Systematic Review

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Dietary Diversity and Associated Factors among Children 6–23 Months Old in Ethiopia: Systematic Review and Meta-Analysis

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Background: Feeding diversified food for children is the major indicator of nutritional quality and adequacy that is crucial during the complementary feeding period for infants and young children aged 6–23 months. Ensuring diversified food is highly essential for the normal growth and development of the infant and young children. In Ethiopia, malnutrition and food insecurity remain prevalent, underscoring the need to understand and improve dietary diversity among children. The primary objective of this review was to determine the pooled prevalence of dietary diversity and its associated factors among children aged 6–23 months in Ethiopia.

Methods: We thoroughly searched some electronic databases, including Pub Med, Africa Index Medicus, Science Direct, Hinari, and Google Scholar, to perform a meta-analysis. Excel was used to extract and combine the data, while Stata 17 was used for statistical analysis. To estimate pooled prevalence rates and related associated factors, we used a random-effect model and the Der Simonian-Laird technique. The I^2-test was utilized to examine heterogeneity, and funnel plots, in conjunction with Egger's and Begg's tests, were employed to investigate publication bias.

Result: This review analyzed 42 full-text studies, finding a pooled prevalence of 26.78% (95% confidence interval (CI): 23.35–30.21) with significant heterogeneity (I^2 = 98.95%). Maternal education levels—college & above Adjusted Odds Ratio (AOR: 5.377, 95% CI: 3.116–9.279), secondary and above (AOR: 3.324, 95% CI: 1.939–5.700), primary (AOR: 3.065, 95% CI: 2.275–3.129), and formal education (AOR: 2.484, 95% CI: 1.722–3.583)—showed higher odds than counterparts. Similarly, fathers' education—secondary and above (AOR: 2.837, 95% CI: 1.981–4.065) and primary (AOR: 2.082, 95% CI: 1.016–4.266)—and father's occupation as merchant (AOR: 2.739, 95% CI: 1.355–5.539), and mother's occupation as housewife (AOR: 3.636, 95% CI: 2.457–5.381) showed higher odds. Additionally, male child sex (AOR: 1.877, 95% CI: 1.185–2.972), child age 18–23 months (AOR: 2.470, 95% CI: 1.568–3.987), and 12–17 months (AOR: 2.460, 95% CI: 1.914–3.163) indicated higher odds than counterparts. Having Postnatal Care (PNC) follow-up, counseling on infant and young child feeding (IYCF) practices, and no history of child illness were associated with higher odds (AOR: 3.155, 95% CI: 2.104–4.732), (AOR: 2.960, 95% CI: 2.288–3.829), and (AOR: 2.420, 95% CI: 1.765–3.318), respectively. Maternal knowledge of dietary diversity, urban residency, Antenatal Care (ANC) follow-up, child growth monitoring, and media exposure also showed higher odds. Similarly, maternal age groups 25–34 years and 35–44 years had higher odds compared to those aged 15–24 years. Other factors associated with higher odds included home grading, food security, institutional delivery, availability of cow milk, and household wealth index.

Conclusion: Among Ethiopian children aged 6–23 months, the prevalence of recommended dietary diversity feeding practices was remarkably low, with only about 25% meeting the minimum recommended diversified food. The scientific predictors factor affecting dietary diversity included maternal media exposure, place of delivery, food security, urban residency, availability of cow milk, child growth monitoring, age, and knowledge of IYCF practices; paternal factors like education and occupation; child-related variables like age, sex, and history of illness; and history of ANC and PNC.

Keywords: dietary diversity; minimum dietary practice; children; Ethiopia

Background

Dietary diversity refers to a variety of food types that are frequently used to gauge the variety and nutrient sufficiency of diets [1]. It measures the range of foods or food groups consumed over the course of a 24-hours [2]. The World Health Organization-United Nations International Children's Emergency Fund (WHO-UNICEF) Technical Expert Advisory group determined that eight food groups—breast milk, grains, roots, and tubers; legumes and nuts; dairy products; flesh foods (meats, fish, and poultry); eggs; vitamin A-rich fruits and vegetables; and other fruits and vegetables—offer children aged 6–23 months the appropriate amount of macro and micro-nutrients. It is recommended that children 6–23 months old consume at least five different food groups from eight food groups per 24 hours [3–5].

Increasing the variety of food and food groups for the child in the diet can ensure the adequacy of essential nutrients [6,7]. Food categories from a range of diets are crucial parts of child-feeding techniques that meet their nutritional demands and promote healthy growth and development in infancy [8,9]. For a child to experience the best possible growth and development, proper feeding methods for infants and early children are essential [10]. Additionally, lacking diversified foods puts children at a greater risk of achievement of potential growth and development, dropping out of school, and failing a class, which has a significant negative impact on communities, families, and the educational institutions of the country [11,12].

Over half of the deaths of under-five children are caused by inappropriate infant and young child feeding (IYCF) practices [13,14].

It can be difficult to meet nutritional needs between the ages of 6–23 months [15]. The minimum dietary diversity (MDD) indicator should be revised, according to the WHO-UNICEF Technical Expert Advisory Group on Nutrition Monitoring (TEAM), which has also created a set of core indicators to evaluate IYCF practices among children aged 6–23 months, taking into account both breast- and complementary feeding-related practices [16–19].

Overall, 25.1% of children aged 6–23 months in Sub-Saharan African Countries ate sufficiently diversified food [6]. The prevalence of an adequate, diversified diet feeding practice among children aged 6–23 months was, Burkina Faso had the lowest prevalence (5.6%), Ethiopia had the highest (27.2%), and South Africa had the highest (43.9%) feeding practice [6].

Since Ethiopia is one of the low and middle-income countries, infants between the age of 6–23 months old were more vulnerable to both micro-nutrient and macro-nutrient deficiency [20]. Early childhood malnutrition has long-term effects that negatively impact an individual's overall growth, cognitive development, morbidity, academic performance, and productivity in the future [21].

The Ethiopian government is currently working with other sectors to develop a national nutrition plan that includes complementary feeding practices for children aged 6–23 months to combat the negative effects of a diet lacking in dietary diversity. Despite this, the problem of poor dietary diversity is still high in magnitude and varies across regions in Ethiopia [22].

However, researchers carried out a number of studies throughout Ethiopia to evaluate the extent of dietary diversity among children aged 6–23 months. According to these studies, higher family education [23–26], knowledge of IYCF practice [10,23,24,26,27], Postnatal Care (PNC) and Antenatal Care (ANC) [10,28,29], food insecure households [30,31], media exposure [32–34], place of delivery [29,35,36], a household with poor wealth index [22,31,37] significantly affected the dietary diversity.

To reduce the high prevalence of poor dietary diversity, it is essential to evaluate the extent of dietary diversity practice among children aged 6–23 months. This will help to design effective interventions. Therefore, representative data that offers an estimated pooled prevalence of dietary diversity practices among Ethiopian children aged 6–23 months is required. Although the practice of dietary diversity has been previously studied in Ethiopia, the results of the studies differed depending on the region and the study. Even though there have been previous systematic reviews and meta-analyses, there have only been a few studies done, and the study from 2011 to 2018 had a small sample size. When working with children between the ages of 6–23 months, public health professionals and legislators require up-to-date information on dietary diversity practices. Thus, the purpose of this review was to calculate the combined prevalence of healthy eating practices among Ethiopian children aged 6–23 months.

Materials and Methods

This systematic review and meta-analysis were conducted by collecting the most updated and recently published articles to assess the pooled prevalence and associated factors of dietary diversity among children aged 6–23 months in Ethiopia. We meticulously reviewed articles from various sources, like electronic database search, disk review of gray literature, and manual examination of the referenced list. To organize this systematic review and meta-analysis report, we used the protocol of the preferred Reporting Items for systematic reviews and meta-analysis (PRISM-2020 statement) guidelines [38] (**Supplementary PRISMA 2020 checklist**). The protocol of the review

was prospectively registered in the International Prospective Register of Systematic Review (PROSPERO), under the registration number (CRD42023486476).

Information Source and Search Strategies

To organize this review report, we use various search engines to identify publications from the databases of Pub Med, Africa Index Medicus, Science Direct, Hinari, and search engines Google Scholar from November 20th to December 18th, 2023. We used the following key terms for the data search Dietary diversity practice "Minimum dietary diversity", "Inadequate dietary diversity", "Associated factors", "predictor", "Child", "Age 6–23 months", and "Ethiopia". Search strategies included various techniques like truncation (*), Boolean operators ("OR" and "AND"), and phrase searching ("…"), additionally, we employed MeSH terms, and synonyms to make our search comprehensive.

This review reports detailed data search terms in each database provided in (**Supplementary Table 1**). From several electronic databases, all published, unpublished, and gray literature were extracted and exported into EndNote After version X8. The two independent reviewers (Sileshi Mulatu and Chernet Tafere) carefully examine the title, Abstract, and all text of the papers in order to remove the duplicated papers from the EndNote.

Inclusion and Exclusion Criteria

This systematic review and meta-analysis were conducted within the study only in Ethiopia. We use the following criteria for the selection of the studies: Articles published within the English language, articles only conducted in Ethiopia, all articles that were published before December 18/2023, and all observational (cohort, case-control, and cross-sectional), and only studies estimated the proportion or associated factors of dietary diversity practice among 6–23 months of age. However, studies that lacked relevant information (abstracts or full texts, anonymous reports, or studies lacking clear reporting of outcomes) were excluded from this review report.

Outcome Variable

Dietary diversity is the range of foods from the eight food groups that children between the ages of 6–23 months eat. These dietary groups consist of plantains, white/pale starchy roots, tubers, and breast milk. lentils, beans, peas, almonds, and seeds Milk, infant formula, yogurt, cheese, and dairy products; flesh foods (meat, fish, fowl, and organ meats); eggs; and various fruits and vegetables that are vitamin A enrich [39]. Children are said to be following good dietary diversity practices if they have eaten five or more different foods from the eight food groups over the last twenty-four hours.

Consequently, the proportion of children with dietary diversity in the 6–23-month age range calculated as the total number of children experiencing good dietary diversity among all 6–23-month-old children was one of the study's main findings. The study's second finding was the most common correlation between feeding habits and dietary diversification.

Outcome Measurement

Determining the pooled prevalence of dietary diversity and its associated characteristics among Ethiopian children aged 6–23 months was the primary goal of this analysis. The prevalence was calculated by dividing the number of kids in the study who had good levels of dietary diversity by the total number of kids in the trial, then multiplying that result by 100. We pulled information on the variables that had been discovered to be connected to dietary variety in order to analyze the secondary outcomes (factors linked to dietary diversity).

The other criteria for selecting variables were how frequently they were reported in studies included in the meta-analysis. In examining factors associated with dietary diversity, data were extracted from the primary studies in the form of two-by-two tables and a crude odd ratio (OR) was calculated to determine the association between each of the independent variables and dietary diversity.

Quality Assessment and Data Abstraction Procedure

The studies that were found through database searches were imported into EndNote version 20 to eliminate duplicates and get the references ready for further handling. The remaining articles and abstracts were independently examined by two people (Sileshi Mulatu and Chernet Tafere) before being included in the full-text evaluation following the removal of the duplicate article. Disagreement was addressed by the third party (Destaw Edenshaw and Asnake Gashaw Belayneh), and disagreements among reviewers were resolved through discussion. The Newcastle Ottawa appraisal technique (**Supplementary Table 2**) was used to assess the quality of the included study [40].

The NOS had three categorical criteria, each of which was worth up to ten points. The NOS comprises sample representatives, the sample size, non-respondents, and the ascertainment of the exposure, Comparability, outcome, and statistical test. A study scoring six and above out of ten is considered to be of good quality by NOS. We only included high-quality primary studies to maintain the validity of our review.

Data Extraction and Analysis

The authors used Excel 2013 (Microsoft Corporation, Redmond, WA, USA) to generate the data extraction format. The format included the name of the author or authors, the study year, the year of publication, the area, the study design, the sample size and actual sample size, the proportion, and the Adjusted Odds Ratio (AOR) along with its 95% confidence interval (CI). Data were extracted and

then exported to the statistical program Stata 17 (StataCorp LLC., College Station, TX, USA) to conduct a meta-analysis. Using the Der Simonian-Laird approach and a random-effects model, a pooled analysis was carried out [41]. Ultimately, the finding was presented with several graphs, tables, and texts.

A forest plot was employed to demonstrate the prevalence of dietary diversification practices in children between the ages of 6–23 months. To provide a visual summary of the data, the estimated pooled prevalence and a 95% confidence interval were provided. We used the Cochran Q and inverse variance (I^2) statistics to assess differences between studies. Three categories for heterogeneity levels were established: low (25%), moderate (50%), and severe (75%). Significant heterogeneity among the trials was indicated by an I^2 score of more than 75% [41,42].

Subgroup analysis was conducted using study region, study area, sample size, and area of coverage. To examine publication bias, we employed funnel plot asymmetry and conducted Egger's and Begg-Mazumdar Rank correlation tests to assess publication bias. When significant evidence of publication bias was detected through these tests, we utilized trim and fill analysis within the random-effects model to determine the final effect size [43]. Furthermore, sensitivity analysis was employed to assess the influence of individual studies on the overall estimation.

Results

Search Results

A total of 1511 items from the electronic sources mentioned above were found in the first search. 1442 unique items remained after 69 duplicates were removed. 1384 papers were subsequently deemed unnecessary for this evaluation and excluded after the titles and abstracts were examined. Only 58 publications were requested to be recovered; however, 10 were rejected because the desired outcome was not addressed, and 4 of the studies used identical data from Ethiopia Demographic and Health Survey (EDHS) 2011 and 2016 [22,37,44,45] making them unsuitable for retrieval for additional analysis.

After that, 44 full-text publications were carefully evaluated in accordance with the inclusion criteria, and two research were disqualified for unclear reporting results [46,47]. In the end, 42 papers [10,20,23–36,48–73], satisfied the requirements for inclusion and were added to the meta-analysis (Fig. 1).

Characteristics of Reviewed Studies

A total of 48,916 babies and young children (6–23 months of age) together with their mothers and caregivers were included in the 42 Ethiopian studies that were included in this meta-analysis. From the total only 37 of the included papers had a cross-sectional study design based in the community, three had an institutional cross-sectional study design, and two had a community comparative cross-sectional study design. Predominantly, the highest number of threaten studies were conducted in Amhara, eleven studies were conducted in Oromia, nine studies were conducted in South Nation and Nationality, four studies were national-based study (study from the EDHS), and others were Addis Ababa, Tigray, Dridawa and Afar (Table 1, Ref. [10,20,23–36,48–73]).

Risk Bias Assessment

The study included in this systematic review and meta-analysis showed insignificant risk according to the Newcastle-Ottawa Scale quality appraisal criteria [40]. As a result, all studies were included for analysis in this review.

Publication Bias

An indication of possible publication bias in the outcome was provided by both Egger's test of the intercept and precision asymmetry funnel plots. Egger's tests produced statistically significant findings (p <0.001), and visual inspection of the funnel plot revealed an asymmetric distribution (Fig. 2). The trim-and-fill approach was utilized in the random effect model to reduce the potential impact of publication bias. Six studies were identified as missing from publication by the study (Fig. 3). There may have been an influence from the missed studies on the final results because the trim and fill analysis result was different from the original findings.

Sensitivity Analysis

According to the outcome of a random effect model, no single study has had an impact on the total pooled prevalence of dietary diversity among Ethiopian children aged 6–23 months (Fig. 4).

Prevalence of Dietary Diversity Practice among Children 6–23 Months of Age, Ethiopia, 2023

In the random effect model analysis, the overall dietary diversity practice of children age 6–23 months was 26.78% (95% CI: 23.35–30.21) with the heterogeneity index (I^2 = 98.95%, p-value <0.001), showing substantial heterogeneity of different studies. In this analysis, the dietary diversity among children 6–23 months of age ranged from 7% [20] to 74.6% [23]. The forest plot showed a distribution of weight across studies with a relatively narrow range, extending from 2.31% to 2.44% (Fig. 5).

Subgroup Analysis of Dietary Diversity among Children Age 6–23 Months of Age in Ethiopia

The subgroup analysis was conducted by region, study area, and sample size using a meta-regression model. However, only the study area was statistically significant with the dietary diversity of dietary diversity among children aged 6–23 months in Ethiopia.

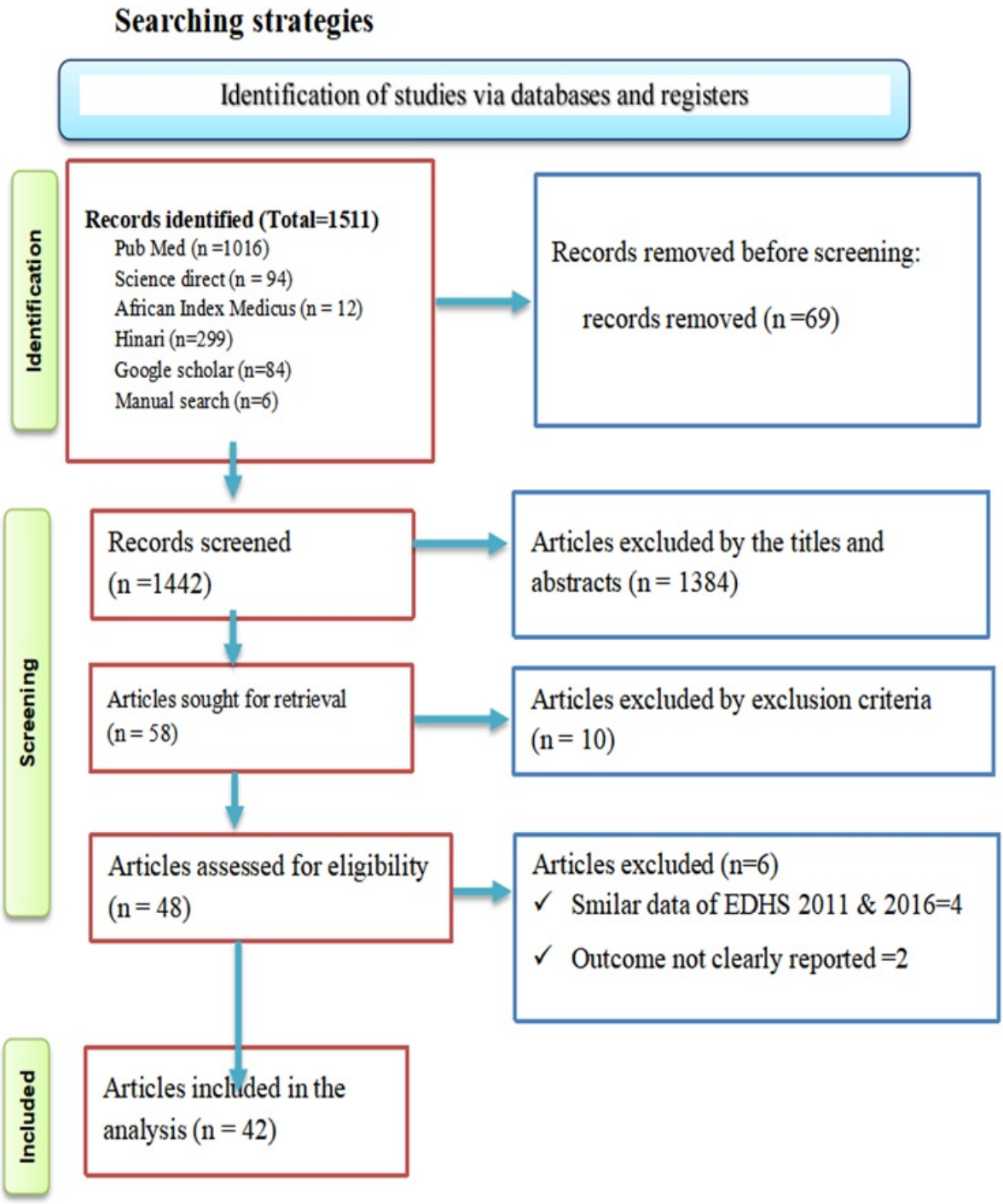

Fig. 1. PRISMA Flow Diagram illustrating the study screening process for a systematic review and meta-analysis on dietary diversity among children aged 6–23 months in Ethiopia, 2023.

In light of the substantial heterogeneity observed, we proceeded with a subgroup analysis based on the above three factors (region, study area, and sample size). Particularly, in the urban area the dietary diversity practice of children 6–23 months of age was relatively higher at 33.85% (95% CI: 22.86–44.835), and higher small sample size (≤ 423), Addis Ababa 67.37% (95% CI: 52.96–81.77) (Table 2).

Dietary diversity feeding practice and associated factors among children 6–23 months of age in Ethiopia

Out of the articles we reviewed, four of the articles [26,28,34,67] reported that maternal education being college & above (AOR: 5.377, 95% CI: 3.116–9.279), fourteen of the articles [10,23,26,28,32,34,37,48,51,52,62,67,68,71] secondary and above (AOR: 3.324, 95% CI: 1.939–5.700), five of the articles formal education [29,31,54,57,

Table 1. Descriptive summary of 42 studies included in the meta-analysis of dietary diversity among 6–23 months of age across Ethiopia, 2023.

Author (s), publication year	Regions	Study design	Sample size	Study area	Prevalence
Abebe, H., *et al.* [23] (2021).	Addis Ababa	IBC-SS	562	Urban	74.6
Aemro, M., *et al.* [48] (2013).	National	CBC-SS	2836	Mixed	10.8
Agize, A., *et al.* [24] (2017).	Oromia	CBC-SS	700	Mixed	16
Alemu, T. G., *et al.* [49] (2022).	National	CBC-SS	1578	Mixed	12.6
Getacher, L., *et al.* [31] (2020).	Amhara	CBC-SS	652	Mixed	48.8
Assefa, D. and Belachew, T. [50] (2022).	Amhara	CBC-SS	512	Mixed	18.2
Bedada Damtie, S., *et al.* [32] (2020).	Oromia	CBCC-SS	508	Urban	23
Belete, K. T., *et al.* [51] (2022).	Oromia	CBC-SS	674	Mixed	26.1
Belew, A. K., *et al.* [33] (2017).	Amhara	CBC-SS	1034	Mixed	17
Berhe Gebremichael, G.E. and Assefa, N. [52] (2017).	Oromia	CBC-SS	635	Urban	25.2
Beyene, M., *et al.* [34] (2015).	Amhara	CBC-SS	920	Urban	12.6
Bilal, S. M., *et al.* [53] (2016).	Tigray	CBCC-SS	416	Mixed	41.06
Birie, B., *et al.* [54] (2021).	Amhara	CBC-SS	430	Mixed	12.6
Bitew, S., *et al.* [30] (2020).	SNNP	CBC-SS	616	Mixed	46.1
Dafursa, K. *et al.* [55] (2019).	SNNP	CBC-SS	502	Mixed	12
Dangura, D.*et al.* [56] (2017).	SNNP	CBC-SS	417	Mixed	10.6
Dejene, Y., *et al.* [27] (2023).	Amhara	CBC-SS	359	Urban	16.7
Demie, T. G., *et al.* [57] (2021).	Amhara	CBC-SS	377	Urban	58.4
Edris, M., *et al.* [28] (2018).	SNNP	CBC-SS	405	Mixed	38
Eshete, T., *et al.* [25] (2018).	National	CBC-SS	16,650	Mixed	14.9
Eskezyiaw, A., *et al.* [35] (2015).	SNNP	CBC-SS	562	Mixed	23.3
Forsido, S. F., *et al.* [58] (2019).	Oromia	CBC-SS	558	Mixed	16.1
Gebremedhin, S., *et al.* [20] (2017).	Amhara	CBC-SS	2028	Mixed	7
Gezahegn, H. *et al.* [59] (2020).	Oromia	CBC-SS	503	Urban	39.8
Habtamu, T., *et al.* [60] (2021).	SNNP	CBC-SS	334	Urban	7.8
Kassa, T. [61] (2020).	SNNP	IBC-SS	422	Urban	26.3
Keno, S., *et al.* [10] (2021).	Oromia	CBC-SS	631	Mixed	17.32
Kuche, D., *et al.* [62] (2020).	National	CBC-SS	1848	Mixed	19.5
Kumera, G., *et al.* [63] (2018).	Amhara	CBC-SS	955	Mixed	13.6
Mekonnen, T. C., *et al.* [64] (2017).	SNNP	CBC-SS	623	Urban	27.3
Molla, A., *et al.* [26] (2021).	Amhara	CBC-SS	531	Mixed	31.6
Molla, W., *et al.* [65] (2021).	Oromia	CBC-SS	665	Mixed	29.9
Sagaro, G.*et al.* [66] (2017).	SNNP	CBC-SS	939	Mixed	43.2
Sema, A., *et al.* [29] (2021).	Dire Dawa	CBC-SS	451	Urban	24.4
Solomon, D., *et al.* [67] (2017).	Addis Ababa	IBC-SS	352	Urban	59.9
Tefera, T. B., *et al.* [68] (2020).	Oromia	CBC-SS	508	Mixed	23
Tegegne, M., *et al.* [69] (2017).	Oromia	CBC-SS	810	Mixed	28.5
Temesgen, H., *et al.* [36] (2018).	Amhara	CBC-SS	736	Mixed	13
Worku, T., *et al.* [70] (2020).	Amhara	CBC-SS	832	Mixed	29.9
Wuneh, A. G., *et al.* [71] (2019).	Afar	CBC-SS	2834	Mixed	21.8
Yazew, T. and Daba, A. [72] (2020).	Oromia	CBC-SS	500	Mixed	47.8
Yesuf, N. N., *et al.* [73] (2021).	Amhara	CBC-SS	511	Urban	44.6

SNNP, Southern Nations, Nationalities, and Peoples' Region; CBC-SS, Community-Based Cross-sectional study; CBCC-SS, Community-Based Comparative Cross-sectional study; IBC-SS, Institutional Base Cross-sectional study.

65] (AOR: 2.484, 95% CI: 1.722–3.583), and four articles [10,28,48,60] primary education (AOR: 3.065, 95% CI: 2.275–3.129) had higher odds of mothers with no formal educations.

This review also highlighted the significance of the father's education with the outcome variable. Out of the total article only two articles [23,24] educational status being secondary and above (AOR: 2.837, 95% CI: 1.981–4.065) and three studies [23,25,26] (AOR: 2.082, 95% CI: 1.016–4.266), educational status being primary fathers were feed diversified food for their child compared to fathers with no formal education.

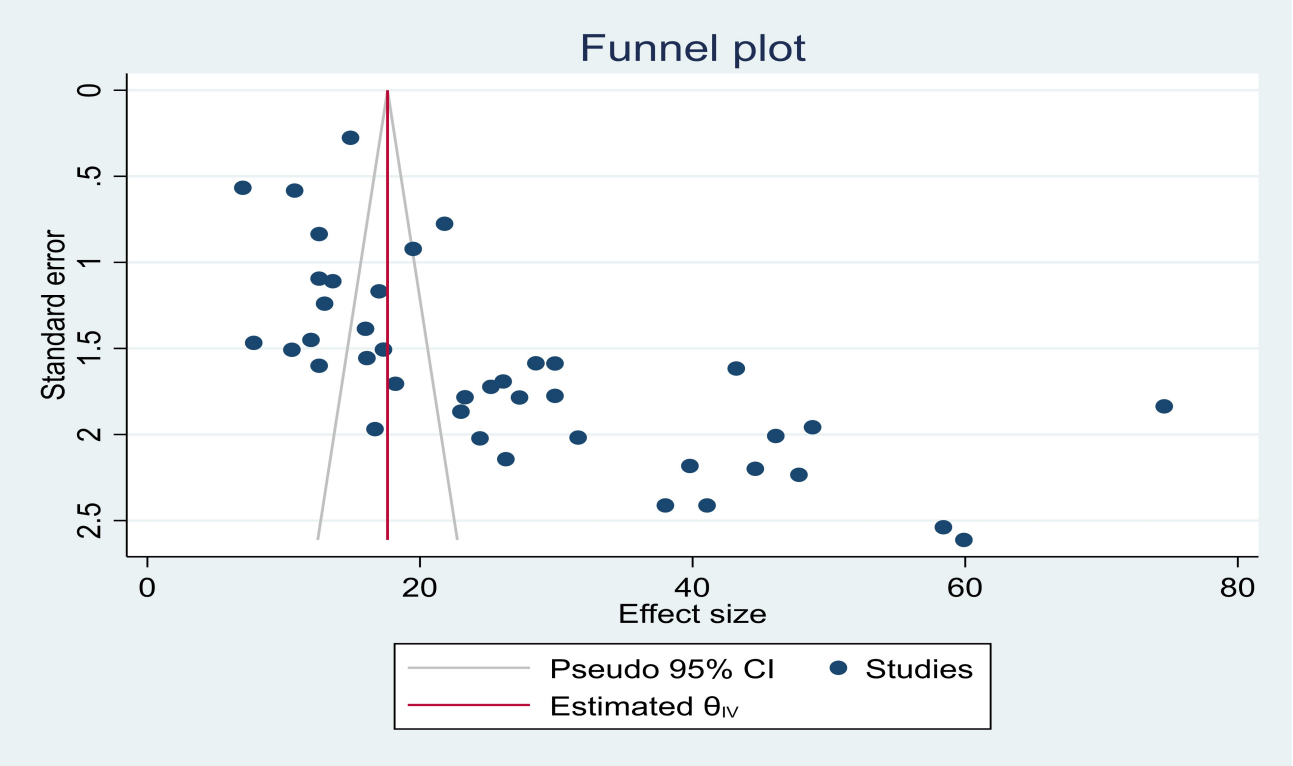

Fig. 2. Funnel plot showing the asymmetric distribution of 42 articles on dietary diversity among 6–23 months of age across Ethiopia, 2023.

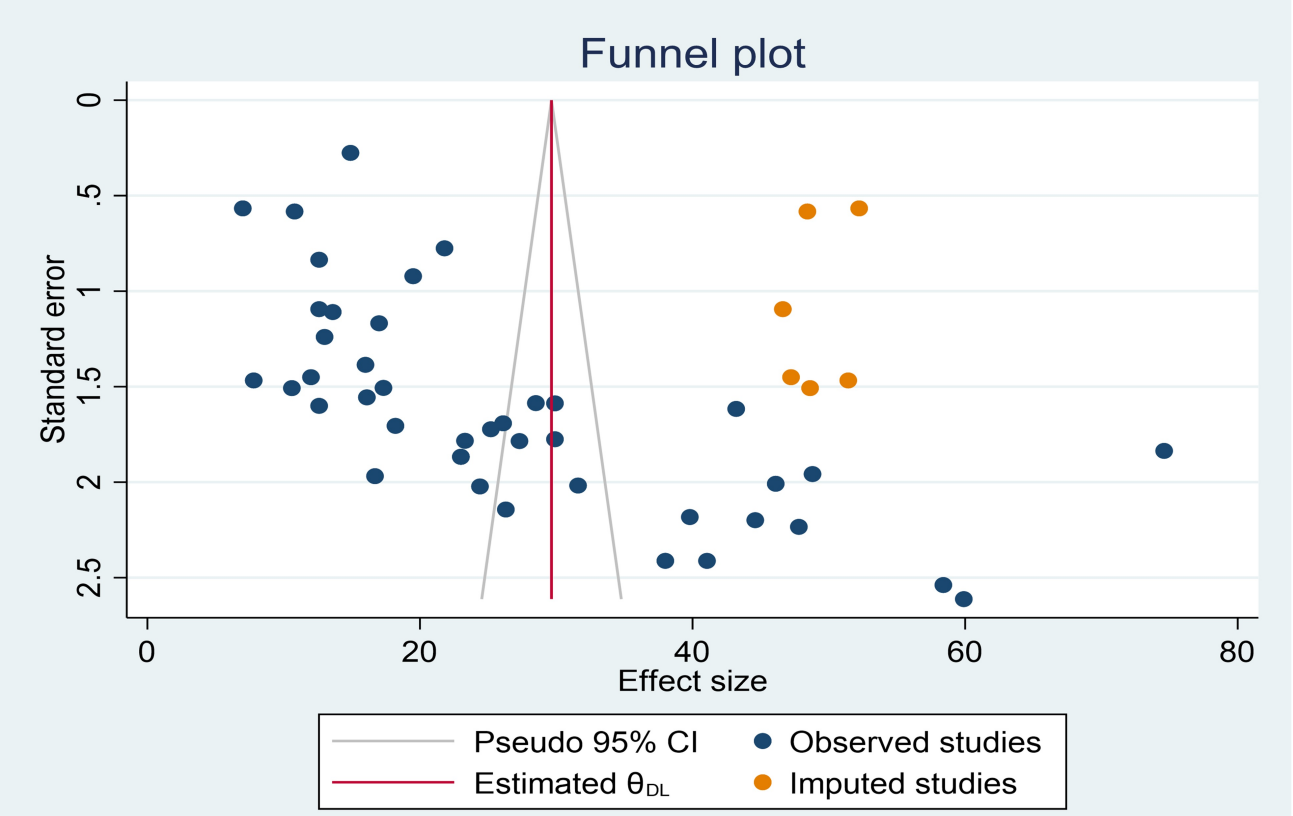

Fig. 3. The trim fill analysis showed the pooled prevalence when the unpublished studies were filled.

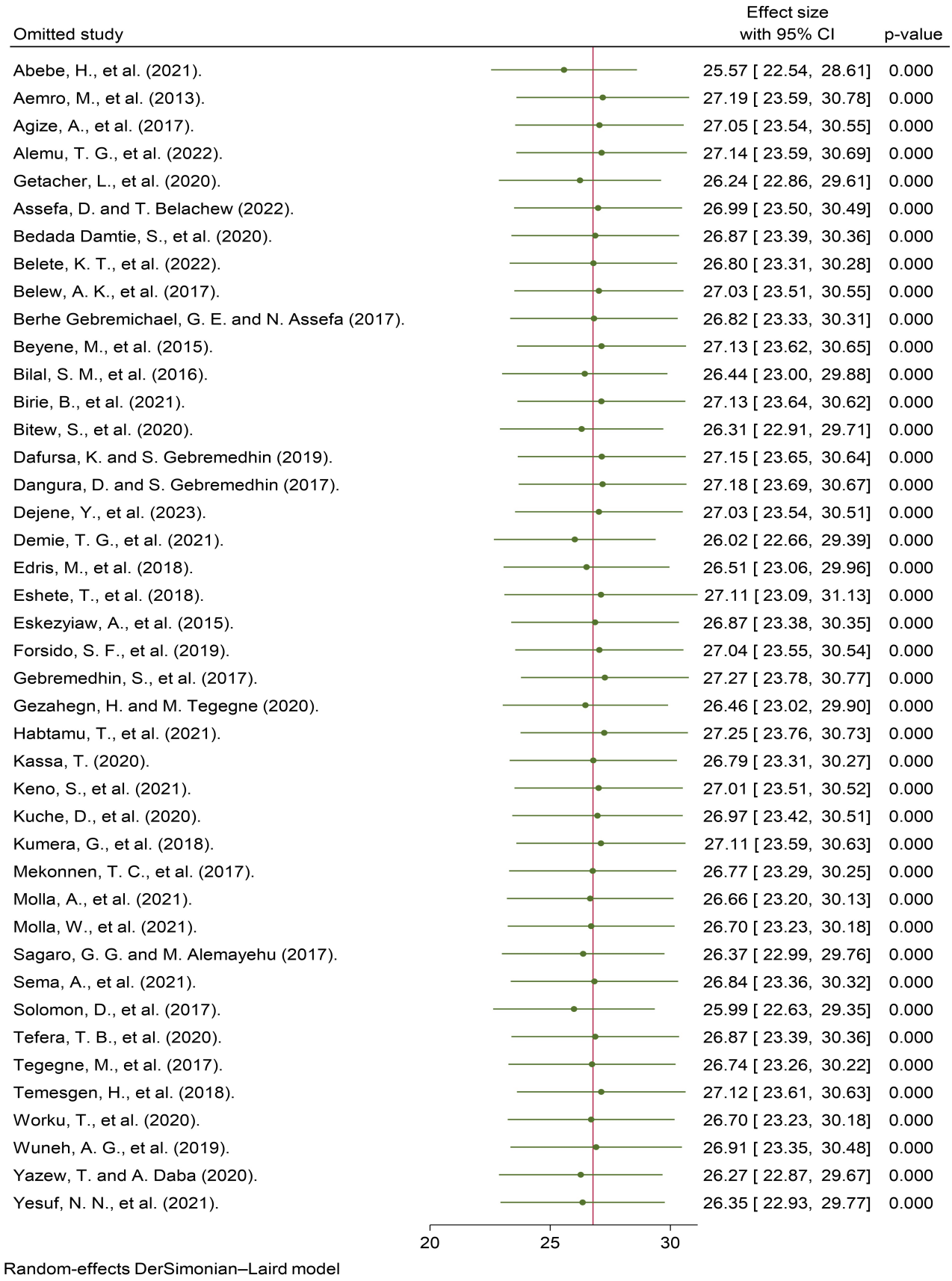

Fig. 4. Sensitivity analysis of dietary diversity practice among children 6–23 months of age in Ethiopia, 2023 (n = 42).

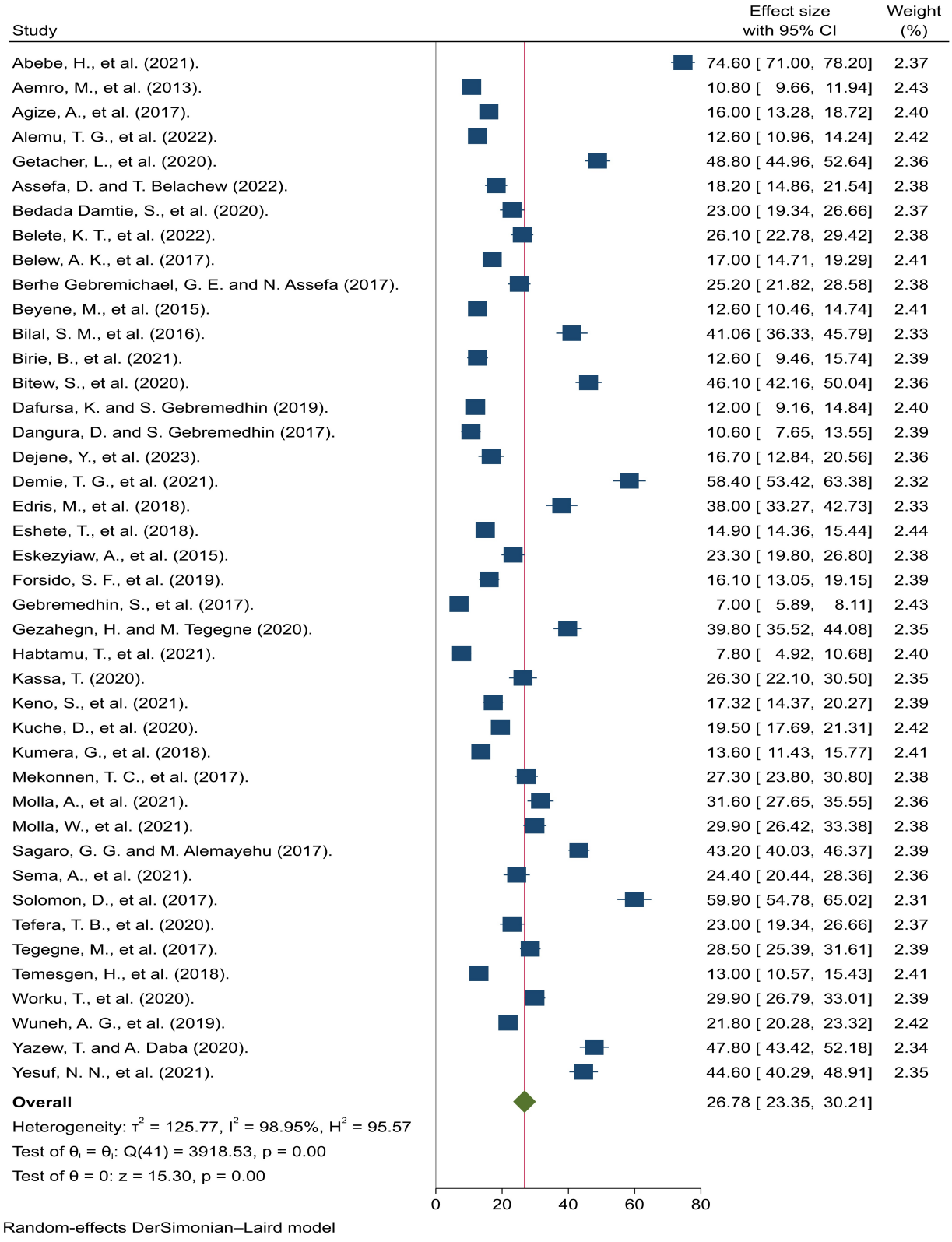

Fig. 5. A forest plot of dietary diversity practice among children 6–23 months of age in Ethiopia, 2023 (n = 42).

This meta-analysis revealed that the odds of the father's occupation being merchant [51,57], (AOR: 2.739, 95% CI: 1.355–5.539), and [32,68] (AOR: 2.27, 95% CI: 1.438–3.585) fathers practice feeding recommended diversified food than those government employee and daily laborers respectively. In addition, three studies [23,57,71] mothers' occupations being housewives (AOR: 3.636, 95% CI: 2.457–5.381) more practice feeding diversified food

Table 2. Subgroup analysis of dietary diversity among children age 6–23 months of age based on the two variables.

Sub-group variables	No of studies	Pooled DDs rate (95% CI)	I^2 (*p*-value)
Study area			
Mixed	29	23.62 (20.43–26.81)	98.58 (<0.001)
Urban	13	33.85 (22.85–44.84)	99.18 (<0.001)
Sample size			
Small (<423)	8	32.27 (18.55–45.98)	98.96 (<0.001)
Large (>423)	34	25.53 (21.98–29.09)	98.95 (<0.001)
Region			
Addis Ababa	2	67.37 (52.96–81.77)	99.02 (<0.001)
Afar	1	Single study	Single study
Amhara	13	24.79 (17.77–31.81)	98.68 (<0.001)
Dridawa	1	Single study	Single study
National	4	14.40 (11.49–17.32)	96.04 (<0.001)
Oromia	11	26.51 (21.28–31.75)	98.98 (<0.001)
SNNP	9	26.02 (16.47–35.57)	98.96 (<0.001)
Tigray	1	Single study	Single study
Total	42	26.78 (23.35–30.21)	98.95 (<0.001)

CI, confidence interval; DDs, Dietary Diversity score.

than governmental employees, other two studies [52,64] housewives (AOR: 2.359, 95% CI: 1.582–3.626) were practice diversified food than private workers and two studies (AOR: 3.580, 95% CI: 2.379–5.387) being employed were practice to feed recommended diversified food compared to unemployed.

On the other hand, seven studies [23,24,27,29,52,64,71], reported that male children get the recommended diversified food than female. Similarly, seven studies showed that child age significantly affected the dietary diversity among 6–23 months. Being in the range of 18–23 months of age [10,26,33,34,48,52,62], (AOR: 2.470, 95% CI: 1.568–3.987), and four studies in the range of 12–17 months of age [26,33,34,48] with (AOR: 2.460, 95% CI: 1.914–3.163) practice feeding diversified food than children 6–11 months of age.

Having PNC follow-up nine studies [10,29,30,33,51,59,69–71], counseling about IYCF-Practice six studies [10,23,24,26,27,69], with the (AOR: 3.155, 95% CI: 2.104–4.732) and (AOR: 2.960, 95% CI: 2.288–3.829) than those who had no PNC follow-up and no counseling about IYCF-practice respectively. Six studies [26,27,31,52,69,73] reported that childhood illness was one significant variable in dietary diversity practice. Previous history of childhood illness also significantly affects the practice of feeding recommended food. In this review report, children without previous childhood illnesses received the recommended food (AOR: 2.420, 95% CI: 1.765–3.318).

In our study, only nine studies [23,24,27,28,31,32,67,68,73] reported that the mother's knowledge about the importance of dietary diversity was significantly associated with the feeding practice. Children from mothers with adequate knowledge about diversified feeding practices were four times more likely to feed diversified food as compared to those with inadequate knowledge (AOR: 3.897, 95% CI: 2.682–5.662).

Two studies [28,34], being urban residency 2 times more than rural, (AOR: 2.266, 95% CI: 1.387–3.702), four studies [10,28,29,70], had a history of ANC follow-up were a significant factor for dietary diversity. Children from mothers who had a history of were 2 times more likely to feed diversified food as compared to their counterparts (AOR: 2.372, 95% CI: 1.580–3.561), similarly, five studies [26,33,35,59,70], child those who had growth monitoring practice were two times more likely to had diversified food as compared to their counterpart (AOR: 1.910, 95% CI: 1.529–2.387).

In this meta-analysis, eight studies [25,32–34,36,54,63,68] showed that media exposure significantly affected the practice of good dietary diversity (AOR: 3.445, 95% CI: 2.799–4.240), and three studies [23,24,33] reported that mothers age 25–34 years, and only two studies[10,32] reported that mothers' age 35–44 years (AOR: 1.602, 95% CI: 1.166–2.200), and (AOR: 2.621, 95% CI:1.539–4.464) were more likely to practice diversified food practice as compared to maternal age 15–24 years of age, respectively.

Five studies [26,31,34,50,60] reported that children from households who had home grading were two times more likely to practice good dietary diversity (AOR: 2.445, 95% CI:1.824–3.278), and only two studies [30,31] reported that food security was also significant variable to dietary diversity. Children from food-secure households were three times more likely to feed diversified food compared to food-insecure households (AOR: 3.419, 95% CI: 2.305–5.072). On the other hand, in this meta-analysis place of delivery significantly affects the practice of dietary diversity.

Four studies [29,35,36,54] reported that mothers who give birth at the health institution were three times more likely to practice good dietary diversity than those who give birth at home (AOR: 3.206, 95% CI: 2.232–4.605).

We have tested the associations of the availability of cow milk [35,36,50] with the feeding practice of diversified food for children aged 6–23 months, households who had cow milk were four times more likely to practice feeding the recommended diversified food to their child as compared to those who had no cow milk (AOR: 4.063, 95% CI: 1.374–12.016).

Lastly, households' wealth index is the most pertinent significant variable for the outcome. In this review report, only twelve research demonstrated a significant correlation between children aged 6–23 months and the wealth index and dietary diversity. Four studies [25,48,52,62] in the review describe that the richest household (AOR: 2.690, 95% CI: 1.498–4.753), five studies [10,31,54,65,66] and three [10,31,66] studies high monthly income household (AOR: 3.754, 95% CI: 2.090–6.743) and middle monthly income household (AOR: 2.866, 95% CI: 1.843–4.456), compared to low wealth index were feed diversified food than the low households (Table 3).

Discussion

This study combined and analyzed data from multiple previous studies to estimate the overall prevalence and associated factors of diverse dietary feeding practices among Ethiopian children aged 6–23 months. The pooled prevalence rate was 26.78% (95% CI: 23.35–30.21), comparable to studies in Mozambique (27.4%) [74], Sub-Saharan African Countries (25.1%) [6], Gambia (22.22%) [75] three Sub-Saharan African Countries (23.2%) [76], Myanmar (20.9%) [77], Tanzania (26%) [78], and 33 Sub-Saharan African Countries (23.47%) [79]. The similarity may be due to the socioeconomic conditions shared by these low-income, predominantly Sub-Saharan African countries.

But compared to similar studies conducted globally, such as those, in Brazil (63.4%) [80], two studies in Bangladesh (38%) [81], and (37.47%) [82], Cameroon (48.4%) [83], Ghana (45%) [84], Pakistan (44.1%) [85], India (38%) [86], and South-West Nigeria (48.6%) [87]. The discrepancies may be due to the inclusion of multiple studies with low dietary diversity prevalence, which lowers the overall estimate.

Compared to the studies in Burkina Faso (18.3%) [88], Haiti (7.3%) [89], Angola (11.2%) [90], Ghana (17.1%) [91], and India (12.6%) [92]. In this review, the prevalence of dietary diversity among 6–23 months children was higher. These discrepancies may be due to differences in study settings, sample sizes, and socio-demographic characteristics.

Evidence in Ethiopia shows varying prevalence of dietary diversity across different areas. Our review found higher prevalence in urban areas, confirmed by subgroup analysis showing better dietary diversity in urban studies compared to mixed areas.

According to this review, mother education was found to be a significant predictor of dietary diversity among Ethiopian children aged 6–23 months. In comparison to mothers without any formal education, over two-thirds of the research revealed that mothers with formal education (primary, secondary, college, or above) were fed their children a diversified food.

This study confirms the overwhelming body of research showing that maternal education greatly increases the variety of a child's food between the ages of 6–23 months, as seen in studies from Haiti [89], Sub-Saharan African Countries [76], Myanmar [77], and two studies in Bangladesh [82,93] respectively.

Furthermore, compared to fathers without any formal education, fathers with secondary or primary education were two and three times more likely to provide their kids with a variety of diversified food, respectively. Like moms, educated fathers probably recognize the value of a varied diet., as supported by studies in Angola [90] and 42 African countries [94].

Fathers' occupation as merchants, compared to government employees or daily laborers, increased the likelihood of providing a diverse diet due to better income. Likewise, mothers who were housewives or employed had higher odds of feeding diverse foods compared to unemployed mothers, supported by studies in Sub-Saharan African Countries [79], Urban Pakistan [85], and Bangladesh [93].

Male children were twice as likely to receive diverse diets compared to females, possibly due to parental preference. Compared to children aged 6–11 months, those aged 12–17 and 18–23 months had a 2.5 times higher chance of having a varied diet because older children are more able to adjust to a wider variety of foods. This is supported by research in Bangladesh [93], Nigeria [87], Urban Pakistan [85], Gambia [75], and East and Southern Africa [74].

In children aged 6–23 months, this review identified substantial relationships between dietary diversity and various factors. Children from mothers who had a history of PNC were 3.1 times more likely to feed diversified food to their child as compared to those who had no history of PNC as they had more information regarding the importance of feeding a diversified food for their children [10,29,30,33,51,59,69–71]. Information from the care provider about infant and young child feeding practices increases the maternal practice of feeding diversified food to their child. Childhood illness was also one important factor that influenced diversified food practices. Children with previous infection or a history of recent illness were 2.4 times more likely to have diverse diets, aligning with studies in Sub-Saharan African Countries [79] and Bangladesh [93].

Table 3. An overview of the factors influencing dietary diversity in Ethiopia, 2023.

Factor	No of studies	Pooled AOR (95% CI)	I^2 (*p*-value)	Ref. category
Mat. Edu. College & above	4	5.377 (23.116–9.279)	0.00 (0.0000)	no formal. Edu
Maternal Edu. Sec & above	14	3.324 (1.939–5.700)	90.91 (0.000)	no formal. Edu
Maternal Edu. Primary	4	3.065 (2.275–3.129)	0.00 (0.0000)	no formal. Edu
Maternal Edu. Formal Edu.	5	2.484 (1.722–3.583)	0.00 (0.0000)	no formal. Edu
Fathers Edu. ≥Secondary	2	3.276 (2.001–5.366)	0.00 (0.0000)	no formal. Edu
Fathers Edu. Primary	3	1.649 (1.081–2.517)	57.42 (0.0204)	no formal. Edu
Fath. occupation/Merchant	2	2.739 (1.355–5.539)	0.00 (0.0050)	Gov. employee
Fath. occupation/Merchant	2	2.270 (1.438–3.585)	0.00 (0.0004)	daily laborers
Mothers' occupation (HW)	3	3.636 (2.457–5.381)	0.00 (0.0000)	Gov.employee
Mothers' occupation (HW)	2	2.359 (1.360–4.094)	0.00 (0.0023)	private
Mothers' Occu. (Employed)	2	3.580 (2.379–5.387)	0.00 (0.0000)	unemployed
Child sex (male)	7	1.877 (1.185–2.972)	82.94 (0.0073)	female
Child age (18–23 months)	7	2.470 (1.568–3.987)	93.69 (0.0024)	6–11 months
Child age (12–17 months)	4	2.460 (1.914–3.163)	0.00 (<0.001)	6–11 months
PNC follow-up (yes)	9	3.155 (2.104–4.732)	83.11 (<0.001)	no
Counseling (IYCF)	6	2.960 (2.288–3.829)	0.00 (0.0000)	no
Child illness (no)	6	2.420 (1.765–3.318)	39.05 (0.0000)	yes
Mothers' knowledge(good)	9	3.897 (2.682–5.662)	72.59 (0.0000)	poor
Residency (Urban)	2	2.065 (1.585–2.689)	0.00 (0.0011)	rural
Hx. of ANC (yes)	4	2.372 (1.580–3.561)	39.44 (0.0000)	no
Growth monitoring (yes)	5	1.910 (1.529–2.387)	24.06 (0.0000)	no
Media exposure (yes)	8	3.445 (2.799–4.240)	0.00 (0.0000)	no
Mothers' age (25–34 years)	3	1.602 (1.166–2.200)	0.00 (0.0000)	15–24 years
Mothers' age (35–44 years)	2	2.621 (1.539–4.464)	0.00 (0.0004)	15–24 years
Home grading practice/yes	5	2.445 (1.824–3.278)	0.00 (0.0000)	no
Food security/(secure)	2	3.419 (2.305–5.072)	0.00 (0.0000)	insecure
Place of delivery (HF)	4	3.206 (2.232–4.605)	0.00 (0.0000)	home
Availability of cow milk/yes	3	4.063 (1.374–12.016)	87.52 (0.0113)	No
Monthly income (richest)	4	2.696 (1.498–4.753)	77.95 (0.0009)	poorest
Monthly income (high)	5	3.754 (2.090–6.743)	76.32 (0.0000)	low
Monthly income (middle)	3	2.866 (1.843–4.456)	41.70 (0.0000)	low

AOR, Adjusted Odds Ratio; ANC, Antenatal Care; PNC, Postnatal Care; Mat. Edu., Maternal education; Edu., Education; Gov., government; Occu., Occupation; IYCF, infant and young child feeding.

Mothers' good knowledge of IYCF practices increased the likelihood of dietary diversity by four times, indicating the importance of maternal education and health professional counseling during antenatal care (ANC) and PNC. ANC follow-up increased the odds of diverse feeding by 2.4 [95] times, more likely to feed due to counseling about complementary and diversified feeding practices [82,93,96]. Food-secure households were 3.4 times more likely to provide diverse diets [83], while the availability of cow milk increased the likelihood by four times. This underscores the importance of household food security and access to key food items in promoting dietary diversity for children.

Children of mothers residing in urban areas were twice as likely to receive a diversified diet compared to their counterparts. This difference may be attributed to urban mothers having greater exposure to media and thus possessing better knowledge about diversified foods. This finding is supported by evidence from Bangladesh [93], and Sub-Saharan African Countries [79].

In this meta-analysis, children whose growth was monitored were twice as likely to receive diversified food compared to those without growth monitoring. This suggests that mothers with growth-monitored children may be more informed about nutritional needs and dietary diversity. Additionally, mothers who were exposed to the media were 3.4 times more likely to offer a variety of foods, suggesting that the media may help mothers become more knowledgeable about how to feed their infants and young children. Research from Bangladesh [81,93], Gambia [75], and Sub-Saharan African Countries [79] have supported this conclusion.

In this review article, maternal age was one important significant variable. Maternal aged 25–34 aged, and 35–44

years were 1.6 and 2.6 times more likely to provide diversified food for their child respectively. This aligns with findings from rural South-West Nigeria [87]. This may be due to older mothers having increased experience and adequate knowledge about child-feeding practices.

Additionally, the availability of home gardening was associated with the outcome variable, as reported in five studies. Homes with home gardening tended to offer more diverse foods, likely because they had access to a wider variety of fresh produce.

Moreover, the household wealth index was significantly associated with feeding diversified food. The wealthier households were more likely to feed diversified food as compared to the poorest households. Children from high-wealth index households are 3.7 times more likely to feed compared to the poorest. Similar associations were observed in studies from Gambia [75], Myanmar [77], Sub-Saharan African Countries [79], and Cameron [83]. This suggests that mothers from wealthier households, categorized as rich, high, or middle wealth index, are better able to afford a diverse range of diversified foods for their children, ensuring access to a variety of nutritional options.

Finally, in this review article place of delivery was one important significant factor for dietary diversity among children aged 6–23 months. Compared to mothers who gave birth at home, those who gave birth in the health institution were 3.2 times more likely to feed their children a variety of foods. This may be because health facility deliveries are often accompanied by counseling from health professionals regarding dietary diversity, as supported by studies in Myanmar [77], Sub-Saharan African Countries [79], and Bangladesh Demographic Health Survey 2017–2018 [96].

In this systematic review and meta-analysis, nearly all of the reviewed articles were community-based, and institutional-based cross-sectional study designs. Therefore, findings from this study may be poor generalization to the entire population of interest.

Conclusion

In this systematic review and metanalysis, the finding revealed a low aggregated prevalence of the recommended dietary diversity feeding among children aged from 6–23 months in the study area, with nearly one-fourth meeting the recommended diversified food.

In our study findings: maternal and paternal educational and occupational status, maternal age and knowledge of the mothers about IYCF practice, sex of the child, child age, history of childhood illness, history of ANC and PNC, food security, residency, availability of cow milk, child growth monitoring, maternal media exposure, place of delivery, availability of home gardening, and household wealth index were scientifically significant factors. Given that many of these factors are preventable and health-related, we strongly recommend efforts to increase parental awareness and knowledge of feeding diversified foods for IYCF. Addressing this issue will require multi-disciplinary involvement and cooperation from the government, Ministry of Health, health facilities, and health professionals to strengthen maternal health service utilization and empower women.

Availability of Data and Materials

Data included in article/supplementary material/referenced in the article.

Author Contributions

SM, AGB, CT, and OA were actively involved in the conceptualization, Data extraction, and formal analysis. YTT, STM, GBM, MAM, and AEB were actively involved in searching the studies from different databases and assessing the validation of the results. SM took a role in quality assessment, result writing, statistical analysis, and preparation of manuscripts. In general, all authors listed have made significant contributions starting from the initiation of the idea to finalizing the review reports, and substantially contributed to the writing and critical revisions. We all confirmed the final version of the manuscript and agreed to be accountable for all aspects of the work.

Ethics Approval and Consent to Participate

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Conflict of Interest

The authors declare no conflict of interest.

Supplementary Material

Supplementary material associated with this article can be found, in the online version, at https://doi.org/10.24976/Discov.Med.202436186.141.

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