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Meta-analysis

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Meta Analysis: Effects of Household Size, Maternal Education, and Family Income on Stunting

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ABSTRACT

Background: Nutrition is a requirement for every toddler. Inadequate nutritional intake will cause stunting problems. Stunting is a condition of failure to thrive in children where toddlers are shorter in age. This study aims to examine the effect of the number of family members, mother's education and family income on stunting by using meta-analysis.
Subjects and Method: This was a systematic review and meta-analysis. Population was infants aged 6-59 months. Intervention: high number of family members, high mother's education, high family income. Comparison: low number of family members, low mother's education and low family income. Outcome: stunting. The online databases used are PubMed, Google Scholar, springerlink, and Science Direct with the keywords Stunting AND ("Family Size OR "Household Size") AND ("Maternal Education" OR "Mother's Education") AND "Wealth Status" OR "Household income") AND "Cross sectional" AND aOR. There were 13 published cross-sectional studies from 2016-2022 that met the inclusion criteria. Analysis was performed using RevMan 5.4.
Results: A meta-analysis was carried out on 13 articles with a cross-sectional study design originating from Ethiopia, Nigeria and Zambia and involving 63,888 aged 6-59 months. The results of the meta-analysis show that toddlers with a high number of family members have a risk of stunting 1.43 times compared to a low number of family members (aOR = 1.43; 95% CI = 1.17 to 1.75; p<0.001), toddlers with low maternal education can reduce stunting 0.65 times compared to mothers with high education (aOR= 0.65; 95% CI= 0.48 to 0.88; p= 0.005) and toddlers with low family income can reduce the risk of stunting 0.53 times compared to high family income (aOR= 0.53; 95% CI= 0.47 to 0.59; p<0.001).
Conclusion: Toddlers with a high number of family members can increase the risk of stunting while high maternal education and low family income can reduce the risk of stunting.

Keywords: number of family members, mother's education, family income, stunting

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BACKGROUND

Nutrition is the foundation for the survival and development of a child. Children who have adequate nutrition will have better growth, development, learning abilities, play, resilience, and participation in their environment compared to those who are stunted. Stunting is a condition of failure to

thrive in toddlers (babies under five years) due to chronic malnutrition so that children are too short for their age (TNP2K, 2017). Approximately 144 million children under the age of 5 years have height (short) that does not match their age and low cognitive abilities (UNICEF, 2021).

The highest prevalence of stunting under five was in West Sulawesi at 35.0%, Papua at 34.6%, East Nusa Tenggara (NTB) at 32.7%, Aceh at 31.2% and West Papua at 30.0% (Kemenkes RI, 2022). The government's efforts to reduce this incident can be seen in the Riskesdas data from 2013 of 37.6%, down to 30.8% in the 2018 Riskesdas data. Ofcourse, this figure is not very convincing because it is still below the benchmark for global health quality (Muktiyo, 2020).

Stunting occurs due to several complex and interrelated factors (Oktaviani et al. 2022). The number of family members >5 affects 1.07 times experiencing stunting compared to the number of family members <5 (Muche et al., 2021). A large number of family members will affect stunting if it is not matched by high income because it will cause the amount of nutrients that should be for one child but must be shared for other children as well (Tariku et al., 2017)

Maternal education is a factor influencing stunting where low maternal education is 1.68 times more influential than high maternal education (Afework et al., 2021). Mothers who have higher education will have the knowledge so they are able to practice nutritional behavior, seek better health to prevent stunting in toddlers. Education improves skills and is strongly linked to various socioeconomic factors including lifestyle, income, and fertility at the individual and community levels (Muche et al., 2021).

Families who have low income affect 2.07 times compared to high income. This is because families with low incomes cannot afford nutritious and varied food (Tariku et al., 2017). Other research states that the economic status of households is related to nutritious food at the household level which determines the growth and development of children in early in life (Muche et al., 2021).

This study aimed to estimate the effect of the number of family members, mother's education and family income on stunting stunting.

SUBJECTS AND METHOD

1. Study Design

This meta-analysis was carried out using the PRISMA flowchart using online databases such as Google Scholar, Pro-quest, Science Direct, and Springerlink which published 2016 to 2022. The keywords used were Stunting AND ("Family Size OR "Household Size") AND ("Maternal Education" OR "Mother's Education") AND "Wealth Status" OR "Household income") AND "Cross sectional" AND aOR. There were 13 primary studies with cross-sectional research designs published in 2016-2022 that met the inclusion criteria. Analysis was performed with RevMan 5.4 software.

2. Steps of Meta-Analysis

The meta-analysis was carried out through 5 steps as follows:

1) Formulate research questions using the PICO model. Population: toddlers aged 6-59 months. Intervention: high number of family members, higher education and higher income. Comparison: low number of family members, low education and low family income. Outcome: stunting.
2) Search for primary study research articles from online databases.
3) Conduct screening and quality assessment of primary research articles.
4) Extract and analyze data into RevMan 5.4 software.
5) Interpret results and draw conclusions.

3. Inclusion Criteria

The full paper article uses a cross sectional design, the size of the relationship used Odds Ratio (OR), and the analysis used adjusted Odds Ratio (aOR), the research subjects are toddlers aged 6-59 months, the independent variables are number of family members, education mother and family income and the research outcome is stunting.

4. Exclusion Criteria

Articles published before 2016 and non-cross-sectional study design.

5. Operational Definition of Variables

Stunting: is a condition of failure to thrive in toddlers with a z-score <-2 for HFA (height for age)/height for age.

The number of family members: is the number of children in the family

Mother's education: is the last formal education taken by the mother

Family income: is the income earned by the family every month.

6. Study Instruments

The quality assessment of articles in this study used a critical assessment checklist for cross-sectional studies published by the Joanna Briggs Institute (JBI).

7. Data Analysis

The articles in this study were collected using the PRISMA diagram and analyzed using the Review Manager 5.4 application by calculating the effect size and heterogeneity (I^2) to determine the combined research model and form the final results of the meta-analysis. The results of data analysis are presented in the form of forest plots and funnel plots.

RESULTS

The process of searching for primary articles related to the influence of family size, maternal education and family income on stunting in this meta-analysis study was carried out using 4 online databases namely Google Scholar, Pro-quest, Science Direct and Springerlink. There were 13 articles included in this meta-analysis which can be seen in Figure 1. PRISMA flowchart.

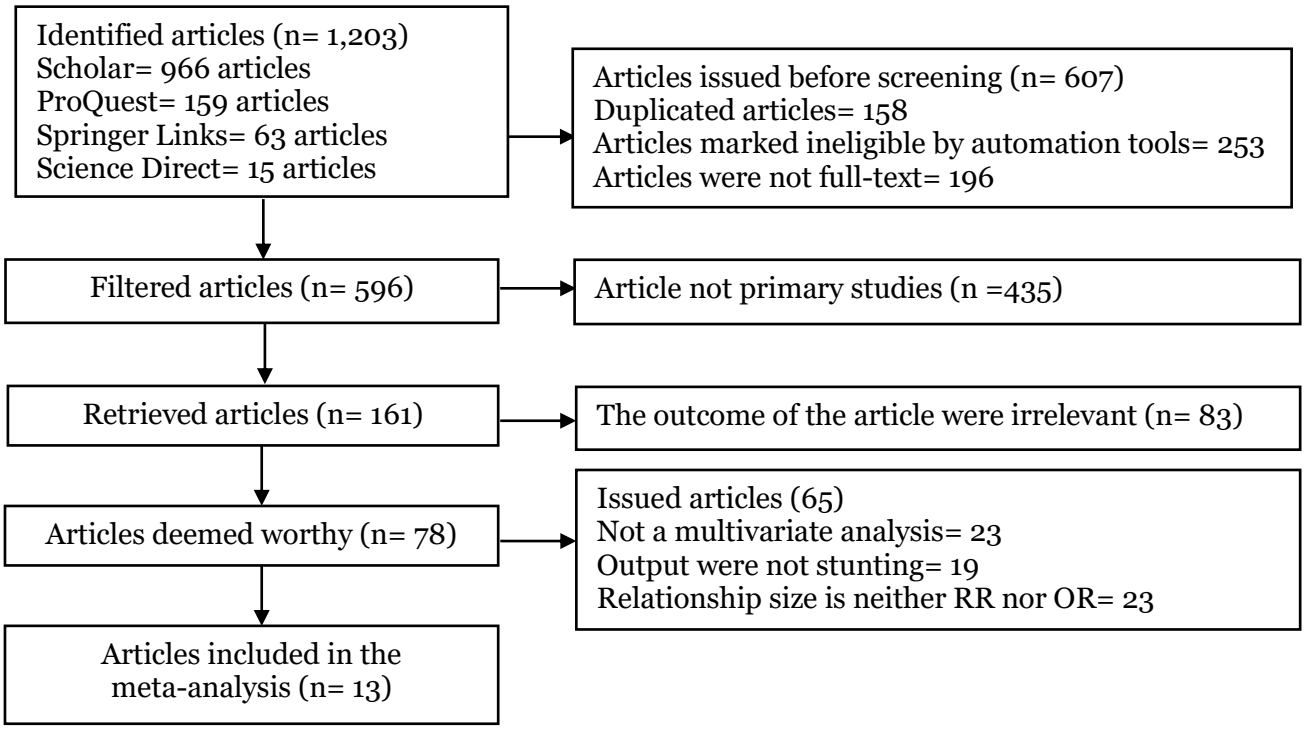

Figure 1. PRISMA Flow Diagram

The total number of articles in the initial search process was 1,203 articles with Google schoolar details of 966 articles, ProQuest= 159 articles, Springerlink= 63 articles, Science Direct= 15 articles. 607 articles were deleted and 596 articles were filtered out. Out of a total 78 eligible full-text articles, 13 were included in the synthesis meta-analysis. Full text articles are included in the exclusion criteria for the following reasons. The results and interventions from the study did not match the PICO criteria or formula in this study. The study subjects were not aged 6 to 58 months, did not include adjusted odds ratio (aOR), results of logistic regression analysis multivariate, research design other than cross sectional, the operational definitions of the variables of the number of family members, mother's education and family income are not in accordance with the operational definitions of these variables in the study.

Figure 2 shows the area of distribution of the primary articles used in this study on the African continent.

Figure 2. Map of the study area on the effect of family size, mother's education and family income on stunting

Table 1. Critical appraisal checklist for cross-sectional studies in meta-analysis

Articles	Questions Checklist								Total
	1	2	3	4	5	6	7	8	
Afework et al. (2021)	2	2	2	2	2	2	2	2	16
Azmeraw et al. (2021)	2	2	2	2	2	2	2	2	16
Dake et al. (2019)	2	2	2	2	2	2	2	2	16
Geberselassie et al. (2018)	2	1	2	2	2	2	2	2	15
Gebrie and Benti (2021)	2	2	2	2	2	2	2	2	16
Gelu et al. (2018)	2	2	2	2	2	2	2	2	16
Mela et al. (2021)	2	2	2	2	2	2	2	2	16
Mengesha et al. (2021)	2	2	2	2	2	2	2	2	16
Muche et al. (2021)	2	2	2	2	2	2	2	2	16
Nkhoma et al. (2021)	2	2	2	2	2	2	2	2	16
Shine et al. (2017)	2	2	2	2	2	2	2	2	16
Tariku et al. (2017)	2	2	2	2	2	2	2	2	16
Yazew (2022)	2	2	2	2	2	2	2	2	16

Description of the question criteria:

1 = Were the criteria for inclusion in the sample clearly defined?
2 = Were the research subjects and settings explained in detail?
3 = Is exposure measured in a valid and reliable way?
4 = What are the standard criteria used for measuring objective conditions?
5 = Were confounding factors identified?
6 = Were strategies for dealing with confounding factors stated?
7 = Were the results measured in a valid and reliable way?
8 = Was proper statistical analysis used?

Description of the answer score:

0 = No
1 = Can't tell
2 = Yes

Table 2. Description of the primary cross-sectional study included in the meta-analysis

Author (year)	Country	Sample size	P	I	C	O
Afework et al. (2021)	Ethiopia	767	<5 years	Number of family members >5, Secondary and above, Rich household wealth	Number of family members <5, No formal education, Poor household wealth	stunting
Azmeraw et al. (2021)	Ethiopia	845	Infants aged 6-59 months	Richest wealth index	The poorest wealth index	stunting
Dake et al. (2019)	Ethiopia	342	Infants aged 6-59 months	Number of family members >5, Above secondary Revenue >15,000 ETB	Number of family members <5, Unable to read and write Income < 750 ETB	stunting
Geberselassie et al. (2018)	Ethiopia	1,320	Infants aged 6-59 months	Number of family members<6	Number of family members <5	stunting
Gebrie and Benti (2021)	Ethiopia	2,020	Infants aged 6-59 months	Number of family members > 6	Number of family members <5	stunting
Gelu et al. (2018)	Ethiopia	593	Infants aged 6-59 months	Number of family members ≥2, Rich wealth status	Number of family members 1, Poor wealth status	stunting
Mela et al. (2021)	Nigeria	807	Infants aged 6-59 months	Secondary education, Revenue >31,000	No formal education, Revenue < 18,000	stunting
Mengesha et al. (2021)	Ethiopia	660	Infants aged 6-59 months	Number of family members >5, Rich wealth status	Number of family members <5, Poor wealth status	stunting
Muche et al. (2021)	Ethiopia	8,117	Infants aged 6-59 months	Number of family members >5, Higher education, Richer wealth index	Number of family members <5, No education, The poorest wealth index	stunting
Nkhoma et al. (2021)	Zambia	7,045	Infants aged 6-59 months	Number of family members over 8, Intermediate and higher, Rich wealth index	Number of family members 1-3, No education, Poor wealth index	stunting
Shine et al. (2017)	Ethiopia	770	Infants aged 6-59 months	Revenue >1,760 ETB	Revenue < 1,760 ETB	stunting

Author (year)	Country	Sample size	P	I	C	O
Tariku et al. (2017)	Ethiopia	1,295	Infants aged 6-59 months	Number of family members 8-10 Secondary lessons Rich wealth status	Number of family members <7 No formal education Poor wealth status	stunting
Yazew (2022)	Ethiopia	500	Infants aged 6-59 months	High wealth status	Low wealth status	Stunting

*ETB = Birr Ethiopia

The forest plot in Figure 3 shows that there is an effect of the number of family members on stunting and this effect is statistically significant. Toddlers with high family members the risk of stunting 1.43 times compared to those with low family members (aOR= 01.43; 95% CI= 1.17 to 1.75; p<0.001). The Forest Plot also shows low heterogeneity of effect estimates between primary studies with I^2=80% (p<0.001). The calculation of effect estimation is carried out using fixed effect model approach.

The funnel plot in Figure 4 shows distribution of effect estimates between studies is symmetrical, namely the distribution or distribution of effect estimates to the right of the vertical line, the average effect estimate is relatively the same as the left side effect estimate. This funnel plot indicates that there is no publication bias.

Table 3. Effect of Adjusted Odd Ratio (aOR) and 95% CI Effect of number of family members on stunting (N= 23,004)

Author (Year)	aOR	95%CI	
		Lower Limit	Upper Limit
Afework et al. (2020)	1.54	0.99	2.37
Tariku et al. (2017)	0.89	0.61	1.30
Muche et al. (2021)	1.07	0.95	1.19
Mengesha et al. (2022)	1.69	1.03	2.70
Dake et al. (2019)	1.80	1.40	2.40
Nkhoma et al. (2019)	1.02	0.77	1.36
Azmeraw et al. (2020)	2.33	1.70	3.21
Gelu et al. (2017)	1.28	0.85	1.95
Geberselassie et al. (2018)	1.77	1.35	2.32
Gebrie dan Benti (2020)	1.57	1.13	2.19

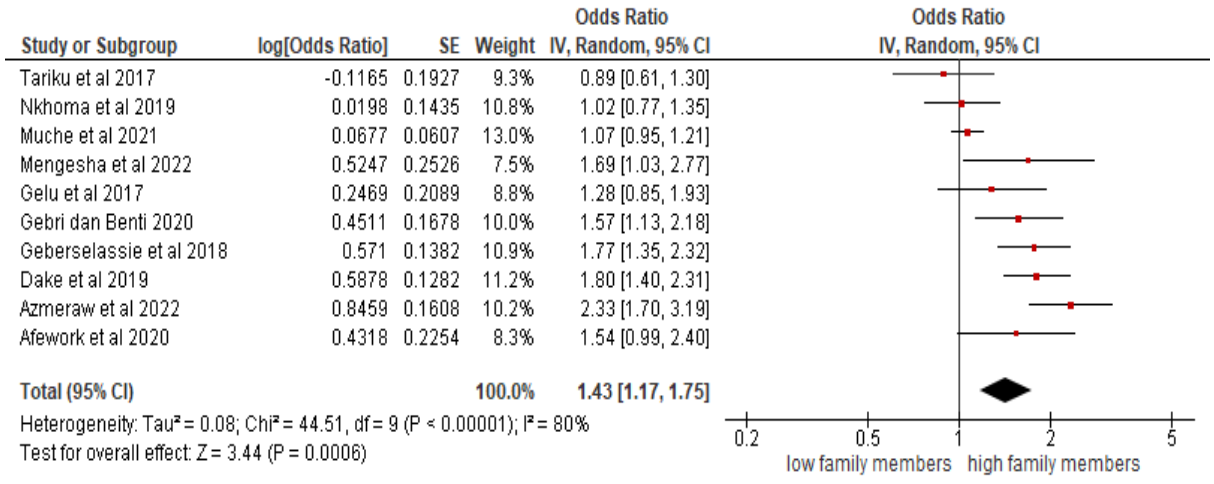

Figure 3. Forest Plot of number of family members on stunting

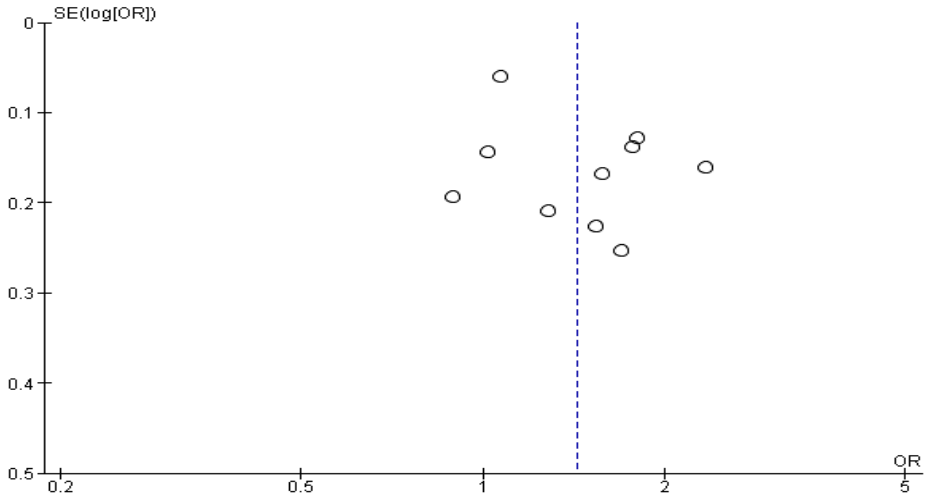

Figure 4. Funnel Plot Effect of number of family members on stunting

The forest plot in Figure 5 shows that there is an effect of maternal education on stunting and this effect is statistically significant. Toddlers with high maternal education reduced the risk of stunting 0.65 times compared to those with low maternal education (aOR= 0.65; 95% CI= 0.48 to 0.88; p<0.001). The figure also shows high heterogeneity of effect estimates between primary studies with I^2=61% (p =0.020). The effect estimation carried out using random effects model.

The funnel plot shows the effect estimates between studies are symmetrical, that is, the distribution of effect estimates to the right of the average vertical line is relatively the same as the distribution of effect estimates to the left. this funnel plot indicates that there is no publication bias (Figure 6).

Table 4. Effect of Adjusted Odd Ratio (aOR) and 95% CI of mother's education on stunting (N= 19, 143)

Author	aOR	95% CI	
		Upper Limit	Lower Limit
Afework et al. (2020)	0.59	0.33	1.04
Tariku et al. (2017)	0.80	0.55	1.17
Muche et al. (2021)	0.50	0.33	0.78
Dake et al. (2019)	0.30	0.10	0.70
Nkhoma et al. (2019)	0.86	0.69	1.07
Mela et al. (2018)	1.43	0.59	3.49
Shine et al. (2017)	0.32	0.15	0.71

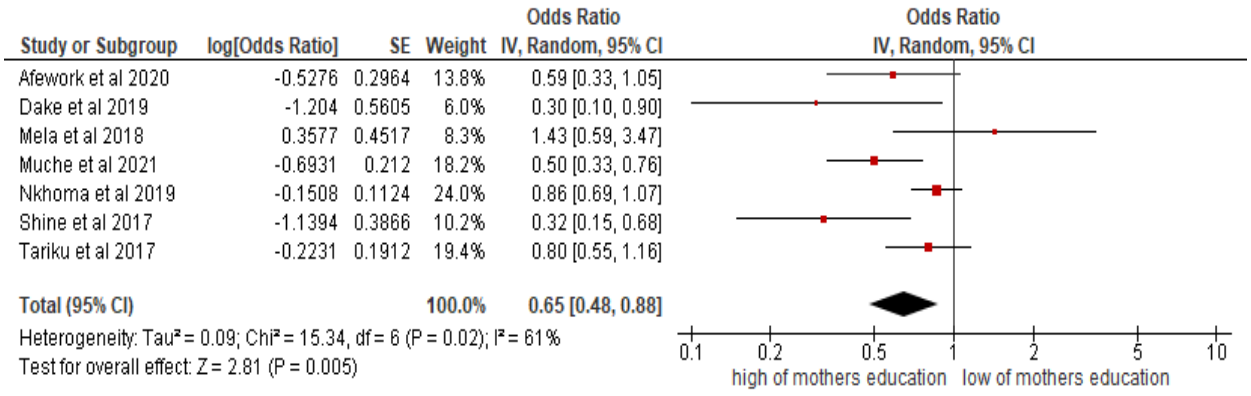

Figure 5. Forest plot of the effect of mother's education on stunting

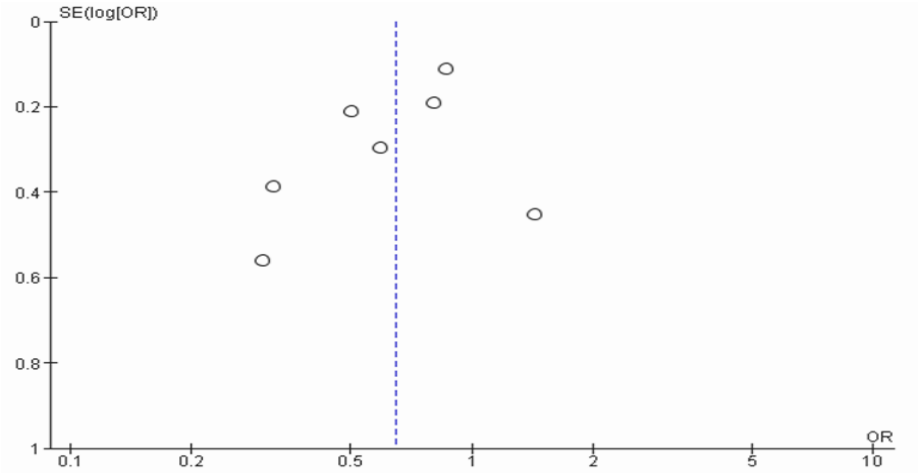

Figure 6. Funnel plot of the effect of mother's education on stunting

The forest plot in Figure 7 shows that toddlers with high income reduce the risk of stunting 0.53 times compared to those with low income and this effect is statistically significant (aOR= 0.53; 95% CI= 0.47 to 0.59; p<0.001). The figure also shows low heterogeneity of effect estimates between primary studies with I^2=42% (p=0.070). The effect estimation was carried out using fixed effects model approach.

The funnel plot shows the effect estimates between asymmetric studies, namely the distribution or distribution of effect estimates on the right side of everything (over estimate) if it is divided into top and bottom two parts. Thus funnel plot indicates publication bias.

Table 7. Data of Adjusted Odd Ratio (aOR) and 95% CI of family income on stunting (N=21,741)

Author	aOR	95% CI	
		Upper Limit	Lower Limit
Afework et al. (2020)	0.33	0.17	0. 61
Yazew (2022)	0.40	0.18	0.90
Tariku et al. (2017)	0.48	0.36	0.64
Muche et al. (2021)	0.56	0.43	0.74
Mengesha et al. (2022)	0.46	0.26	0.79
Dake et al. (2019)	0.20	0.10	0.40
Nkhoma et al. (2019)	0.60	0.48	0.75
Azmeraw et al. (2022)	0.35	0.21	0.60
Mela et al. (2018)	0.63	0.44	0.82
Shine et al. (2017)	0.68	0.47	0.97
Gelu et al. (2017)	0.55	0.37	0.84

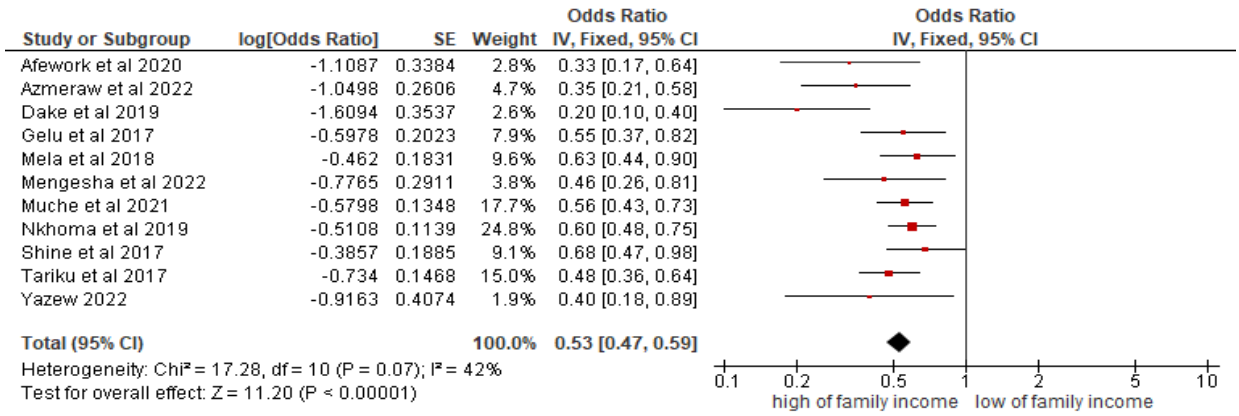

Figure 7. Forest plot effect of family income on stunting

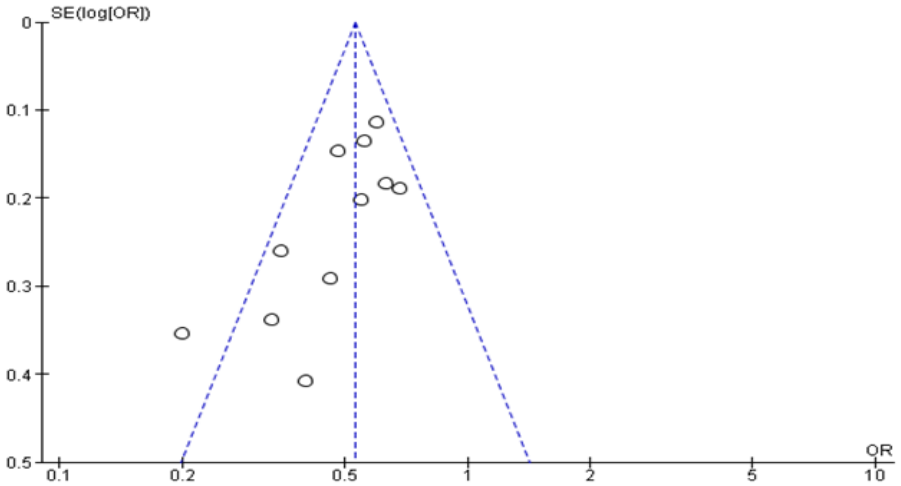

Figure 8. Funnel plot effect of family income on stunting

DISCUSSION

1. The effect of the number of family members on stunting

A high number of family members will affect stunting if it is not accompanied by high income. This can happen because the amount of nutritional intake that should be sufficient for one child must be shared with other children (Wahyudi et al., 2022).

The primary study of 9 articles found that toddlers with a high number of family members had a 1.43 times increased risk of stunting (aOR = 1.43; 95% CI= 1.17 to 1.75; p <0.001). The results of this study are in line with research by (Azmeraw et al., 2022) which shows that a high number of family members is 2.33 times more likely to increase the risk of stunting than a low number of family members (aOR= 2.33; 95% CI = 1.70 to 3.21).

Research by (Dake et al., 2019) shows that a high number of family members has a 1.80 times increased risk of stunting compared to a low number of family members (aOR= 1.80; 95% CI= 1.40 to 2.40). This research is also in line with research by (Geberselassie et al., 2018) which shows a significant positive relationship between the number of family members and stunting. Children with a high number of family members have a 1.77 times increased risk of stunting compared to a low number of family members (aOR= 1.77; 95% CI= 1.35 to 2.32).

2. The Effect of Mother's Education on Stunting

Mother's education will affect stunting. Low maternal education will have an impact on child health care, child diet, child hygiene, and the amount of nutritional intake that must be met by children (Chowdhury et al., 2022).

Based on the 7 articles, there were 5 articles from Ethiopia, 1 article from Zambia and 1 article from Nigeria. This meta-analysis concluded that high maternal education 0.65 times reduced the risk of stunting (aOR= 0.65; 95% CI= 0.48 to 0.88; p=0.005). This meta-analysis demonstrated high heterogeneity of effect estimates between primary studies (I^2= 61%; p= 0.020).

The results of this meta-analysis are in line with research by (Dake et al., 2019) which shows that high maternal education is 0.30 times to reduce the risk of stunting compared to low maternal education (aOR= 0.30; 95% CI= 0.10 to 0.70). Another study by Muche et al. (2021) showed that high maternal education was 0.50 times more likely to reduce the risk of stunting than low mater-

nal education (aOR= 0.50; 95% CI= 0.33 to 0.78). Similar research was also conducted by Shine et al. (2017) showing that high maternal education was 0.32 times to reduce the risk of stunting compared to low maternal education (aOR= 0.32; 95% CI= 0.15 to 0.71).

3. The Effect of Family Income on Stunting

Family income affects stunting which will have an impact on the diversity of food consumed by children. In addition, family income also affects the purchasing power of food (Farah et al., 2021).

The primary study was conducted with 9 articles, of which 7 articles were Ethiopian, 1 article was Nigerian and 1 article was Zambia with a sample size of 21,741. This meta-analysis concluded that high family income 0.53 times reduced the risk of stunting (aOR= 0.53; 95% CI= 0.47 to 0.59; p<0.001).

This meta-analysis showed low heterogeneity of effect estimates between primary studies with I^2= 42% (p= 0.070). Several studies have shown that there is an effect of family income on stunting, such as research by (Dake et al., 2019) which shows that high family income reduces the risk of stunting by 0.20 times compared to low family income (aOR= 0.20; 95% CI= 0.10 to 0.40).

Another study by (Gelu et al., 2017) showed that high family income reduced the risk of stunting by 0.55 times compared to low family income (aOR= 0.55; 95% CI=0.37 to 0.84). In line with research by (Muche et al., 2021) entitled, it shows that high family income is 0.56 times to reduce the risk of stunting compared to low family income (aOR= 0.55; 95% CI= 0.43 to 0.74).

AUTHOR CONTRIBUTION

Septa Decelita Wahyuni as a researcher who selects topics, searches for and collects research data. Bhisma Murti and Rita Benya Adriani analyzed the data and reviewed research documents.

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The study was self-funded.

CONFLICT OF INTEREST

There is no conflict of interest in this study.

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