Journal of Nutrition and Health Sciences
Volume 13 | Issue 2
ISSN: 2393-9060

Review Article Open Access

Knowledge and Associated Factors of Iodized Salt Utilization among Households in Ethiopia: Systematic Review and Meta-Analysis

Habtamu Bekele Beriso[1,*], Habtamu Hurisa Dadi[1], Besufikad Yilma[1], Yonas Nega[1], Belete Birhan[1], Tadele Damena[2], Yabibal Asfaw[3], Belay Melkam[4], Getachew Nigussie[1] and Workneh Elias[1]

[1]School of Nursing, College of Health Sciences and Medicine, Wolaita Sodo University, Wolaita Sodo, Ethiopia
[2]School of Nursing, College of Medicine and Health Sciences, Jinka University, Jinka, Ethiopia
[3]Department of Surgical Nursing, School of Nursing, College of Medicine and Health Science, Woldia University, Woldia, Ethiopia
[4]School of Midwifery, College of Health Sciences and Medicine, Wolaita Sodo University, Wolaita Sodo, Ethiopia

[*]**Corresponding Author:** Habtamu Bekele Beriso, School of Nursing, College of Health Sciences and Medicine, Wolaita Sodo University, Wolaita Sodo, Ethiopia, E-mail: habtamubekele2021@gmail.com

Citation: Habtamu Bekele Beriso, Habtamu Hurisa Dadi, Besufikad Yilma, Yonas Nega, Belete Birhan, et al. (2026) Knowledge and Associated Factors of Iodized Salt Utilization among Households in Ethiopia: Systematic Review and Meta-Analysis, J Nutr Health Sci 13(2): 201

Received Date: March 27, 2026 **Accepted Date:** April 14, 2026 **Published Date:** April 17, 2026

Abstract

Background: Insufficient iodine intake can lead to iodine deficiency, which is associated with thyroid gland dysfunction and a group of abnormalities known as Iodine Deficiency Disorders. Although studies are available on household knowledge and use of iodized salt, the results are inconsistence and with review questions What is the aggregate level of knowledge among Ethiopian Households regarding iodized salt utilization?

Objective: To determine the pooled level of knowledge and associated factors of iodized salt utilization among households in Ethiopia.

Methods: The current systematic review searched using the electronic databases Science Direct, Medline, African Journals Online (AJOL), Medical Database, Scopus, PubMed and Google Scholar were searched. The DerSimonian and Laird method for randomized control models was used to estimate the pooled prevalence with 95% confidence interval in STATA V.14.2. Forest plots and funnel plots were used to test for publication bias and study heterogeneity, respectively. We also conducted a leave-one-out sensitivity analysis.

Results: This systematic review and meta-analysis included a total of 11 studies involving 4833 participants. The estimated pooled prevalence of knowledge on household iodized salt use in Ethiopia was 59.14% (95% CI: 48.51, 69.77, I^2 = 98.5%, P ≤ 0.001). Occupation (AOR = 2.63; 95% CI: 1.17, 5.92) was the only significantly associated variable with knowledge level on

iodized salt utilization among Ethiopian households.

Conclusions: Households' knowledge of iodized salt is low, so it is essential to implement strategies and policies to promote the use of iodized salt

Keywords: Iodized Salt; Thyroid Hormones; Iodine Deficiency Disorders; Nursing; Ethiopian Households

Abbreviations: ICCIDD: International Council for Control of Iodine Deficiency Disorders; IGN: Iodine Global Network; PRISMA-P: Preferred Reporting Items for Systematic reviews and Meta-Analysis protocols; SAC: School-age children; STROBE: Strengthening the Reporting of Observational Studies in Epidemiology; WHO: World Health Organization

Introduction

Iodine is a trace element that is essential for the production and synthesis of thyroid hormones [1]. Iodine must be obtained through the diet because the body cannot produce it; it is naturally found in soil and seawater and present in various foods [2, 3]. Insufficient iodine intake can lead to iodine deficiency, which is associated with thyroid gland dysfunction and a group of abnormalities known as Iodine Deficiency Disorders (IDDs) [4, 5]. One common manifestation of IDD is goiter, which is characterized by an abnormal enlargement of the thyroid gland in response to low dietary iodine intake [6].

Foods such as fish, seafood, seaweed, certain drinking water sources, cow's milk and vegetables grown in soil rich in iodine may contain it naturally [7, 8]. In addition, iodine can be obtained by using iodized salt, which is salt enriched with iodized iron. Iodine deficiency may have a significant impact on different tissues, leading to a condition called mydriasis [9, 10]. The World Health Organization (WHO) has recommended daily iodine intake levels for various age groups, such as 150 mg per day in adults, 200 mg per day in pregnant and breastfeeding women, 120 mg per day in children from 6 to 12 years of age and 90 mg per day in children from 0 to 59 months of age [11,12]. In addition, the level of knowledge of one iodized salt depends on socio-demographic characteristics (age, marital status, region of residence, level of education, religion, nationality, occupation of the household) [13, 14].

Iodine deficiency is a widespread health problem in many countries, most of the earth's iodine is found in the oceans, and exposed soil surfaces may be eroded away from the iodine [7, 15]. In Africa, some 60 million people are at risk of iodine deficiency, 30 million suffer from goiter, and half a million suffer from overt congenital malformations [16, 17].

A study carried out in South Africa found that most patients, 89.1%, were unaware of the harmful effects of iodine deficiency in children [18, 19]. The most important health issue in Ethiopia was endemic goiter, one of the most visible manifestations of IBD, with a national prevalence of goiter in women 36% and in children 35% [20, 21]. Studies conducted in rural Sidama zone (6%), Southern Ethiopia (12%) and, North Gondar of Ethiopia (25%) revealed that only of the participants knew the benefits of iodized salt utilization [22-25].

Evaluating progress in addressing iodine deficiency as a critical public health issue and working to build on these achievements is a key element in the fight against iodine-deficiency disease (IDD) [26, 27]. Despite the availability of research findings on the knowledge of the use of iodized salt in households in Ethiopia, these findings are inconsistence and we need up-to-date level of knowledge on iodized salt utilization among Ethiopian households due to low emphasis on properly utilization of iodized salt. Healthcare practitioners, healthcare policy makers, and health economic analysts will need this information in particular to make decisions at the clinical and policy levels. However, there hasn’t been a current national assessment in Ethiopia on the pooled knowledge of household use of iodized salt and related factors.

Therefore, by synthesizing data from existing scientific research, we have carried out a systematic review and meta-analysis of all available studies to determine the current pooled knowledge on the use of iodized salt and related factors in Ethiopian households.

Review Questions

The following review questions provide a framework for this systematic review and meta-analysis:

(1) What is the aggregate level of knowledge among Ethiopian Households regarding iodized salt utilization?

(2) What are the contributing factors to Ethiopian Households knowledge of salt utilization?

Objectives

The primary objective of this review is to assess the pooled prevalence of knowledge on iodized salt utilization among Households in Ethiopian. The secondary objective is to identify the associated factors and investigating any regional differences in Ethiopia.

Methods

Design and Search Strategy

We conducted a comprehensive search of electronic databases including Science Direct, Medline, African Journals Online (AJOL), Medical Database, Scopus, PubMed and Google Scholar to identify relevant observational studies on the level of knowledge and factors related to iodized salt utilization among Ethiopian households, published up to June 29, 2025. EndNote version 20 was used for downloading, organizing, and citing the articles. Additionally, a manual search of reference lists from retrieved articles was performed to find any potentially relevant studies.

The search employed keywords and MeSH terms such as “Knowledge,” “Iodized Salt Utilization,” “Associated Factors,” “Predictors,” “Determinants,” and “Households,” combined with “Ethiopian” using ‘AND’ and ‘OR’ operators. The search terms were used both separately and in combination to ensure a thorough search. The inclusion criteria limited results to observational studies involving human subjects, published in English.

Study Protocol and Registration

As part of the protocol development process, Preferred Reporting Items for Systematic Review and Meta-analysis (PRISMA)-P guidelines were followed [28]. The review was registered on the PROSPERO with ID: CRD420251051319. The reporting flowchart is presented in (supplementary file 1).

Criteria for Eligibility

PICO: Population: Households; Intervention: not applicable; Comparison: not applicable; Outcome: knowledge on iodized salt utilization.

Inclusion Criteria: We agreed on the following inclusion standards for this meta-analysis and systematic review in order to include articles in this review.

1. Participants: Including those who reside in Ethiopia.

2. Community research carried out in Ethiopia

3. Study design: All observational study designs, including cross-sectional, case control, and cohort studies were included.

4. Setting: Only Ethiopia is the location of the studies.

5. Study: Up to 29 June 2025, the final date of data analysis, all studies both published and unpublished that was published in the form of journal articles, master's theses, and dissertations were included. Articles dated up to, 29, June, 2025.

6. Language: This study only took into account the English language.

Exclusion Criteria: Review articles, case series, case reports, and letters to the editors were excluded.

Quality Assessment and Data Collection

The study was critically evaluated using the Newcastle-Ottawa Scale (NOS). Before choosing the articles for the final review, a thorough evaluation of their quality was conducted [29]. Based on predetermined article selection criteria, each author independently evaluated the abstract and title of the article for inclusion in the review. They evaluated the studies' quality using standards modified for reporting cross-sectional and prevalence data. If a study received a score of seven or higher on the quality assessment indicators, it was deemed low risk (Table 1). Any disagreements were settled by discussion or, if necessary, by speaking with a third reviewer.

Study Selection and Extraction

The retrieved studies were imported into Endnote (version 20, for Windows, Thomson Reuters and Philadelphia, USA) and the duplicate studies were deleted by Endnote. Three independent evaluators (HBB, HHD and BM) screened all the documents for eligibility criteria: first, abstract and title, then full text. Three investigators independently (YA, BB, TDK and YN) used a consistent format for extracting data from Microsoft Excel. The three independent researchers were blinded to all study data prior to the extraction procedure. The data extraction tool contains information on the name of the first author, year of publication, region, country, sample size, response rate and for the second objective (factors), a format for extracting information on each specific factor, education, occupation and residence, has been developed. Variables were selected in this study when they were reported as significant by two or more studies. During the disagreement on data abstraction between the investigators, this was settled by consensus and by the fourth investigator (Table 1).

Table 1: Characteristics of the 11 studies included in the Systematic review and meta-analysis of Knowledge and Associated Factors of Iodized Salt Utilization among Households in Ethiopia

Study No	Author	Year of Publication	Country	Region	Study design	Population	prevalence	Sample Size	RR(%)	Quality Score
1	WB Tariku etal	2019	Ethiopia	Amhara	Cross-Sectional	Households	28.2	700	100.00%	8
2	S Dessu et al	2018	Ethiopia	southern E	Cross-Sectional	Households	52.8	475	100	7
3	HF Gemede, etal	2021	Ethiopia	Orromo	Cross-Sectional	Households	53.5	357	100	7

4	H Gerenesa, etal	2016	Ethiopia	Tigiray	Cross-Sectional	Households	83	478	98.50%	9
5	AM Senbeta, etal	2021	Ethiopia	Somalia	Cross-Sectional	Households	74.1	361	94.10%	9
6	TG Ambaye et al	2015	Ethiopia	Tigiray	Cross-Sectional	Households	72	280	96%	7
7	Y Haji et al.	2017	Ethiopia	southern E	Cross-Sectional	Households	44.7	556	96%	9
8	M Kebed et al	2022	Ethiopia	Orromo	Cross-Sectional	Households	66.1	386	96%	8
9	S Worku et al	2020	Ethiopia	A.Abeba	Cross-Sectional	Households	58.6	470	100%	8
10	Kedire Nura etal	2021	Ethiopia	A.Abeba	Cross-Sectional	Households	57.3	335	99%	9
11	Teka D et al	2022	Ethiopia	Orromo	Cross-Sectional	Households	60.4	435	100.00%	7

Methodological Quality Assessment of Studies

After the full text review, three authors (BYD, BM and TDB) were assessed the article's quality by using Newcastle-Ottawa Quality Assessment Scale (adapted for cross sectional studies) [30]. Any disagreements was resolved by discussion and consensus. We used the following items as criteria for an appraisal: 1. Representativeness of the sample (Maximum score=1), 2. Sample size (Maximum score=1), 3. Non-respondents rate (Maximum score=1) 4. (Risk factor) (Maximum score=2), 5. The outcome groups are comparable, based on the study design (Maximum score=2), 6. Assessment of the outcome (Maximum score=2), 7. Statistical test (Maximum score=1). Articles with a score of ≥5 of the quality assessment checklist criteria showed a study with low risk and those studies were included in the systematic review and meta-analysis. No study was dismissed after the quality rating (Table 2).

Table 2: Quality rating for studies included in the Systematic review and meta-analysis of Knowledge and Associated Factors of Iodized Salt Utilization among Households in Ethiopia

Study	**Selection Criteria**				**Comparability**	**Outcome**		
	Representativeness of the sample *	Sample size *	No respondents *	Ascertainment of the exposure(maximum score = **2)** **	The subjects in different outcome groups are comparable, based on The study design or analysis. Confounding factors are controlled ((maximum score = **2)** *	Assessment of the outcome(maximum score=**2**) **	Statistical test *	Quality Score(10)
WB Tariku etal	1	1	1	2	1	1	1	8

S Dessu et al	1	1	1	2	1	1	1	8
HF Gemede, etal	1	1	1	2	1	1	1	8
H Gerenesa, etal	1	1	1	2	1	1	1	8
AM Senbeta, etal	1	1	1	2	0	1	1	8
TG Ambaye et al	1	1	1	1	1	1	1	7
Y Haji et al.	1	1	1	2	0	1	1	7
M Kebed et al	1	1	1	2	1	1	1	8
S Worku et al	1	1	1	2	1	2	1	8
Kedire Nura etal	1	1	1	2	0	1	1	7
Teka D et al	1	1	1	1	1	1	1	7

Outcome Measurement

The first outcome was the level of knowledge of iodized salt usage in households. It was determined as the level of household knowledge, calculated from the total number of households, on the use of iodized salt in all reviewed studies. The second outcome was predictors of household knowledge of iodized salt consumption measured by the adjusted odds ratio. In our review, a predictor was defined as an independent variable or factor that was significantly related to household knowledge of iodized salt use. A variable was considered to be predictive if it showed a statistically significant association ($p<0.05$) with knowledge level in a multivariable analysis.

Heterogeneity and Publication Bias

Rigorous screening (electronic and database searches and manual searches) was used to minimize the risk of bias. The collaborative work of the authors was also crucial in reducing bias, selecting articles based on clear objectives and eligibility criteria, deciding on the quality of the studies and collecting and collating data. The funnel plot test, I^2, and with p-value were used to determine the degree of heterogeneity. The results of the heterogeneity test were classified as low, intermediate and high heterogeneity using the values of 25, 50 and 75% respectively. For results, which were statistically significant due to heterogeneity, a randomized control model was used for the variation. The statistical significance of publication bias was assessed by Egger regression and an asymmetry test was used.

Statistical Analysis

The data were entered using Microsoft Excel. The Meta-analysis was conducted by STATA 14.2 software. We used the DerSimonian and Laird method of random effects models to calculate pooled prevalence of household iodized salt consumption in Ethiopia. The I^2 statistical test was calculated to control for heterogeneity across studies. The I^2 values of 0, 25, 50 and 75% were assumed to represent no, low, medium and high variations, respectively. As significant heterogeneity was observed between

studies, a meta-analysis was performed using a random-effect model to estimate the pooled prevalence with 95% confidence limits (CI). The forest plot was used to present the results of the meta-analysis. The Egger test was used to check for publication bias and any possible publication bias was determined by visual inspection of the funnel diagram. To pinpoint the key studies that have the most significant influence on between-study heterogeneity, a leave- one-out sensitivity analysis was also conducted. By excluding individual studies, an analysis was made to determine the impact of each study on the pooled prevalence of knowledge in Ethiopia's households. The input variables needed by the cells of the two-by-two tables for factors related to knowledge of iodized salt utilization are binary data, or "prevalence of knowledge," in each study's exposed and non-exposed groups who had good knowledge and poor knowledge on iodized salt utilization. The odds ratio (OR), calculated based on the binary results of the main studies included, was used to evaluate all factors related to the knowledge of the use of iodized salt. The pooled odds ratio was calculated using a meta-analysis of random effects using a 95% confidence interval. The magnitude of the effect and the 95% confidence interval are presented with the results as forest plots.

Results

A total of 1,084 scholarly articles were obtained, which had been published until June 29, 2025 through the use of electronic databases. In total, 1043 articles were avoided due to duplication. Of the remaining 41 articles, 25 were removed by title and abstract, whereas 16 were read in full and assessed for eligibility. On the other hand, five study that fulfilled the eligibility criteria but was excluded it failed to access the full text. Finally, 11 studies with a total of 4833 participants who fulfilled the eligibility requirements were included in the meta- analysis (supplementary file 1) (Table 1).

Characteristics of Included Studies

Among the 11 included studies, three studies were conducted in Oromia [13,31,32], two tudies were conducted in Addis Ababa [33,34], two studies were conducted in South Ethiopia [35,36], one study conducted in Somalia [37], one study conducted in Amhara [14], 1 and the rest 2 studies were conducted in Tigray [38,39]. The highest prevalence (74.1%) of knowledge among households in Ethiopia was reported by a study conducted in Somalia [37]. While the lowest prevalence (28.2%) was reported by a study conducted in Ethiopia was Amhara [14].

Pooled Prevalence of Knowledge on Iodized Salt Utilization among Households in Ethiopia

Pooled prevalence of Knowledge on iodized salt utilization among Households in Ethiopia was 59.14% (95% CI: 48.51, 61.47). The forest plot below, shows a statistically significant heterogeneity (I^2 =98.5 %; $p < 0.001$) (Fig 1). Therefore, a random-effects model was used to estimate the pooled prevalence knowledge of iodized salt utilization among households in Ethiopia. Additionally, subgroup analysis was conducted to determine the potential source of heterogeneity among the studies because of the high degree of heterogeneity.

Subgroup Analysis

Because of the significant heterogeneity among the studies, a sub -group analysis was conducted to identify potential sources of heterogeneity. Subgroup analysis was conducted depending on the region and year of publication to identify possible sources of heterogeneity. Regarding the sub-group analysis by region, the highest pooled prevalence of knowledge was reported in Tigray region 77.69% (95% CI: 66.92, 88.47), whereas the Lowest was documented in the Amhara region 28.20% (95 % CI: 24.687, 31.53) (Fig. 2).

Meta-regression

Meta-regression was conducted by considering continuous variables to identify factors associated with the pooled prevalence

knowledge of iodized salt utilization among households. Sample size and years of publication were taken in the meta-regression. This finding suggests that there is no significant relationship between the year of publication and the prevalence of knowledge (β = -1.47, 95% CI: -0.154 to -0.0302; p= 0.332). A wide confidence interval between negative and positive values indicates considerable uncertainty about any temporal trend. Conversely, a statistically significant but minimal negative association between sample size and prevalence of knowledge was observed (β = -0.092, 95% CI: -0.157 to -0.0302; p = 0.004) (Table 4).

Table 3: Meta-regression to identify source of heterogeneity for the pooled prevalence of Knowledge among Households in Ethiopia

Variables	Coefficient (β)	95 % CI	P-value
Year of publication	-1.47	-4.461 to 1.507	0.332
Sample Size	-0.092	-0.154 to 0.0302	0.004

Heterogeneity and Publication Bias

The I^2 (variation in ES attributable to heterogeneity) test results revealed that there was considerable heterogeneity with I^2 = 98.5%, at p-value ≤ 0.001 (Fig.1). The funnel plot results revealed that a symmetrical distribution of the included studies through inspection, (Fig 3), which implied there was no potential publication bias (Egger's test: β = 9.2, p = 0.578) (Table 5).

Table 4: Tests for Funnel plot Asymmetry (Eggers test) for level of knowledge on iodized salt utilization among Ethiopian households

Standard effect	Coefficient	Standard error	T	P > t	95 % CI
Slope	38.1	35.2	1.08	0.307	-41.46 to117.67
Bias	9.2	15.9	0.58	0.578	-26.82 to 45.22

Sensitivity Analysis

Leave-one-out Sensitivity Analysis

Sensitivity analysis using leave-one-out method demonstrated robust pooled estimate, with prevalence range from 46.40% to 69.77% upon individual study exclusion. No single study significantly changed the overall estimate, confirming that the findings are not unduly affected by any single set of data (Fig. 4).

Factors Associated with Knowledge of Iodized Salt Utilization Among Households in Ethiopia

To determine factors associated with knowledge of iodized salt utilization among households in Ethiopia, variables such as residency, occupation and education were extracted from the included studies. Of those variables, only occupation is associated with knowledge on iodized salt utilization among households in Ethiopia. According to this systematic review and meta-analysis, the occupation of household members is a significant factor influencing their level of knowledge regarding iodized salt. Participants who were government employees were found to be 2.6 times more likely to be knowledgeable about the use of iodized salt compared to housewives (AOR = 2.63, 95 % CI: 1.17, 5.92) (Table 6).

Table 5: Factors associated with knowledge of iodized salt utilization among Households in Ethiopia

Factors	Numbers of studies	Sample size	AOR (95 % CI)	P-value
Occupation	4	1186	2.63 (1.17, 5.92)	0.019
Education	4	1624	1.57 (0.13, 18.68)	0.718
Residency	4	2147	3.76 (0.78, 18.14)	0.098

Discussion

This systematic review and meta-analysis assessed the level of knowledge about iodized salt utilization among households residing in Ethiopia. The findings indicate that the pooled level of knowledge among Ethiopian households was 59.14%, with a 95% confidence interval of 48.51% to 69.77%. The pooled prevalence of the level of knowledge of iodized salt utilization among Ethiopian households is consistent with other studies conducted in Ethiopia, Arba Minch (52.8%) [35] and Debreberhan (53%) [34], Sudan (56%) [40] and India (56.2%) [41]. The possible explanations could be attributed to shared factors such as comparable levels of public health education, similar access to iodized salt, and common socioeconomic and cultural influences across these regions. Additionally, widespread national health campaigns and efforts to improve awareness about iodine deficiency might have contributed to these consistent levels of knowledge.

Despite these similarities, ongoing education and intervention are necessary to further improve knowledge and ensure proper utilization of iodized salt in these communities. However, it is higher than the study conducted in different parts of Ethiopia including Mecha district (28.5%) [14], Woliata Sodo (44.7%) [36], in Addis Ababa (58.3%) [34], and Turkey (46.3%) [42] and the United Arab Emirates (46.4%) [43].

The relatively low levels of knowledge reported in these studies may be due to factors such as limited public awareness, inadequate health education, cultural beliefs, or limited access to information about the benefits of iodized salt [44]. Differences in health infrastructure, educational outreach, and socioeconomic conditions across these regions likely contribute to the varying levels of knowledge and utilization.

In contrast, this finding is lower than the study conducted in Addis Ababa (78%) [45], Axum (80%) [39], and Ghana (72%) [46]. These variations may be attributed to differences in factors such as awareness levels, access to iodized salt, socioeconomic status, cultural practices, and the effectiveness of public health interventions across different regions.

This systematic review and meta-analysis also identified associated factors with knowledge of iodized salt utilization among households. Occupation of household's is one factor that determines the knowledge of households. The occupation of household members is a significant factor influencing their level of knowledge regarding iodized salt. Participants who were government employees were found to be 2.6 times more likely to be knowledgeable about the use of iodized salt compared to housewives.

The possible reasons maybe government employees often have better access to information through workplace health programs, official communications, and educational campaigns, which can enhance their awareness and understanding [47]. Additionally, their exposure to formal training or information sessions about health and nutrition may contribute to higher knowledge levels. In contrast, housewives might have limited access to such information sources, potentially resulting in lower knowledge. Therefore, occupation plays a crucial role in determining the extent of knowledge about iodized salt among households, highlighting the need for targeted educational interventions to reach those with less access to health information. This finding agrees with previous studies conducted in Northwest Ethiopia [14] and China [48].

Strengths of this Review

Strengths of the review included uniform abstraction of material using a predetermined structure that helped minimize errors and the use of multiple databases to search articles (both electronically and manually).

Limitations of this Review

There may have been bias because the search was limited to English. A small sample size for each of the included studies could

be an additional drawback.

Clinical Implication

This systematic review underlines the importance of raising awareness of iodized salt in Ethiopia. Improving education, particularly for rural populations and women, and integrating iodine deficiency prevention into health services can improve use. Policymakers should strengthen regulation and ensure access to iodized salt to reduce iodine deficiency and improve maternal and infant health.

Conclusion

The current meta-analysis and systematic review suggest that the level of knowledge of iodized salt intake in Ethiopian households varies and is influenced by several factors, including access to information, education and occupation. Increasing its use and reducing iodine deficiency require two key strategies: ensuring iodized salt is available and raising awareness through targeted education. Improved population health outcomes can result from the intensification of public health initiatives in different fields.

Declarations

Ethical Approval

Since this study is based solely on published data, ethical approval is not required and therefore not applicable.

Prospero Registration

https://www.crd.york.ac.uk/PROSPERO/view/CRD420251051319

Acknowledgement

We would like to express our gratitude to the participants of the studies included in this systematic review and meta- analysis.

Funding

The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not--for-profit sectors.

Authors' Contributions

HB, BM, BB and BY conceived and designed the protocol. HB will be responsible for manuscript drafting. TD, YN, YA and HH took part in the critical revision for methodological and intellectual content. H.B is the guarantor of this review. All the authors read and approved the final version of the manuscript.

Data Availability

All relevant data regarding this research work is included in the manuscript.

References

1. Köhrle J (2023) Selenium, iodine and iron–essential trace elements for thyroid hormone synthesis and metabolism. International journal of molecular sciences. 24: 3393.

2. Andersson M, de Benoist B, Delange F, Zupan J (2007) Prevention and control of iodine deficiency in pregnant and lactating women and in children less than 2-years-old: conclusions and recommendations of the Technical Consultation. Public Health Nutr. 10: 1606-11.

3. Zheng C, Yin Z, Zhan B, Xu W, Ma ZF (2024) Pregnant women at risk for iodine deficiency but adequate iodine intake in school-aged children of Zhejiang Province, China. Environ Geochem Health. 46: 204.

4. Lisco G, De Tullio A, Triggiani D, Zupo R, Giagulli VA, De Pergola G, et al. (2023) Iodine deficiency and iodine prophylaxis: an overview and update. Nutrients. 15: 1004.

5. Bertinato J (2021) Iodine nutrition: Disorders, monitoring and policies. Advances in Food and Nutrition Research. 96: 365-415.

6. Olivieri A, De Angelis S, Moleti M, Vermiglio F (2021) Iodine deficiency and thyroid function. Thyroid, Obesity and Metabolism: Exploring Links between Thyroid Function, Obesity, Metabolism and Lifestyle. 3-20.

7. Prasad MNV (2023) Iodine Essentiality for Human Health: Sources, Toxicity, Biogeochemistry, and Strategies for Alleviation of Iodine Deficiency Disorders. Medical Geology: En route to One Health. 155-74.

8. Bath SC, Rayman MP (2020) Dairy foods as a source of dietary iodine. Milk and Dairy Foods: Elsevier; 323-45.

9. Hatch-McChesney A, Lieberman HR (2022) Iodine and iodine deficiency: a comprehensive review of a re-emerging issue. Nutrients. 14: 3474.

10. Winder M, Kosztyła Z, Boral A, Kocełak P, Chudek J (2022) The impact of iodine concentration disorders on health and cancer. Nutrients. 14: 2209.

11. Fan L, Meng F, Sun Q, Zhai Y, Liu P (2022) Assessment of sustainable elimination criteria for iodine deficiency disorders recommended by international organizations. Frontiers in Nutrition. 9: 852398.

12. Delange F, Bürgi H, Chen ZP, Dunn JT (2002) World status of monitoring of iodine deficiency disorders control programs. Thyroid. 12: 915-24.

13. Gemede HF, Tamiru B, Fite MBJIJoFS (2021) Knowledge, practice, and availability of iodized salt and associated factors in Jibat Woreda, West Shoa Zone, Ethiopia. 2021: 5562390.

14. Tariku WB, Mazengia ALJ Jon (2019) metabolism. Knowledge and utilization of iodized salt and its associated factors at household level in Mecha District, Northwest Ethiopia. 2019: 9763830.

15. Zimmermann MB (2020) Iodine and the iodine deficiency disorders. Present knowledge in nutrition: Elsevier. 429-41.

16. Liu S, Li M, Fan L, Liu P, Meng F, Su X, et al. (2019) Iodine Deficiency Disorders (IDD). Endemic Disease in China. 37-60.

17. Elmanssury AEA (2013) Prevalence of Goitre among Population, Shendi Locality, River Nile State, 2013: Abdel Ghaffar Ali Adam.

18. Senbeta AM, Mamo FT, Desalegn BB, Daba AK (2021) Knowledge and practices of iodized salt utilization, health consequences, and iodine concentration on dietary salts at retailer and households in Jigjiga town, Somali, Ethiopia. Cogent Food & Agriculture. 7: 1911421.

19. Sebotsa MLD, Dannhauser A, Mollentze W, Oosthuizen GM, Mahomed F, Jooste PL (2009) Knowledge, attitudes and practices regarding iodine among patients with hyperthyroidism in the free state, South Africa. South African Journal of Clinical Nutrition. 22: 18-21.

20. Gebretsadikan TM, Troen AMJBN (2016) Progress and challenges in eliminating iodine deficiency in Ethiopia: a systematic review. 2: 1-12.

21. Abuye C, Berhane YJBPh (2007) The goitre rate, its association with reproductive failure, and the knowledge of iodine deficiency disorders (IDD) among women in Ethiopia: cross-section community based study. 7: 1-7.

22. Ersino G, Tadele H, Bogale A, Abuye C, Stoecker BJJEMJ (2013) Clinical assessment of goiter and low urinary iodine concentration depict presence of severe iodine deficiency in pregnant Ethiopian women: a cross-sectional study in rural Sidama, southern Ethiopia. 51: 133-41.

23. Tafere G, Barbara JJFJ (2014) Knowledge, attitude and practice of rural women in Sidama zone, southern Ethiopia concerning iodized salt, iodine and goiter. 28: 804-19.

24. Gebremariam HG, Yesuf ME, Koye DNJISRN (2013) Availability of adequately iodized salt at household level and associated factors in Gondar town, Northwest Ethiopia. 2013: 160582.

25. Commission PC (2008) Summary and statistical report of the 2007 population and housing census. Population size by age and sex.

26. Zimmermann MB (2023) The remarkable impact of iodisation programmes on global public health. Proceedings of the Nutrition Society. 82: 113-9.

27. Untoro J, Timmer A, Schultink W (2010) The challenges of iodine supplementation: a public health programme perspective. Best Practice & Research Clinical Endocrinology & Metabolism. 24: 89-99.

28. O'Dea RE, Lagisz M, Jennions MD, Koricheva J, Noble DW, Parker TH, et al. (2021) Preferred reporting items for systematic reviews and meta-analyses in ecology and evolutionary biology: a PRISMA extension. Biological Reviews. 96: 1695-722.

29. Modesti PA, Reboldi G, Cappuccio FP, Agyemang C, Remuzzi G, Rapi S, et al. (2016) Panethnic Differences in Blood Pressure in Europe: A Systematic Review and Meta-Analysis. PloS one. 11: e0147601.

30. Modesti PA, Reboldi G, Cappuccio FP, Agyemang C, Remuzzi G, Rapi S, et al. (2016) Panethnic differences in blood pressure in Europe: a systematic review and meta-analysis. PloS one. 11: e0147601.

31. Molla A, Giza M, Kebede F, Kebede TJSOM (2023) Iodine status, impact of knowledge, and practice for adequate iodized salt utilization in house hold at North West Ethiopia. 11: 20503121221148612.

32. Ewunie TM, Kabthymer RH, Hailu S, Mareg M, Mengie T, Sisay D, et al. (2022) Iodine concentration level of iodized dietary salt and its associated factors: a systematic review and meta-analysis. 11.

33. Gemede HF, Tamiru B, Fite MB (2021) Knowledge, Practice, and Availability of Iodized Salt and Associated Factors in Jibat Woreda, West Shoa Zone, Ethiopia. International journal of food science. 2021: 5562390.

34. Worku S, Garedew G, Adugna L, Girma D, Dejene HJJPH (2021) Knowledge and utilization of iodized salt and associated factors among households of Fitche Town, Central Ethiopia, 2020: a community based cross-sectional study. 6: 555681.

35. Dessu S, Dawit Z, Alemu GJIJRSMHS (2018) Assessment of knowledge on iodized salt utilization and associated factors among households in Arba Minch Town, Southern Ethiopia. 3: 17-23.

36. Haji Y, Abdurahmen J, Paulos WJF (2017) bulletin n. Knowledge and perception of consumption of iodized salt among food handlers in Southern Ethiopia. 38: 92-102.

37. Senbeta AM, Mamo FT, Desalegn BB, Daba AKJCF (2021) Agriculture. Knowledge and practices of iodized salt utilization, health consequences, and iodine concentration on dietary salts at retailer and households in Jigjiga town, Somali, Ethiopia. 7: 1911421.

38. Ambaye TGJJFSNT (2015) Knowledge of iodine deficiency disorders and intake of iodized salt in residents of Mekelle Tigray, Ethiopia. 1: 002-7.

39. Gerensea H, Yohannse A, Baymot B, Atsbha HJEJND (2015) Knowledge, attitude and practice (KAP) towards iodized salt utilization in HaweltiKebelle, Axum, Tigray, Ethiopia, 2: 1-8.

40. Elmanssury A, Elnour SA, Elmosaad YJESJ (2017) Knowledge and attitude of population towards iodized salt in Shendi locality river Nile state in Sudan. 13: 312-22.

41. Datta A, Karmakar N, Nag K, Singha SJJoC, Research D (2018) A Study on Knowledge, Attitude and Practices Regarding Household Consumption of Iodized Salt among Selected Urban Women of Tripura, India. 12.

42. Darcan Ş, Unak P, Yalman O, Lambrecht FY, Biber FZ, Göksen D, et al. (2005) Determination of iodine concentration in urine by isotope dilution analysis and thyroid volume of school children in the west coast of Turkey after mandatory salt iodization. 63: 543-8.

43. Salma L, Musameh T, Motawea A, Elshafiey A, Al Ketbi K, Alkindi A, et al. (2024) Knowledge, Attitudes, and Practices of Iodized Salt Among Adults Aged 18 to 65 in the United Arab Emirates. 16.

44. Campmans JMD, Smit DJM, van Oostrom SH, Engels JA, Proper KI (2022) Barriers and facilitators to the implementation of workplace health promotion programs: Employers' perceptions. Frontiers in public health. 10: 1035064.

45. Bazezew MM, Yallew WW, Belew AkJBrn (2018) Knowledge and practice of iodized salt utilization among reproductive women in Addis Ababa City. 11: 1-8.

46. Buxton C, Baguune BJAoPH (2012) Knowledge and practices of people in Bia District, Ghana, with regard to iodine deficiency disorders and intake of iodized salt. 70: 1-9.

47. Arena R, Guazzi M, Briggs PD, Cahalin LP, Myers J, Kaminsky LA, et al. (2013) Promoting health and wellness in the work-

place: a unique opportunity to establish primary and extended secondary cardiovascular risk reduction programs. Mayo Clinic proceedings. 88: 605-17.

48. Wang X, Lou X, Mo Z, Xing M, Mao G, Zhu W, et al. (2019) Poor iodine knowledge, coastal region, and non-iodized salt consumption linked to low urinary iodine excretion in Zhejiang pregnant women. 11: 413.