined by parents. The previous studies support this finding. Mother's education has a positive impact on their knowledge and practice in child health matters [43]. One explanation would be that educated families read and comprehend materials regarding newborn health and the benefits of vitamin D or sunlight exposure, use health services more frequently, and learn about rickets and human health through their academic and educational experiences. Additionally, educated fathers support their wives in identifying beneficial and hazardous habits for their children, which may have a positive impact on the mothers' practice of sun exposure.

This review will have implications for the minister of health and regional health bureau about improving children's health via sunlight exposure in Ethiopia. The minister of health should address the advantages and consequences of not sunning children via social media programs like "Tenawo Bebietew program" /ጤናዎ በቤትዎ ፕሮግራም/ (TV show that explores health and health-related topics with clinical experts), radio, and magazines to increase the practice of sunlight exposure among mothers. We would like to announce the regional health bureau in order to evaluate the existing counseling practice of health care professionals about maternal and child health at each level (ANC, PNC, Immunization, and under-five evaluation) and should provide both on-the-job and off-the-job training for health care professionals.

Strength and limitation of the study

The strength of this review is that it estimated the pooled prevalence as well as the determinants of sunlight exposure practice among mothers at the national level. This review has certain limitations. Firstly, the operational definition and the tools utilized to measure the outcome variable (practice of sunlight exposure) and independent variable (e.g., knowledge) were not similarly measured in the included studies. Secondly, all included studies in this review were cross-sectional; due to this, it couldn't estimate the cause-and-effect relationship among the dependent and independent variables. Thirdly, due to limited studies and inadequate information, pertinent variables (such as wealth index, previous experience status about sunlight exposure, media exposure status, etc.) about sunlight was not addressed, which may have associations to the outcome variable. The last but not the least is that, the search criteria might have missed out some potentially eligible studies.

Conclusion

This systematic review and meta-analysis address showed the practice of good sunlight exposure practices of the mothers towards their children in Ethiopia is not satisfactory. Maternal occupation, knowledge about sunlight exposure, maternal educational level, and husband education level were the factors that have associations with good sunlight exposure practice in Ethiopia. The government may initiate community-oriented awareness building creation and effective counseling programs or grater information circulation in the communities especially in the remote areas about sunlight exposure practice during ANC, postnatal, and vaccination time.

Abbreviations

 ANC
 Antenatal care

 AOR
 Adjusted odds ratio

 CI
 Confidence interval

 PNC
 Postnatal care

 PRISMA
 Preferred Reporting Items for Systematic Review and Meta-Analysis

Supplementary Information

The online version contains supplementary material available at https://doi. org/10.1186/s12978-024-01918-7.

Additional file 1. Additional file 2.

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Author contributions

SDA: Participated in the conceptualization, searching, and selection, data extraction and analysis, writing, editing and approving the manuscript. TH: Participated in the conceptualization, searching, and selection, writing, and approving the manuscript. AT: Participated in the conceptualization, searching, and selection, writing, and approving the manuscript. EN: Participated in the conceptualization, searching, and selection, data extraction and analysis, writing, editing and approving the manuscript.

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Availability of data and materials

Data is provided within the manuscript.

Declarations

Ethical approval and consent to participate

Not applicable

Consent for publication

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Competing interests

The authors declare no competing interests.

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