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Ethiopian residents' knowledge and attitude towards blood donation and its associated factors: systematic review and meta-analysis

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Abstract

Introduction Despite the existence of numerous blood donation centers globally, there remains a significant gap between the demand and supply of blood. In Ethiopia, replacement blood donation is more common than voluntary donation. The National Blood Bank of Ethiopia collects approximately 200,000 units of blood each year, while the daily requirement is 18,000 units. Donors' knowledge and attitudes are vital for ensuring a steady blood supply. This systematic review and meta-analysis sought to evaluate the knowledge and attitudes of Ethiopian residents regarding blood donation and the factors influencing them.

Methods Relevant research articles were identified through searches of various databases. Data extraction and organization were performed using Microsoft Excel, and the data were then analyzed using STATA/MP 17.0. A weighted inverse variance random-effects model with a 95% confidence interval was employed to pool the data. Heterogeneity was examined with the Galbraith plot and Cochrane I² statistics. To identify sources of heterogeneity, meta-regression, subgroup analysis, and sensitivity analysis were conducted. Publication bias was assessed using Egger's test and managed with trim and fill analysis. The adjusted odds ratio was calculated to explore the relationship between knowledge and attitudes towards blood donation, with a significance threshold of $p < 0.05$.

Results The pooled prevalence of favorable attitudes towards blood donation was 65.95%. Moderators such as study year ($p = 0.72$), publication year ($p = 0.877$), and sample size ($p = 0.291$) were not significant, indicating they did not contribute to heterogeneity. Studies from Northern Ethiopia reported the highest prevalence of favorable attitudes at 69.95%, while research on healthcare workers also indicated a high proportion of favorable attitudes at 69.29%. There was a significant association between knowledge and attitudes towards blood donation (AOR = 2.03).

Conclusion The pooled prevalence of favorable attitudes towards blood donation was 65.95%, with the highest levels observed in Northern Ethiopia and among healthcare workers. A significant association between knowledge and positive attitudes towards blood donation was found. To enhance attitudes towards blood donation, increasing public awareness and education about the importance and safety of donating blood is crucial.

Keywords Blood, Blood donation, Knowledge, Attitude, Systematic review, Meta-analysis, Ethiopia

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Introduction

Blood transfusion is very extremely important for certain populations, including pregnant women, anemic patients, trauma survivors, patients undergoing extensive surgery, and people receiving cancer therapy [1]. Globally, the unbalance between blood donors and their demand is a major global public health concern [2]. Even if frequent blood donation campaigns, there is a significant scarcity of blood exists to preserve the lives of millions [3]. To access a sufficient amount of blood, donors’ level of knowledge and attitude should be increased [4]. World Health Organization (WHO) encouraged blood donation to save the lives of patients. Especially, young people should donate blood because they constitute a significant proportion of the population and are relatively healthy, active, and self-motivated [1].

In the world, there are numerous blood donation centers. However, more than half of the blood was drawn from urban areas and high-income nations [5]. In the developed countries, most blood donors are voluntary and nonpaid. However, in low-income countries and rural residences, blood donors were donating only to their family members and friends [6]. In Ethiopia the percentage of volunteer blood donation ranges from 13 to 97% [7, 8] and replacement type of blood donation encompasses from 1.7 to 78% [8, 9]. A total of 4224 people donated blood and males constitute 98.7%. However, 98% of donors were replacement donors [10]. The National Blood Bank of Ethiopia collects nearly 200,000 units of donor blood each year, but the country requires 18,000 units of blood per day [11]. Globally, research has shown a positive correlation between favorable attitudes toward blood donation and the actual act of donating. Individuals who have positive attitudes are more likely to engage in regular blood donation compared to those with less favorable views. Positive attitudes and beliefs significantly influence the likelihood of individuals participating in blood donation programs [12].

Table 1 Searches on different databases to find articles done on Ethiopian residents’ knowledge and attitude towards blood donation and its associated factors

Databases	Searching terms	Number of studies
MEDLINE/ PubMed	“Attitude”OR “blood donation” AND “as- sociated factors” OR “determinant factors” OR “prevalence” AND “Ethiopia”	10,152
Google Scholar	“Attitude”OR “blood donation” AND “as- sociated factors” OR “determinant factors” OR “prevalence” AND “Ethiopia”	25,200
Other databases	“Attitude”OR “blood donation” AND “as- sociated factors” OR “determinant factors” OR “prevalence” AND “Ethiopia”	4
Total retrieved articles		35,356
Included studies		40

The level of knowledge and attitude toward blood donation plays a crucial role in getting adequate blood supply., and negative feelings about blood donation were more prevalent in low-income nations like Ethiopia [13]. In addition, low self-esteem, poor health status, and a lack of information had an impact on the level of attitude toward blood donation [14].

To ensure that blood supplies remain safe, sufficient, and sustainable nationwide, it is crucial to thoroughly investigate and address any potential barriers. Although there have been studies in Ethiopia on knowledge and attitudes toward blood donation, this systematic review and meta-analysis are vital for several reasons. Identifying both barriers and facilitators can enhance recruitment strategies, improve retention rates, inform policy and practice, meet public health needs, provide benchmarks track progress, and guide future research. Overall, this study aims to develop a comprehensive understanding of these factors, leading to more effective strategies for promoting blood donation and maintaining a stable blood supply. Therefore, this research is designed to explore Ethiopian residents’ knowledge and attitudes toward blood donation and their associated factors.

Method and materials
Reporting and registration protocol

A systematic review and meta-analysis were conducted to estimate the pooled prevalence of Ethiopian residents’ knowledge and attitude towards blood donation and its associated factors. The protocol for this manuscript was not registered in the PROSPERO database. The Preferred Reporting Items for Systematic Review and Meta-analysis (PRISMA) reporting guidelines are used in this systematic review and meta-analysis to report the findings (Table S1) [15].

Databases and search strategy
Several databases; PubMed/MEDLINE, HINARI, EMBASE, Scopus, Google Scholar, African Journals Online (AJOL), gray literature, and unpublished articles from the Ethiopian Universities repository were searched to find all the available articles. The authors searched the relevant articles conducted on Ethiopian residents’ knowledge and attitude towards blood donation and its associated factors from January 1st, 2010-June 30, 2024. The phrases “Attitude”, “blood donation”, “associated factors”, “determinant factors”, “prevalence”, and “Ethiopia” were used to search the available articles. The Boolean operators “AND” and “OR” were applied to connect the search terms (Table 1).

Screening and eligibility of the studies
All retrieved articles were exported into the “End-Note reference software version 8 (Thomson Reuters,

Stamford, CT, USA) citation manager” to sort, clean, and remove possible duplications. Two authors (AG and BTA) independently reviewed and evaluated each study based on its relevance, title, and abstracts using predetermined inclusion criteria. Then, all authors (AG, BTA, TA, MG, GY, MB, and AW) carefully determined the eligibility of each article. Both published and unpublished articles conducted on Ethiopian residents’ knowledge and attitude towards blood donation and its associated factors were included. All studies were measured using the Newcastle Ottawa Scale (NOS) assessment tool. Accordingly, those studies with an adequate sample size, a representative sample size, a minimal non-response rate, ascertainment of exposure, a correct statistical test, and a true assessment of outcome were included in the study. However, interventional studies, trials, systematic reviews and meta-analyses, narrative reviews, qualitative studies, articles without full text after twice emailing the correspondence author, case reports, and policy statements were excluded. Any disagreement that arose amongst the authors during the process was settled via conversation.

Outcome measurement of the study

This systematic review and meta-analysis had one main outcome, which is the attitude of Ethiopian residents. It is measured as a favorable attitude and an unfavorable attitude. Those study participants who scored mean and above on attitude questions were considered to have favorable attitudes whereas respondents who scored below the mean were considered to have unfavorable attitudes.

Quality assessment

Two authors separately extract the findings on the extraction sheet, and a third author verifies it, to ensure the study’s quality. The Newcastle Ottawa Scale (NOS) was utilized to evaluate the attributes of every study [16]. The main evaluation criteria used to determine the quality of the studies were the sample’s representativeness, the study’s methodological quality, the study’s comparability, the measurement of exposure or risks, the evaluation of the study’s outcome, and statistical testing. Studies that had a score of at least seven out of ten were deemed to be of excellent quality and were incorporated into the final analysis. Each author evaluated the studies on their own to determine which ones should be taken into account and included in the analysis.

Data processing and analysis

In this systematic review and meta-analysis, the data were pooled using a weighted inverse variance random-effects model at 95%CI to examine the overall pooled prevalence of Ethiopian residents’ knowledge and attitude towards

blood donation and its associated factors [17]. Microsoft Excel was used to extract and clean the data before being exported to STATA/MP 17.0 for analysis. The Cochrane Q test, the I^2 with its related p-value, and the Galbraith plot were used to evaluate the studies’ heterogeneity [18]. To detect the source of heterogeneity, meta-regression, subgroup analysis, and sensitivity analysis were carried out. Furthermore, a funnel plot and Egger’s test were used to assess the possibility of publication bias [19]. To manage publication bias, a trim and fill analysis was employed. A log odds ratio was employed to ascertain the association between the resident’s knowledge and attitude towards blood donation. Finally, a P-value less than 0.05 was deemed statistically significant.

Result

In this study, a total of 35,356 articles were gathered from various databases. Of these, 19,876 were discarded due to duplication. Additionally, 9,235 articles were excluded after evaluating their titles and abstracts. Another 12 articles were removed because the full text was inaccessible. Moreover, 6,193 articles were excluded for reasons such as irrelevance, lack of reported outcomes of interest, and failure to meet the inclusion criteria. Ultimately, 40 articles were included in the final analysis (Fig. 1).

Characteristics of the studies and study participants

In this study, 40 research articles with a total of 17,035 study participants conducted until June 2024 were included. Of these studies, 16 were carried out in the Central region of Ethiopia [3, 7, 20–33], 17 in Northern Ethiopia [11, 34–48], and seven were done in Southern Ethiopia [8, 49–54]. Of all articles, 14 were done among all adult populations, 4 in civil servants, 7 in health care workers, 6 in health science students, and 9 in all students other than health science students. Thirteen studies used a face-to-face interview whereas, 27 used self-administered questioners. All articles were cross-sectional in design and the sample size ranged from 15 to 845. The design of all articles is cross-sectional (Table 2).

Meta-analysis

Pooled prevalence of favorable attitude

The overall pooled prevalence of favorable attitudes toward blood donation among potential blood donors in Ethiopia was 65.95% (95% CI: 61.01–70.90) (Fig. 2).

Heterogeneity and publication bias

The asymmetrical distribution of the included articles was visible in the funnel plot, and Egger’s test revealed a statistically significant result ($p=0.006$), indicating the possibility of publication bias (Fig. 3A). To manage publication bias, a trim and fill analysis was done resulting in a bias-adjusted prevalence of favorable attitudes towards

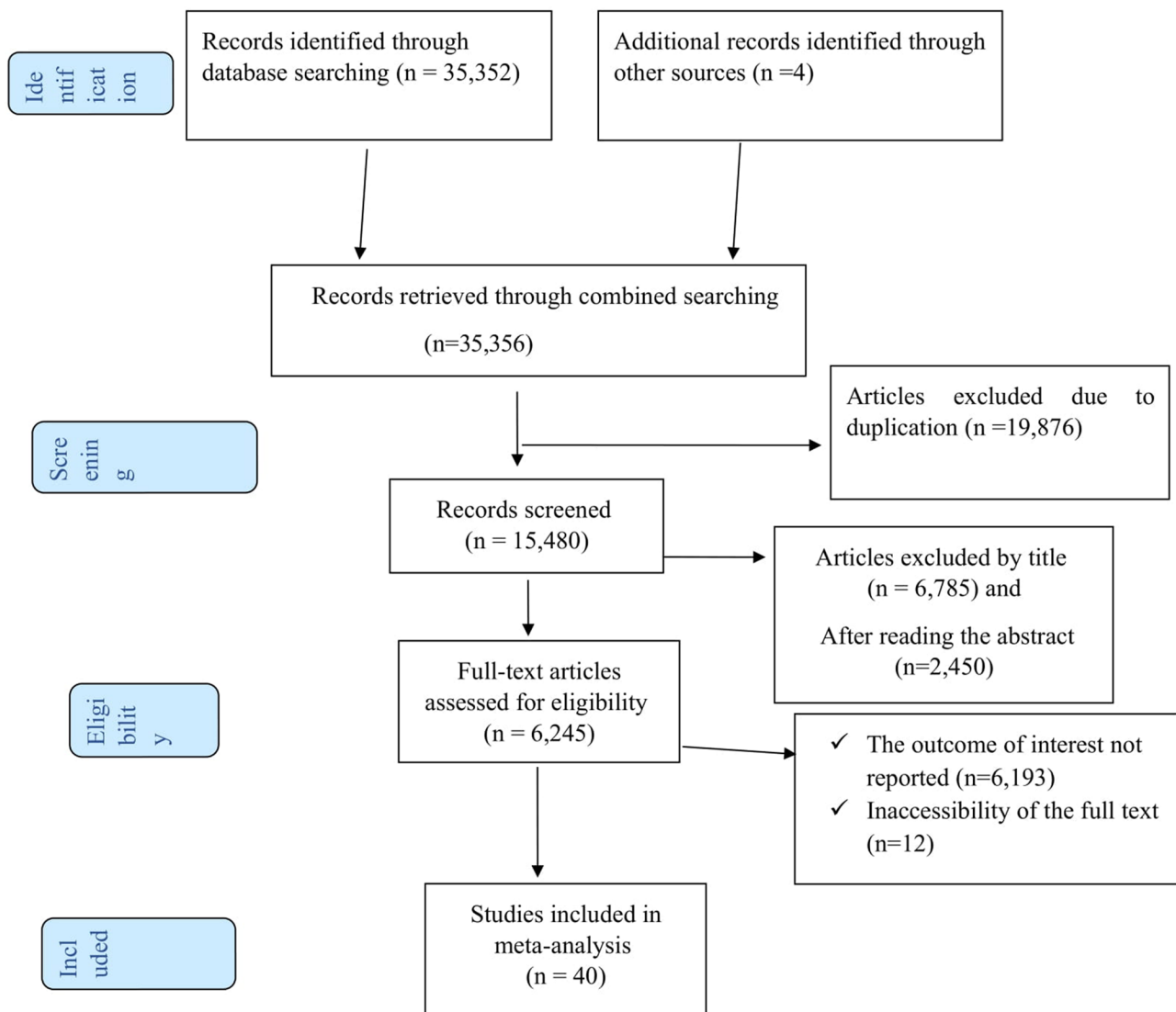


Fig. 1 Flow chart of selection for systematic review and meta-analysis on Ethiopian residents' knowledge and attitude towards blood donation and its associated factors

blood donation (Fig. 3B). Visual examination of the Galbraith plot reveals significant high heterogeneity among the included studies (I^2 98.29%, $p < 0.001$) (Fig. 4).

Measures to detect sources of heterogeneity

In this study, meta-regression, subgroup analysis, and sensitivity analysis were conducted to identify potential sources of heterogeneity. Meta-regression was performed considering the moderators: study year, publication year, and sample size. The results showed that the study year ($p = 0.72$), publication year ($p = 0.877$), and sample size ($p = 0.291$) were not significant, suggesting they were not sources of heterogeneity. Subgroup analysis was also conducted based on region, type of study population, and data collection method. Studies from Northern Ethiopia reported the highest favorable attitude at 69.95% (95%

CI: 62.13, 77.78). Research on healthcare workers also showed a high proportion of favorable attitudes towards blood donation at 69.29% (95% CI: 60.02, 77.65). Additionally, studies using self-administered questionnaires had a higher prevalence of favorable attitudes compared to those using face-to-face interviews (Table 3). Sensitivity analysis was performed using a leave-one-out approach with the random-effects model, revealing that all estimates fell within the overall 95% confidence interval (61.01–70.90), indicating no influential study.

Knowledge and general feeling of residents towards blood donation

In Ethiopia, 50.66% (95% CI 27.45–73.02) of residents did not know their blood group. Of all residents, 64.51% (95% CI 54.08–74.95) understand that voluntary blood

Table 2 (continued)

Author	Study area	sample size	Favorable attitude (%)	Best blood donation type (%)			Willingness (%)			General feeling (%)		
				Volunteer	Replacement	Paid	Don't know	Yes	No	Good	Bad	Neutral
Idris E et al., [33]	Central	518	60.4	86.9	68.0			85.52	14.5	94.4	5.6	
Tebabal et al., [11]	Northern	123	87.8	69.9	78.0	38.8		82.93	17.1	95.9	4.1	
Tsega A et al., [48]	Northern	198	74.7									

donation is the best type of blood donation practice. However, 27.96% (95% CI 15.97–39.94) think that a replacement type of blood donation is necessary. Furthermore, 10.17% (95% CI 4.18–16.16) of participants believe that blood donation must be paid. Amongst the study participants, 41.53% (95% CI 31.03–52.03) think that risk will happen following blood donation. More than three-fourths: 75.91% (95% CI 69.48–82.34) of participants were willing to donate in the future and 78.06% (95% CI 68.48–87.64) motivates others to donate blood. However, 4.34% (95% CI 2.69–5.98) of residents had bad feelings about blood donation.

Factors associated with attitude towards blood donation in Ethiopia

The level of knowledge and attitude toward blood donation were significantly associated. Thus, study participants who had good knowledge about blood donation were 2.03 times more likely to have a favorable attitude towards blood donation than their counterparts (AOR=2.03; 95% CI: 1.87–2.20) (Fig. 5).

Discussion

The overall pooled prevalence of favorable attitudes toward blood donation among potential blood donors in Ethiopia was 65.95% (95% CI: 61.01–70.90). This is lower than studies from the Kingdom of Saudi Arabia (99%) [55], Nigeria (81.6%) [56], Iran (98%) [57], and Saudi Arabia (78.6%) [58]. This disparity may arise from the different contexts in which the studies were conducted. The current research is being undertaken in a low-income country where many participants have limited access to media and other information sources about blood donation. In contrast, previous studies have focused on a range of motivational factors and were conducted among healthcare professionals and urban residents who likely have greater access to information and resources. In low-income countries, the restricted availability of healthcare and educational resources can significantly influence awareness and attitudes towards blood donation. Cultural norms and beliefs regarding blood donation can also vary considerably, affecting individuals’ willingness to participate. Moreover, the presence and effectiveness of blood donation programs and facilities play a crucial role in shaping donation rates. Inadequate infrastructure and less effective programs in low-income settings may further hinder blood donation efforts, contributing to the observed disparities [59].

The research conducted in Northern Ethiopia showed the most positive attitude toward blood donation, with a notably high percentage of favorable responses. This discrepancy can be attributed to a range of factors, including cultural, socioeconomic, educational, and infrastructural differences. In Northern Ethiopia, there

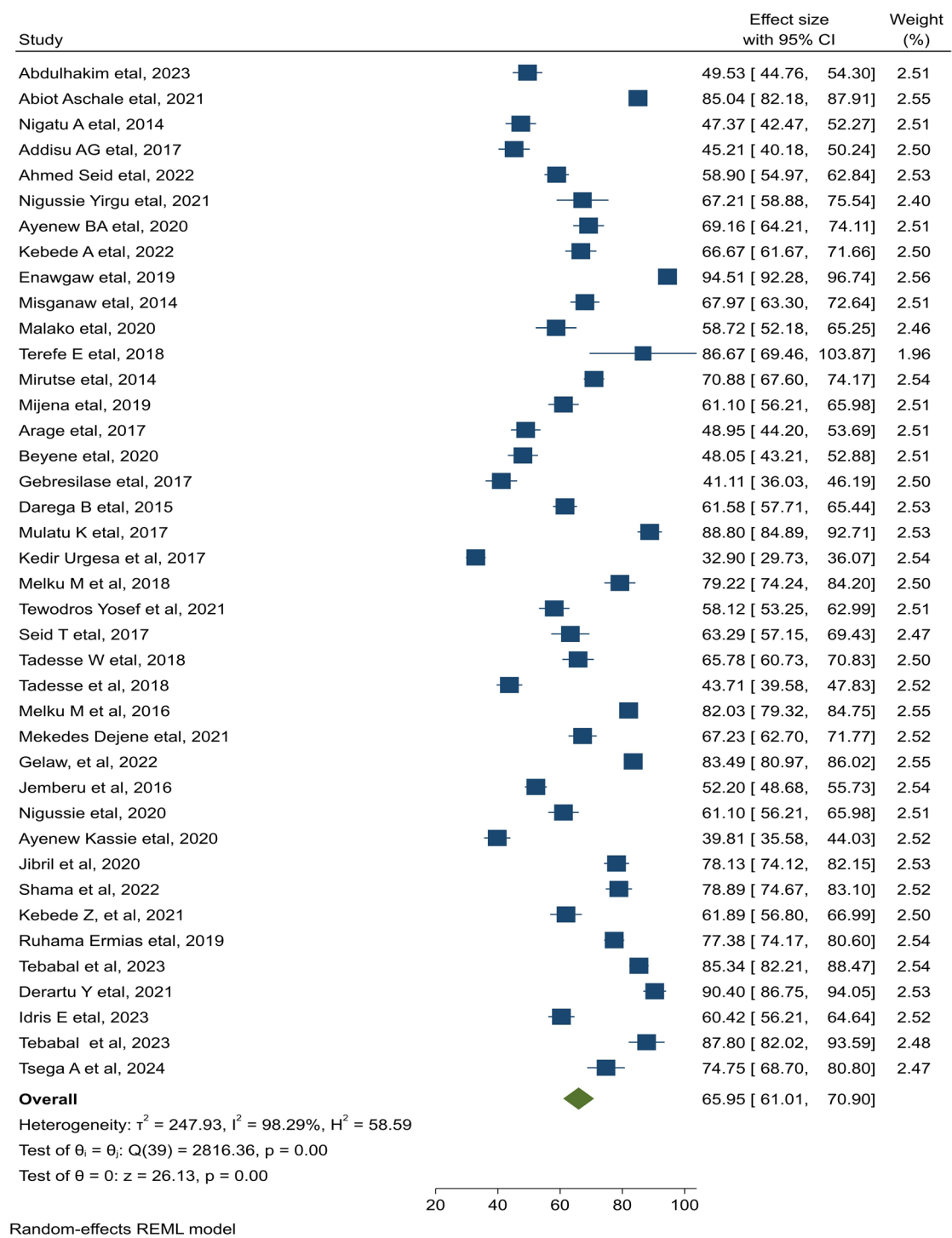


Fig. 2 Frost plot on the pooled prevalence of favorable attitudes toward blood donation among potential blood donors in Ethiopia

may be greater access to educational opportunities, which could enhance awareness about blood donation and foster a more positive attitude towards it. Improved educational resources in this region might lead to better understanding and knowledge about the importance of blood donation, thereby increasing willingness to participate. Additionally, other factors such as cultural

attitudes, socioeconomic conditions, and the availability of infrastructure supporting blood donation efforts may also play significant roles in shaping these attitudes. Research involving healthcare workers also indicated a high level of positive attitudes toward blood donation, with a substantial majority expressing favorable views. Healthcare providers possess a heightened awareness of

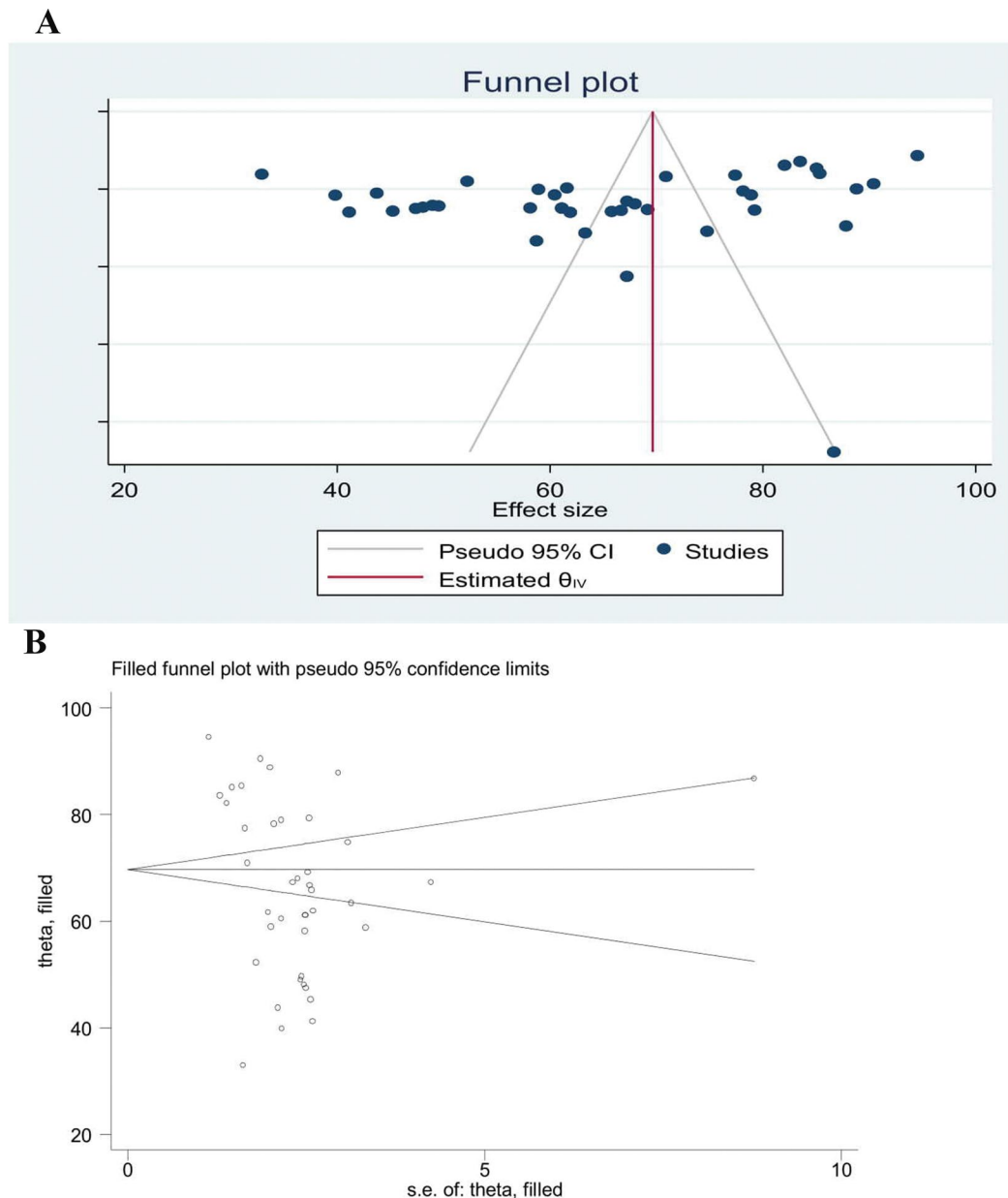


Fig. 3 **A** Funnel plot with 95% confidence limits on Ethiopian residents' knowledge and attitude towards blood donation and its associated factors. **B:** Filled funnel plot with pseudo 95% confidence limits on Ethiopian residents' knowledge and attitude towards blood donation and its associated factors

the crucial role blood plays in a wide range of medical procedures and emergencies. They recognize that blood transfusions are vital for saving lives, whether in critical surgeries, trauma care, or managing chronic conditions. This understanding underscores their professional and ethical dedication to patient care, which naturally leads to a supportive and proactive stance toward blood donation. Their commitment extends beyond clinical responsibilities; it encompasses a broader recognition of the importance of maintaining a stable and adequate blood supply. Consequently, healthcare professionals are often motivated to advocate for and participate in blood donation

initiatives, driven by their commitment to improving patient outcomes and ensuring that life-saving resources are readily available [60].

In Ethiopia, a significant portion of the population is unaware of their blood type. This issue is particularly pronounced in rural areas, where access to healthcare services is often limited. In many regions, there is a general lack of awareness about the critical importance of knowing one's blood type. This lack of awareness can lead to fewer opportunities for individuals to undergo blood testing, as there may be insufficient resources or information available to encourage such practices. The limited

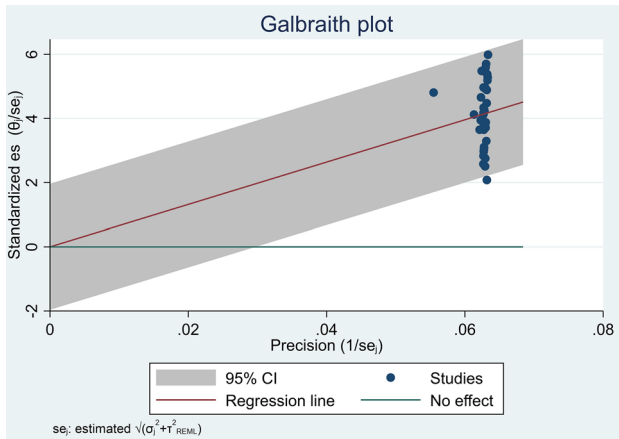


Fig. 4 Galbraith plot on Ethiopian residents’ knowledge and attitude towards blood donation and its associated factors

Table 3 Sub-group analysis on the pooled prevalence of favorable attitude towards blood donation among potential blood donors in Ethiopia

Valuables	Classifications	Studies	Prevalence (95%CI)	I ² (%)	P-value
Region	Northern Ethiopia	16	69.95 (62.13,77.78)	98.55	<0.001
	Southern Ethiopia	7	66.96 (53.21,80.71)	98.58	<0.001
	Central Ethiopia	17	61.30 (54.44,68.16)	97.52	<0.001
Study population	Health care workers	7	69.29 (60.02,77.65)	97.07	<0.001
	All students other than health science students	9	62.25 (53.06,73.45)	99.26	<0.001
	All adult population	14	64.82 (54.40,75.23)	99.17	<0.001
	Civil servants	4	60.77 (58.29,63.24)	96.22	<0.001
	Health science students	6	68.35 (53.94,82.76)	98.64	<0.001
Method of data collection	Face to face interview	13	64.06 (52.93,75.19)	99.26	<0.001
	Self-administered	24	66.83 (61.72,71.94)	97.04	<0.001

healthcare infrastructure and educational outreach contribute to the challenge, making it difficult for many residents to obtain this basic yet vital information [61]. A significant portion of residents believe that replacement-type blood donation is crucial, which could be attributed to a lack of widespread public awareness about the importance of regular blood donations. Many people might not fully grasp the necessity of consistent blood donation unless they or someone close to them is directly impacted by a medical emergency. In some cultural contexts, blood donation may be perceived as essential only when a family member or friend requires it. Additionally,

a small fraction of residents express negative sentiments toward blood donation, likely stemming from insufficient understanding of its benefits and critical role in healthcare [62].

Residents’ understanding of blood donation significantly influences their attitudes toward it. Those with a higher level of knowledge about blood donation are considerably more likely to hold a positive view of the practice. This increased awareness stems from a deeper recognition of the essential role blood plays in medical treatments and emergencies. Knowledgeable individuals appreciate that donating blood is a critical, life-saving act that supports the health and recovery of others. They are also more informed about the safety procedures and standards associated with blood donation, which further reinforces their positive attitude. This comprehensive understanding helps to demystify the donation process and instills confidence, making these individuals more inclined to view blood donation favorably and participate in it [63].

Strengths and limitations of the study

The study demonstrated several notable strengths, such as an extensive literature review concentrating on a particular population and health condition. It employed rigorous statistical methods for analyzing pooled data, including detailed meta-regression and subgroup analyses to uncover sources of variability. Additionally, the study addressed potential publication bias through trim and fill analysis. Nevertheless, the study also encountered certain limitations. One significant issue was the considerable variability among the included studies, which might impact the reliability of the combined results. The relatively small number of studies conducted within Ethiopia also limits the generalizability of the findings to other contexts. Moreover, the absence of a registered protocol in PROSPERO, a common practice for systematic reviews, was another drawback.

Conclusion

Approximately one-third of the participants exhibited a negative attitude toward blood donation, and there were notable regional differences in both knowledge and attitudes regarding blood donation. Additionally, the attitudes toward blood donation varied considerably within the study population. The level of knowledge possessed by residents was found to be a strong determinant of their attitude toward blood donation, indicating that a higher understanding of the importance and process of blood donation often correlated with a more positive attitude. This underscores the importance of enhancing educational efforts to improve attitudes and potentially increase participation in blood donation initiatives. Therefore, a multifaceted approach is essential.

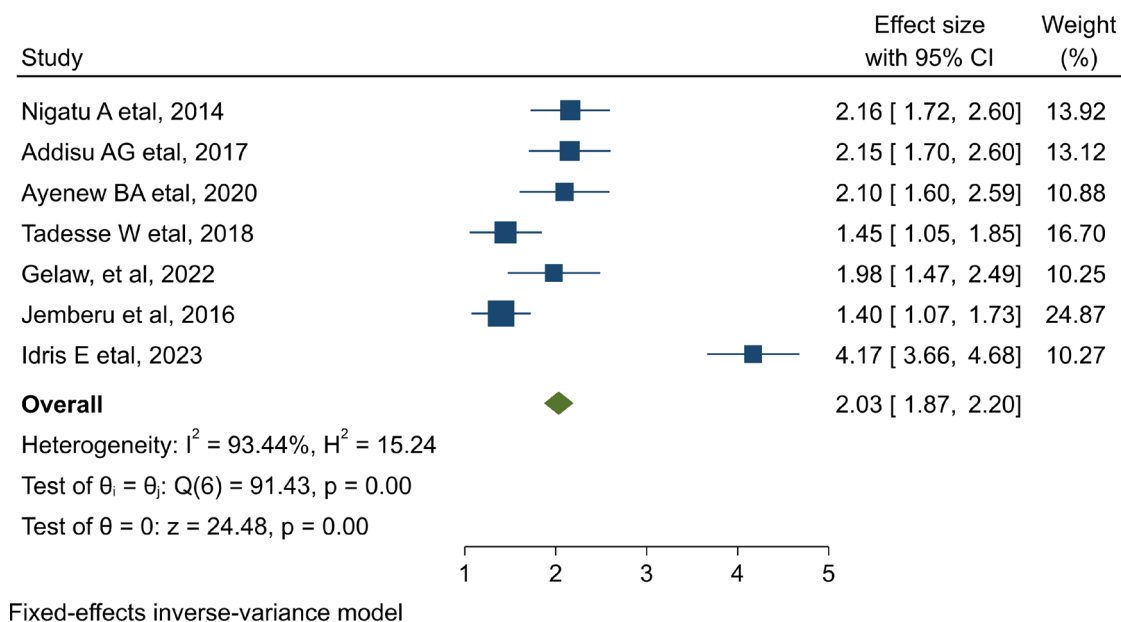


Fig. 5 The overall pooled odds ratio of the association between level of knowledge and level of attitude towards blood donation among potential blood donors in Ethiopia

Increasing public awareness through targeted educational campaigns can help dispel myths and highlight the critical importance of blood donation in saving lives. Implementing community outreach programs and engaging with local influencers or healthcare professionals can foster trust and encourage positive attitudes. Additionally, making the donation process more accessible and convenient, coupled with personalized donor experiences and recognition, can improve participation rates. Strengthening partnerships between healthcare institutions and educational organizations can also facilitate better understanding and positive perceptions among younger populations. Finally, addressing and overcoming regional and cultural barriers through tailored interventions can ensure a more inclusive and effective approach to promoting blood donation.

Abbreviations

AOR	Adjusted Odds Ratio
AJO	African Journals Online
CI	Confidence Interval
NOS	Newcastle Ottawa Scale
PRISMA	Preferred Reporting Items for Systematic Review and Meta-analysis
WHO	World Health Organization

Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1186/s12889-024-20679-3>.

Supplementary Material 1: Table S1 Preferred Reporting Items for Systematic Review and Meta-analysis (PRISMA) guideline for reporting the findings is used and found as a supplementary file

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Author contributions

Three authors (AG, MB, and AW) designed the study, designed and run the literature search. All (AG, BTA, TA, MG, GY, AW, and MB) authors acquired data, screened records, extracted data, and assessed the risk of bias. AG did the statistical analyses and wrote the report. All authors provided critical conceptual input, analyzed and interpreted the data, and critically revised the report. All authors read and approved the final manuscript.

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Data availability

All related data have been presented within the manuscript. The dataset supporting the conclusions of this article is available from the authors on request.

Declarations

Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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References

1. Organization WH. Towards 100% voluntary blood donation: a global framework for action. 2010.
2. Griffin D, Grace D, O'Cass A. Blood donation: comparing individual characteristics, attitudes, and feelings of donors and nondonors. *Health Mark Q*. 2014;31(3):197–212.

3. Mohammed AS, Yassin A, Aliyi AA. Voluntary blood donation practice and its associated factors among civil servants in Bale Robe town, Southeast Ethiopia, 2021. *SAGE Open Med*. 2022;10:20503121221102099.
4. Karacan E, Seval GC, Aktan Z, Ayli M, Palabiyikoglu R. Blood donors and factors impacting the blood donation decision: motives for donating blood in Turkish sample. *Transfus Apheres Sci*. 2013;49(3):468–73.
5. Roberts N, James S, Delaney M, Fitzmaurice C. The global need and availability of blood products: a modeling study. *Lancet Haematol*. 2019;6(12):e606–15.
6. Salaudeen A, Odeh E. Knowledge and behavior towards voluntary blood donation among students of a tertiary institution in Nigeria. *Niger J Clin Pract*. 2011;14(3):303–7.
7. Darega B, Dida N, Tesfaye T, Lencha B. Voluntary blood donation practices and associated factors among regular undergraduate Madawalabu University Students, Southeast Ethiopia: a facility-based cross-sectional study. *J Blood Disord Transfus S*. 2015;5:55–005.
8. Mussema A, Bawore SG, Abebaw T, Tadesse W, Belayneh M, Yirga A, et al. Voluntary blood donation knowledge, attitude, and practice among adult populations of Hosanna Town, South Ethiopia: a community-based cross-sectional study. *Front Public Health*. 2023;11:1141544.
9. Melku M, Terefe B, Asrie F, Enawgaw B, Melak T, Tsegay YG, et al. Knowledge, attitude, and practice of adult population towards blood donation in Gondar Town, Northwest Ethiopia: a community-based cross-sectional study. *J Blood Transfus*. 2016;2016(1):7949862.
10. Mohammed Y, Bekele A. Seroprevalence of transfusion-transmitted infection among blood donors at Jijiga blood bank, Eastern Ethiopia: retrospective 4 years study. *BMC Res Notes*. 2016;9:1–6.
11. Tebabal B, Anagaw TF, Adamu A, Atnafu DD. Factors influencing blood donation practice among health care providers of public hospitals in Bahir Dar City, North West Ethiopia: a case control study. *J Blood Med*. 2023;14:487–98. <https://doi.org/10.2147/JBM.S423013>.
12. Akinmoladun FI, Akinmoladun AI, Akinmoladun JA. Attitudes towards voluntary blood donation among Nigerian students. *J Blood Med*. 2019;10:227–33.
13. Huis in, de Kort WL, Merz EM. Determinants of blood donation willingness in the European Union: a cross-country perspective on perceived transfusion safety, concerns, and incentives. *Transfusion*. 2019;59(4):1273–82.
14. Ou-Yang J, Bei CH, He B, Rong X. Factors influencing blood donation: a cross-sectional survey in Guangzhou, China. *Transfus Med*. 2017;27(4):256–67.
15. Moher D, Liberati A, Tetzlaff J, Altman DG, Group* P. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *Ann Intern Med*. 2009;151(4):264–9.
16. Peterson J, Welch V, Losos M, Tugwell P. The Newcastle-Ottawa scale (NOS) for assessing the quality of nonrandomized studies in meta-analyses. Ottawa: Ottawa Hospital Research Institute. 2011;2(1):1–12.
17. Borenstein M, Hedges LV, Higgins JP, Rothstein HR. A basic introduction to fixed-effect and random-effects models for meta-analysis. *Res Synthesis Methods*. 2010;1(2):97–111.
18. Rücker G, Schwarzer G, Carpenter JR, Schumacher M. Undue reliance on I² in assessing heterogeneity may mislead. *BMC Med Res Methodol*. 2008;8:1–9.
19. Egger M, Smith GD, Schneider M, Minder C. Bias in meta-analysis detected by a simple, graphical test. *BMJ*. 1997;315(7109):629–34.
20. Urgesa K, Hassen N, Seyoum A. Knowledge, attitude, and practice regarding voluntary blood donation among adult residents of Harar town, Eastern Ethiopia: a community-based study. *J Blood Med*. 2017;8:13–20. <https://doi.org/10.2147/JBM.S121460>.
21. Beyene GA. Voluntary blood donation knowledge, attitudes, and practices in Central Ethiopia. *Int J Gen Med*. 2020;13:67–76. <https://doi.org/10.2147/IJGM.S246138>.
22. Mijena GF, Nigussie S, Gobena T, Mitiku H, Abdi H. Voluntary Blood Donation Practice and Associated factors among civil servants in Chiro Town of Western Hararghe Zone. Eastern Ethiopia: A Cross-Sectional Study; 2019.
23. Misganaw C, Tenkir M, Deresa A, Tesfaye M, Tessema TT, Taye H. The level and associated factors of knowledge, attitude, and practice of blood donation among health science students of Addis Ababa University. *IJMHSR*. 2014;1(10):105–18.
24. Anleye BA, Adulla MA. Knowledge, attitude, practices, and factors associated with voluntary blood donation among graduating class students of Assosa University, Benishangul Gumuz, Ethiopia, 2018. *Int J Intern Emerg Med*. 2020;3(1):1025.
25. Nigussie Yirgu A, Hussien Mohammed K, Degno Diriba S, Kumbi Babso A, Abdo AA. Blood donation and associated factors among employees working at Negele Arsi General Hospital and Medical College, Southeast Ethiopia: a cross-sectional study. *J Blood Med*. 2021;12:475–82. <https://doi.org/10.2147/JBM.S301826>.
26. Nigatu A, Demissie D. Knowledge, attitude and practice on voluntary blood donation and associated factors among Ambo University Regular Students, Ambo Town, Ethiopia. *J Community Med Health Educ*. 2014;4(5):6.
27. Aschale A, Fufa D, Kekeba T, Birhanu Z. Intention to voluntary blood donation among private higher education students, Jimma town, Oromia, Ethiopia: application of the theory of planned behavior. *PLoS ONE*. 2021;16(3):e0247040.
28. Gebresilase HW, Fite RO, Abeya SG. Knowledge, attitude, and practice of students towards blood donation in Arsi University and Adama Science and Technology University: a comparative cross-sectional study. *BMC Hematol*. 2017;17(1):1–10.
29. Nigussie S, Gobena T, Mitiku H, Abdi H, Fekadu G, Fage SG. Blood donation practice and its associated factors among civil servants in Chiro town, Western Hararghe, Oromia Region, Ethiopia. *East Afr J Health Biomedical Sci*. 2020;4(2):5–14.
30. Jibril AD, Mohammed A, Hashi A, Omer M, Shegere MM, Joseph NM, et al. Knowledge, attitude, practice and associated factors of adult population towards blood donation in Jijiga Town, Somali Region, Ethiopia. *J Drug Delivery Ther*. 2020;10(6):149–65.
31. Shama AT, Teka G, Yohannes Lemu S, Tesfaye B, Ebisa H, Gebre DS, et al. Assessment of blood donation practice and its associated factors among Wollega University undergraduate students, Ethiopia. *J Blood Med*. 2022;13:711–24. <https://doi.org/10.2147/JBM.S385348>.
32. Kebede Z, Tiruneh M, Michael Beyene K. Blood donation practice and Associated Factors among College students in Kolfe Keraniyo Sub City, Addis Ababa, Ethiopia. *J Blood Disord Transfus*. 2021;12:476.
33. Idris E, Yadeta E, Debella A, Tamiru D, Atnafe G, Arkew M, et al. Blood donation practice and its predictors among undergraduate college students in Harari Regional State, Eastern Ethiopia. *SAGE Open Med*. 2023;11:20503121231159344.
34. Kebede AA, Bitew Y, Birku T, Member Z, Achenef W, Tibebe NS, et al. Willingness to donate blood and associated factors among patient caregivers at the University of Gondar Comprehensive Specialized Hospital, northwest Ethiopia. *Clin Epidemiol Global Health*. 2022;13:100953.
35. Enawgaw B, Yalew A, Shiferaw E. Blood donors' knowledge and attitude towards blood donation at North Gondar district blood bank, Northwest Ethiopia: a cross-sectional study. *BMC Res Notes*. 2019;12(1):1–6.
36. Terefe E. Attitudes of students towards blood donation at the University of Gondar. *Art Hum Open Acc J*. 2018;2(6):440–5.
37. Mirutse G, Fisseha G, Abebe L, Birhanu Z, Alemayehu M. Intention to donate blood among the eligible population in Mekelle City, Northern Ethiopia: using the theory of planned behavior. *Am J Health Res*. 2014;2(4):158–63.
38. Arage G, Ibrahim S, Adimasu E. Blood donation practice and its associated factors among health professionals of University of Gondar Hospital, Northwest Ethiopia: a cross-sectional study. *BMC Res Notes*. 2017;10(1):1–6.
39. Melku M, Asrie F, Shiferaw E, Woldu B, Yihunew Y, Asmelash D et al. Knowledge, attitude, and practice regarding blood donation among graduating undergraduate health science students at the University of Gondar, Northwest Ethiopia. *Ethiop J Health Sci*. 2018;28(5).
40. Seid T, Dimtsu B, Zemene A, Arage G, Mossisa M, Muche T. Voluntary blood donation practice and its associated factors among health care providers, at Axum town public health facilities Northern Ethiopia: a cross-sectional study. *Curr Res Complement Altern Med*. 2017;100007.
41. Tadesse W, Ayalew Y, Yisma E, Liben ML, Wudu M. Knowledge, attitude, practice and associated factors towards voluntary blood donation among regular health science students of Samara University, Ethiopia. *Health Sci J*. 2018;12(1).
42. Tadesse T, Berhane T, Abraha TH, Gidey B, Hagos E, Grum T, et al. Blood donation practice and associated factors among health professionals in Tigray regional state public hospitals, northern Ethiopia. *BMC Res Notes*. 2018;11(1):1–6.
43. Melku M, Terefe B, Asrie F, Enawgaw B, Melak T, Tsegay YG et al. Knowledge, attitude, and practice of adult population towards blood donation in Gondar Town, Northwest Ethiopia: a community-based cross-sectional study. *Journal of blood transfusion*. 2016;2016.
44. Gelaw Y, Zayede A, Wudie A, Aklilu A, Dawit R, Mekuria A, Getawa S. Knowledge, attitude, and practice toward blood donation and transfusion and associated factors among the adult population of Gondar town. *Asian J Transfus Sci*. 2022 https://doi.org/10.4103/ajts.ajts_190_21.

45. Dejene M, Tefera A, Dires A, Gedamu S, Getachew Y, Ademe S. Low blood donation practice of health sciences college students in Northeast Ethiopia: a cross-sectional study. *J Blood Med*. 2021;12:43–51. <https://doi.org/10.2147/JBM.S287398>.
46. Jemberu YA, Esmal A, Ahmed KY. Knowledge, attitude, and practice towards blood donation and associated factors among adults in Debre Markos town, Northwest Ethiopia. *BMC Hematol*. 2016;16:1–8.
47. Kassie A, Birara S. Retracted article: Practice of blood donation and associated factors among adults of Gondar City, Northwest Ethiopia: Bayesian analysis approach. *J Blood Med*. 2020:525–32. <https://doi.org/10.2147/JBM.S283991>.
48. Tsega A, Mullualem D, Tadesse BA. Assessment of Knowledge, attitude, practice, and Associated factors of Voluntary Blood Donation in selected towns of Awi Zone, Injibara, Ethiopia. *Biomed Res Int*. 2024;2024(1):6069684.
49. Addisu A, Sultan H, Deginet T, Addishiwot Z, Samuel T, Bereket A, et al. Assessment of knowledge, attitude, and practice of voluntary blood donation and associated factors among residents of Birbir town. *J Community Med Health Educ*. 2017;7(1):504.
50. Malako D, Yoseph F, Bekele ML. Assessment of knowledge, attitude, and practice and associated factors of blood donation among health care workers in Ethiopia: a cross-sectional study. *BMC Hematol*. 2019;19(1):1–8.
51. Mulatu K, Hailu T, Yegezu A, Tena B. Assessment of knowledge, attitude and practice on blood donation in Aman Sub City Residents, South West, Ethiopia, 2015. *Health Sci J*. 2017;11(1):485.
52. Yosef T, Wondimu W, Tesfaye M, Tesfaw A. Knowledge and attitude towards blood donation among college students in Southwest Ethiopia. *Pan Afr Med J*. 2021;38(1).
53. Ermias R. Blood donation practice and associated factors among Wachemo University students, Southern Ethiopia. 2019.
54. Yonas D. Blood donation practice and its associated factors among health Professionals in Hawassa University Comprehensive Specialized Hospital. HU; 2021.
55. Gader AGMA, Osman AMA, Al Gahtani FH, Farghali MN, Ramadan AH, Al-Momen AKM. Attitude to blood donation in Saudi Arabia. *Asian J Transfus Sci*. 2011;5(2):121.
56. Nwogoh B, Aigberadion U, Nwannadi AI. Knowledge, attitude, and practice of voluntary blood donation among healthcare workers at the University of Benin Teaching Hospital, Benin City, Nigeria. *Journal of blood transfusion*. 2013;2013.
57. Javazadeh Shahshahani H, Yavari M, Attar M, Ahmadiyeh M. Knowledge, attitude and practice study about blood donation in the urban population of Yazd, Iran, 2004. *Transfus Med*. 2006;16(6):403–9.
58. Alfouzan N. Knowledge, attitudes, and motivations towards blood donation among King Abdulaziz Medical City population. *International journal of family medicine*. 2014;2014.
59. Elteuacy NK, Ali HT, Owais TA, Alkanj S, Ebada MA. Unveiling blood donation knowledge, attitude, and practices among 12,606 university students: a cross-sectional study across 16 countries. *Sci Rep*. 2024;14(1):8219.
60. Chauhan R, Kumar R, Thakur S. A study to assess the knowledge, attitude, and practices about blood donation among medical students of a medical college in North India. *J Family Med Prim care*. 2018;7(4):693–7.
61. Ciepiela O, Jaworska A, Łacheta D, Falkowska N, Popko K, Demkow U. Awareness of blood group and blood donation among medical students. *Transfus Apheres Sci*. 2017;56(6):858–64.
62. Ferguson E, Farrell K, Lawrence C. Blood donation is an act of benevolence rather than altruism. *Health Psychol*. 2008;27(3):327.
63. Hossain MS, Siam MHB, Hasan MN, Jahan R, Siddiquee MH. Knowledge, attitude, and practice towards blood donation among residential students and teachers of religious institutions in Bangladesh—A cross-sectional study. *Heliyon*. 2022;8(10).

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