

Meta Analysis the Effect of Intervention Based School toward Nutrition on Body Mass Index

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ABSTRACT

Background: Body mass index (BMI) is a metric used to define anthropometric characteristics and classify interpretations of individual fatness indexes. The International Association For The Study Of Obesity (IASO) and the International Obesity Task Force (IOTF) calculate that 200 million school children worldwide are overweight or obese. This study aims to estimate the magnitude of the effect of school-based interventions for nutrition on body mass index based on a number of previous primary studies.

Subjects and Method: This study is a systematic study and meta-analysis, with the following PICO Population = students (SMP) and (SMA) with obesity. Intervention= School-based interventions for nutrition. Comparison= no intervention. Outcomes in the form of body mass index. The articles used in this study were obtained from several databases, including PubMed, ScienceDirect and Google Scholar. This article was collected for 1 month. The keywords to search for articles were as follows: "School-based intervention" AND "Nutrition " "AND " Obesity " AND "BMI" OR "Body Mass Index"

AND "Randomized Controlled Trial". The articles included in this study are full text articles with a Randomized Controlled Trial study design. Articles were collected using PRISMA flow diagrams. Articles were analyzed using the Review Manager 5.3 aplikasi application

Results: A total of 9 articles were reviewed in this meta-analysis. The study showed that school-based interventions for nutrition had an effect on lowering body mass index (Standarized Mean Difference = -0.23; 95% CI = -0.39 to 0.007 p= 0.005).

Conclusion: School-based interventions for nutrition lower body mass index.

Keywords: school-based interventions, nutrition, obesity, Body mass index.

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BACKGROUND

Body mass index (BMI) is a metric that is currently used to define anthropometric characteristics in children, adolescents, adults and to classify into interpretation groups that represent the individual fatness index (Nuttal, 2015). Body mass index is widely used as a risk factor for the development or prevalence of several health

problems. Obesity is excess body fat mass (Schwartz, 2017).

Most adolescents with obesity impact into adulthood. About 55% of obese children continue to be obese in adolescence and 80% will continue to be obese in adulthood and about 70% will remain obese over the age of 30 years (Simmonds, 2016), so efforts are needed to reduce the nutritional status of obesity. in children to normal nutrition.

Children and adolescents with obesity put them at risk for both short and long term psychological and non-communicable diseases (NCD). In the short term psychologically, children are at risk for depression, anxiety, low self-esteem, a range of emotional and behavioral disorders, asthma, low-grade systemic inflammation, liver complications, and musculoskeletal problems (Cesare, 2019). The number of children who are predicted to be obese in 2025 is 206 million and in 2030 is 254 million (WOF, 2019).

Obesity in adolescence has reached epidemic proportions worldwide, with the prevalence of obesity increasing at least 4-fold over the past 35 years. Approximately 13.7 million children and adolescents are obese. The prevalence of obesity is at the age of 12 to 19 years (CDC, 2020). The International Association For The Study Of Obesity (IASO) and the International Obesity Task Force (IOTF) calculate that 200 million school children worldwide are overweight or obese (WHO, 2018).

Developed countries tend to have higher rates of obesity than developing countries (Ogden, 2020). Nutritional interventions can alter obesity risk and metabolic conditions, reduce morbidity and mortality in the population by improving diet quality, modifying cardiometabolic risk, and promoting weight loss (Wing, 2011). Prevention of obesity in adolescence is a public health priority (Alberga, 2012). Interventions focus on reducing calorie intake and intake of sugary drinks, improving the quality of snacks, increasing fruit and vegetable intake, and promoting moderate exercise (NHLBI, 2015). School-based interventions for nutrition can lead to a decrease in body mass index (Johns, 2014). A decrease in BMI of 5% or more is associated with a lower risk of cardiovascular disease (Wing, 2011).

School-based nutrition policies and programs may be an effective mechanism to

contribute to attainable health standards. Schools play an important role in promoting nutrition by providing access to children from various socioeconomic backgrounds (Khambalia, 2011). A global nutrition policy review conducted in 2016-2017 reported that 89% of 160 countries reported implementing school health and nutrition programs. Middle school interventions that incorporate materials on improving healthy eating patterns report a reduction in obesity (Cadzow, 2015).

NCD prevention strategies, such as school-based interventions, are critical because they are feasible and relatively inexpensive approaches that reach large populations. School-based interventions involving individual and environmental components have shown a small to moderate effect for the prevention of overweight in adolescents (Khambalia, 2012). This whole process resulted in a multicomponent (individual/environmental) intervention program aimed at reducing sugar intake, increasing daily fruit and vegetables, reducing unhealthy snack intake, increasing healthy breakfast intake (Royen, 2015).

This study aimed to examine the influence of school-based interventions for nutrition on BMI in students with obesity using systematic review and meta-analysis.

SUBJECTS AND METHOD

1. Study Design

This is a systematic study and meta-analysis. The articles used in this study were obtained from several databases including PubMed, ScienceDirect and Google Scholar. The keywords to search for articles were as follows: "School-based intervention" AND "Nutrition" AND "Physical Activity" AND "Obesity" AND "BMI" OR "Body Mass Index"

2. Inclusion Criteria

The articles included in this study are full paper articles with a randomized controlled trial study design. The research subjects were

junior high school and high school students. Selected articles provide interventions in the form of school-based interventions for nutrition with body mass index outcomes.

3. Exclusion Criteria

The articles published in this study were articles published before 2010 and articles that did not include the mean SD value.

4. Operational Definition

The search for articles was carried out by considering the eligibility criteria defined using the PICO model. The population in this study were middle school and high school students with obesity, the intervention was in the form of school-based intervention for nutrition, comparison, which was no intervention, and the outcome in the form of a body mass index.

School-based intervention for nutrition is a strategic program to manage and provide students with consistent and accurate health

information that is clear and consistent about nutrition and healthy eating patterns. Instrument: School-based program with categorical measurement scale.

Body mass index is a measure of body weight adjusted for height, calculated as weight in kilograms divided by height squared in meters (kg/m²). Instruments: Scales and stadiometers with continuous measuring scale.

5. Data Analysis

Data processing is carried out by Review Manager (RevMan 5.3) by calculating the mean difference to determine the combined research model and form the final result of the meta-analysis.

RESULTS

The process of searching for articles by searching through a database with journals can be seen in Figure 1.

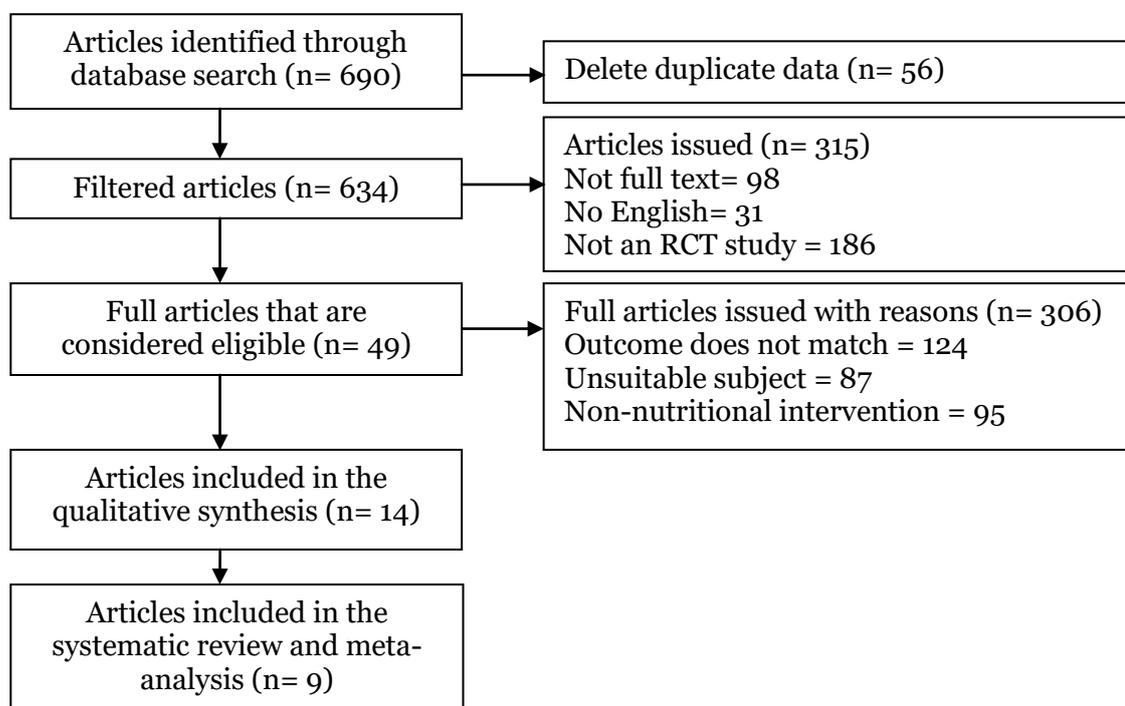


Figure 1. PRISMA flow diagram

There were 690 articles identified from the database, after the process of deleting duplicate articles, 634 articles were obtained

with 319 of them meeting the requirements. Articles were excluded for several reasons, so

that 9 articles were included in the synthesis and meta-analysis studies.

There were 9 articles from 4 continents, namely America, Europe, Asia and Africa. 4

studies from the Americas, 1 study from the European continent, 3 studies from the Asian continent, and 1 study from the African continent.



Figure 2. Map of distribution of areas of influence of school-based interventions for nutrition on body mass index

1. School-based interventions for nutrition on body mass index

9 articles prove that there is a relationship between school-based interventions for nutrition and body mass index.

Based on the results of the forest plot (Figure 3), it showed that the school-based intervention for nutrition reduced the body

mass index -0.23 times and was statistically significant ($p= 0.005$). The heterogeneity of the research data shows $I^2= 81%$ so that the distribution of the data is said to be heterogeneous (random effect model).

a. Forest plot

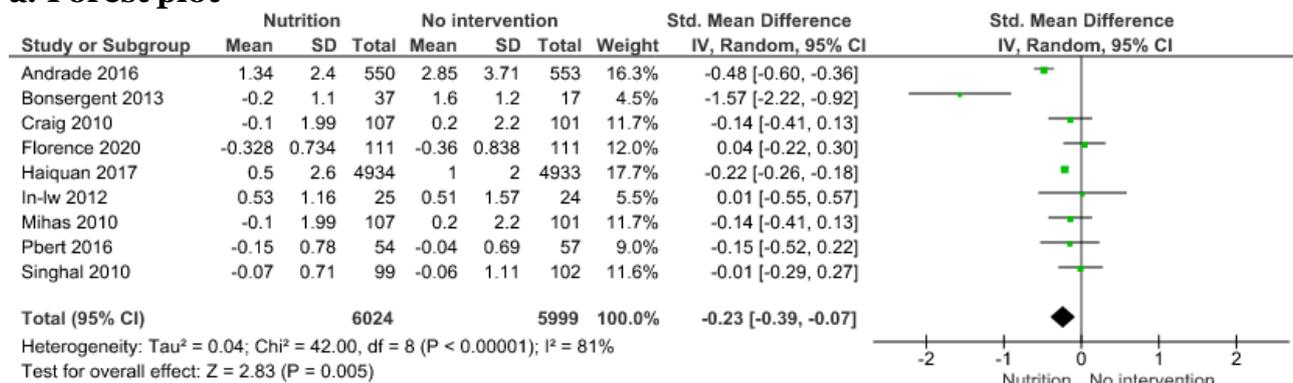


Figure 3. Forest plot of the effect of school-based interventions for nutrition on Body mass index

Table 1. Assessment of Study quality

Questions of checklist	Publication (Author and Year)								
	Singhal et al. (2010)	Andrande et al. (2016)	Craig et al. (2010)	Mihas et al. (2010)	Bonsergent et al. (2013)	Pbert et al. (2016)	In-lw et al. (2012)	Haiquan et al. (2017)	Florence et al. (2020)
Does this study address a clear research focus?	1	1	1	1	1	1	1	1	1
Is the Randomized Controlled Trial research method appropriate to answer the research question?	1	1	1	1	1	1	1	1	1
Are there enough subjects in the study to establish that the findings did not occur by chance?	1	1	1	1	1	1	1	1	1
Were subjects randomly allocated to the experimental and control groups? If not, could this be biased?	1	1	1	1	1	1	1	1	1
Are inclusion/exclusion criteria used?	1	1	1	1	1	1	1	1	1
Were the two groups comparable at the start of the study?	0	1	1	0	1	0	1	1	1
Were objective and unbiased outcome criteria used?	1	1	1	1	1	1	1	1	1
Are objective and validated measurement methods used in measuring the results? If not, were results judged by someone who did not know the group assignment (ie was the assessment blinded)?	1	1	1	1	1	1	1	1	1
Is effect size practically relevant?	1	0	1	0	1	1	0	1	1
How precise is the estimate of the effect? Is there a confidence interval?	1	1	0	1	1	1	1	1	0
Could there be confounding factors that have not been taken into account?	0	0	0	0	0	0	0	0	0
Are the results applicable to your research?	1	1	1	1	1	1	1	1	1
Total	10	10	9	11	10	10	10	11	10

* In question item number 11, a score of 0 is given because the question is scored positive

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

Author (Year)	Country	Study Design	Sample	P (Population)	I (Intervention)	C (Comparison)	O (Outcome)
Singhal et al. (2010)	India	Randomized Controlled Trial.	Nutritional intervention : 99 No intervention :102	SHS	Look at the effectiveness of interventions for nutrition in adolescents and change knowledge related to nutrition, diet and lifestyle practices.	No intervention	Body mass index
Craig et al. (2010).	Mexico	Randomized Controlled Trial.	Nutritional intervention: 37 No intervention: 101	JHS	Seeing the effectiveness of interventions for nutrition in adolescents, providing an environment to support healthy eating habits, education about healthy snacks	No intervention	Body mass index
Mihas et al. (2010)	United States of America	Randomized Controlled Trial.	Nutrition intervention : 107 No intervention :17	SHS	This study compares the effects of health education and nutrition education interventions in schools (diet and nutrition intake)	No intervention	Body mass index
Pbert et al. (2016).	United States of America	Randomized Controlled Trial.	Nutrition intervention : 57 No intervention :54	SHS	This study looks at the effect of program interventions on improving diet	No intervention	Body mass index
Bonsegent et al. (2013)	French	Randomized Controlled Trial.	Nutrition intervention : 2641 No intervention : 2713	SHS	This study looks at the effects of the intervention, development of nutritional knowledge and skills, increasing the availability of healthy food	No intervention	Body mass index
In-lw et al. (2012)	Thailand	Randomized Controlled Trial.	Nutritional intervention : 25 No intervention : 24	JHS	This study looked at the effects of an interactive nutrition intervention, eating a healthy diet.	No intervention	Body mass index
Haiquan et al. (2017)	China (Asia)	Randomized Controlled Trial.	Nutrition intervention : 4934 No intervention : 4933	JHS	This study looks at the effects of school-based interventions for comprehensive nutrition, healthy eating habits	No intervention	Body mass index
Andrade et al. (2016).	United States of America	Randomized Controlled Trial.	Nutrition intervention : 539 No intervention : 521	JHS	This study looks at the effect of the intervention. A comprehensive school-based intervention aimed at improving diet.	No intervention	Body mass index
Florence. (2020).	Kenya	Randomized Controlled Trial.	Nutrition intervention : 111 No intervention : 111	SHS	Improve knowledge, attitudes and skills to improve healthy eating behavior perilaku	No intervention	Body mass index

* Variables included in the meta-analysis

b. Funnel plot

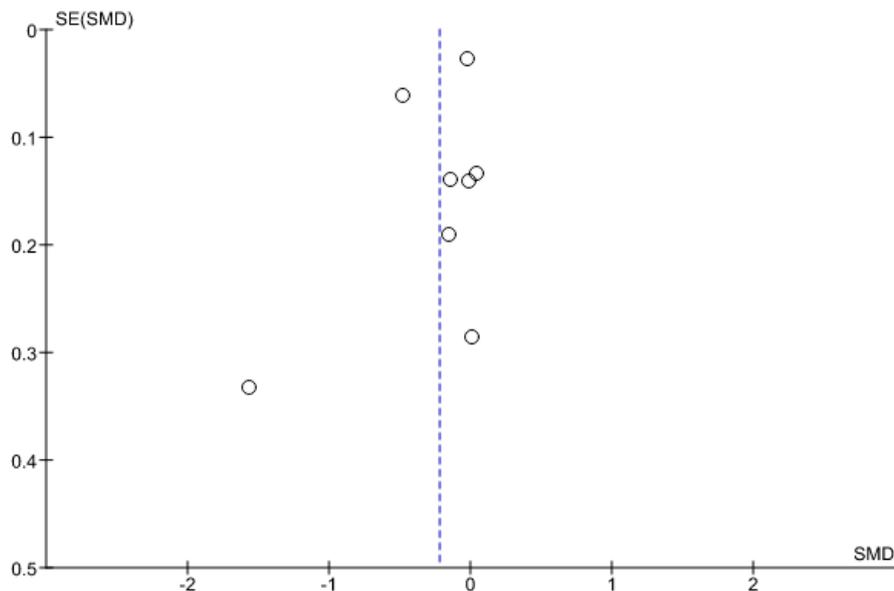


Figure 4. Funnel plot of the effect of school-based interventions for nutrition on body mass index

The funnel plot (figure 4) shows no bias where 2 plots are on the left and 6 plots are on the right, but there is 1 plot that does not appear because there are 2 articles with the same SMD value so it is likely that the plots will overlap. The plot on the left has a standard error between 0 and 0.4 and the plot on the right has a standard error between 0 and 0.3.

DISCUSSION

This systematic review and meta-analysis research raised the theme of the effect of school-based interventions for nutrition and physical activity on body mass index (BMI). The independent variable is a school-based intervention for nutrition and the dependent variable analyzed is the body mass index of obese school students. The intervention was designed to reduce body mass index in obese middle and high school students with a randomized controlled trial design. Research that discusses school-based interventions for nutrition in adolescents with obesity is considered important because this problem is

a problem in almost all countries, both developed and developing countries.

This systematic study and meta-analysis uses research that has controlled for confounding factors which can be seen from the terms of research inclusion, namely the Standardized mean difference. Estimates of the combined effect of school-based interventions for nutrition and physical activity were processed using RevMan 5.3 with the Continuous method. This method was used to analyze the effect size or standardized mean difference in bivariate data of two groups that had been controlled for confounding factors by randomization. The results of the systematic study and meta-analysis are presented in the form of forest plots and funnel plots.

The forest plot results showed that the school-based intervention for nutrition had an effect on reducing BMI by -0.23 times compared to the group that was not given the school-based intervention for nutrition. (SMD= -0.23; 95% CI= -0.39 to 0.07 p= 0.005). The heterogeneity of the research data shows $I^2 = 81%$ so that the distribution

of the data is said to be heterogeneous (random effect model). This meta-analysis study provides strong evidence to support school-based interventions for nutrition as an effective intervention in reducing the body mass index of middle and high school students with obesity.

Several previous studies such as Wing et al., (2011), Vangal & Puja Dudeja (2020), Johns et al (2014), Woodcock et al., (2011), Schwingshackl et al., (2014) reported school-based interventions for Nutrition can alter obesity risk and metabolic conditions, reduce morbidity and mortality in populations by improving diet quality, modifying cardio-metabolic risk, and promoting a decrease in body mass index. Body mass index (BMI) is used to diagnose overweight and obesity (Casanova, 2013).

This study is in line with Singhal (2010) who reported that school-based interventions for nutrition were effective in reducing BMI in students with obesity. The results of the study emphasize that school-based interventions for nutrition provide increased knowledge related to nutrition, healthy eating habits. A global nutrition policy review conducted in 2016-2017 reported that 89% of 160 countries reported implementing school health and nutrition programs. The most frequently reported school health component was nutrition and nutrition education programs that were included in the school curriculum (61%), followed by training of school staff on health and nutrition (56%).

Craig (2010) reported that school-based interventions for nutrition were effective in lowering BMI in obese students. The results of the study emphasize that school-based interventions modify and encourage healthy eating and modify increased physical activity performance. This study is also supported by (Florence, 2020) which states that school-based interventions for nutrition are effective in reducing BMI in obese student.

AUTHOR CONTRIBUTION

Wulandari is the main researcher who selects topics, searches and collects research data. Yulia Lanti Retno Dewi and Bhisma Murti played a role in analyzing data and reviewing research documents.

FUNDING AND SPONSORSHIP

This study is self-funded.

CONFLICT OF INTEREST

There is no conflict of interest in this study.

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