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Research

Meta-Analysis: The Effectiveness of Web-Based Health Promotion Interventions on Vegetable Consumption in Children

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ABSTRACT

Background: Consuming healthy food throughout life helps prevent malnutrition in all forms of various diseases. In the first 2 years of a child's life, optimal nutrition fosters healthy growth. Vegetables and fruit are food sources that contain many nutrients that humans must consume at every meal. EHealth is playing an increasingly large role in life and the internet has great potential to be a source of low cost and effective health promotion interventions.
Subjects and Method: This study was a meta-analysis of a number of Randomized Controlled Trial study designs. The articles used in this study were obtained from several databases including PubMed, Google Scholar, and Springer Link. The articles used in this research are those published from 2010-2020. The article search was carried out by considering the eligibility criteria defined using the PICO model. The population in the study was children aged 2 to 12 years old with an intervention in the form of web-based health promotion, comparison, which was not given a web outcome-based health promotion intervention in the form of vegetables consumption. The keywords for finding articles are as follows: "Intervention Health Promotion Web-Based" OR "eHealth Intervention" AND "Non-Intervention Health Promotion Web-Based" OR "Non eHealth Intervention" AND "Child" AND "Vegetables" AND "Randomized Controlled Trial". The articles included in this study were full text articles with the design of a Randomized Controlled Trial (RCT) study. Articles were collected using PRISMA flow diagrams. Articles were analyzed using the Review Manager 5.3 application.
Results: A total of 9 articles were reviewed in this study. Meta-analysis of 9 primary data shows that web-based health promotion interventions can increase children's vegetable consumption with statistically significant results (Standarized Mean Difference= 0.82; 95% CI= 0.26 to 1.37; p= 0.004).
Conclusion: Web-based health promotion interventions can increase vegetables consumption in children.

Keywords: Intervention Health Promotion Web-Based, eHealth, vegetables consumption

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BACKGROUND

Consuming healthy food throughout life helps prevent malnutrition in all forms of various diseases. In the first 2 years of a child's life, optimal nutrition fosters healthy growth. Vegetables and fruit are food sources that contain many nutrients that humans must consume at every meal. eHealth is playing an increasingly huge role in life and the internet has great potential to be a source of low cost and effective health promotion interventions.

The number of primary studies examining healthy and web-based promotion interventions on vegetable consumption in children encouraged the researchers to conduct more comprehensive studies of these primary studies. The data obtained were analyzed using a systematic review and meta-analysis by synthesizing the results of studies conducted to reduce bias.

SUBJECTS AND METHOD

1. Study Design

This study is a systematic review and meta-analysis study. The articles used in this study were obtained from several databases including PubMed, Google Scholar, and Springer Link. The keywords for finding articles are as follows:"Intervention Health Promotion Web-Based" OR "eHealth Intervention" AND "Non Intervention Health Promotion Web-Based" OR "Non eHealth Intervention" AND "Child" AND "Vegetables" AND "Randomized Controlled Trial".

2. Inclusion Criteria

The articles included in this study are full paper articles with a Randomized Controlled Trial (RCT) study design, in Indonesian and English. The article used a population of children aged 2 to 12 years old, and the intervention was given web-based health promotion with the outcome of vegetables consumption in children.

3. Exclusion Criteria

The articles published in this study are articles that have been carried out by meta-analysis. The articles were published before 2010.

4. Operational Definition of Variables

The article search was carried out by considering the eligibility criteria defined using the PICO model. Population in children aged 2 to 12 years old with intervention in the form of web-based health promotion, comparison, which was no web-based health promotion intervention.

eHealth is described as a tool or solution for healthcare professionals and a personalized healthcare system for patients. For instance, health information networks, telemedicine services, internet-based portable communication systems for improving health (Evers, 2006).

According to WHO (2020), in the first 2 years of a child's life, optimal nutrition fosters healthy growth. This reduces the risk of overweight or obese and reduces non-communicable diseases later in life.

Practical advice for maintaining a healthy diet (intake of vegetables and fruit) are as follows:

1) Eat at least 400g, or five portions of vegetables per day
2) Always include vegetables in your diet
3) Eat fresh vegetables and fruit as snacks
4) Eat a variety of vegetables and fruits.

5. DataAnalysis

Data processing was carried out using the Review Manager (RevMan 5.3) by calculating the effect size and heterogeneity to determine which the research models were combined and formed the final meta-analysis result.

RESULTS

The process of searching for articles by searching through a database with journals can be seen in these following Figures:

1. Figure 2 shows the areas where articles were drawn according to the inclusion criteria. Articles obtained from 3 continents, namely Asia, America and Australia.
2. Based on the results of the forest plot (Figure 3), it showed that the effect of web-based health promotion interventions increased vegetables consumption in children by 0.82 times and it was statistically significant (Standarized Mean Difference= 0.82; 95% CI= 0.26 to 1.37; p= 0.004). The heterogeneity of the

study data showed I^2= 97% so that the distribution of the data was heterogeneous (random effect model).

3. The funnel plot (Figure 4) showed no publication bias which was indicated by a symmetrical plot on the right and left, where 4 plots were on the right and 4 plots were on the left. The plot on the left of the graph has a standard error between 0.1 and 0.3 and the plot on the right has a standard error between 0.1 and 0.4.

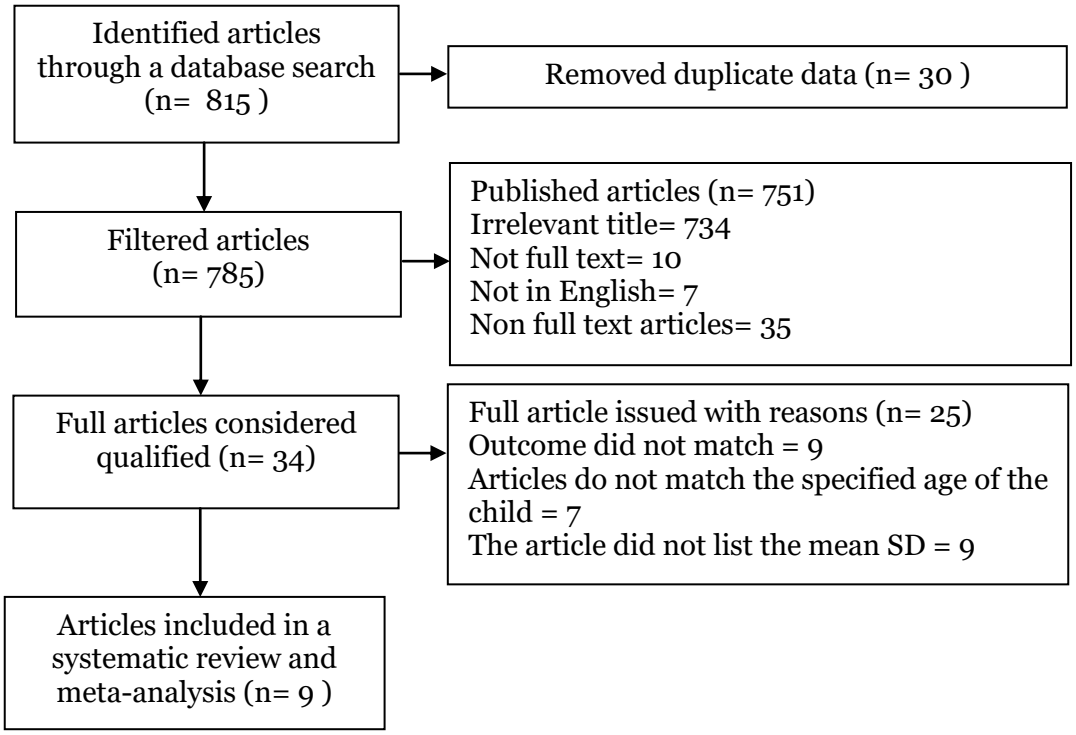

Figure1. PRISMA flow diagram

Figure 2. Map of the study area

1. The Effectiveness of Web-Based Health Promotion Interventions on Vegetable Consumption in Children

a. Forest Plot

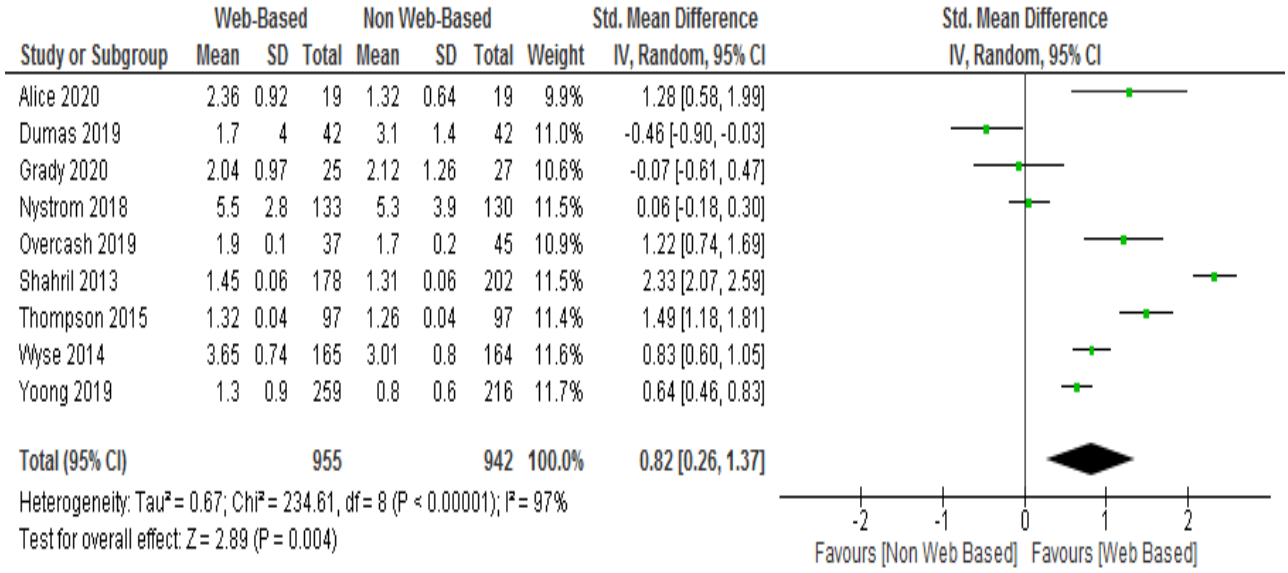

Figure 3. Forest plot of the effectiveness of web-based health promotion interventions on vegetable consumption in children

b. Funnel Plot

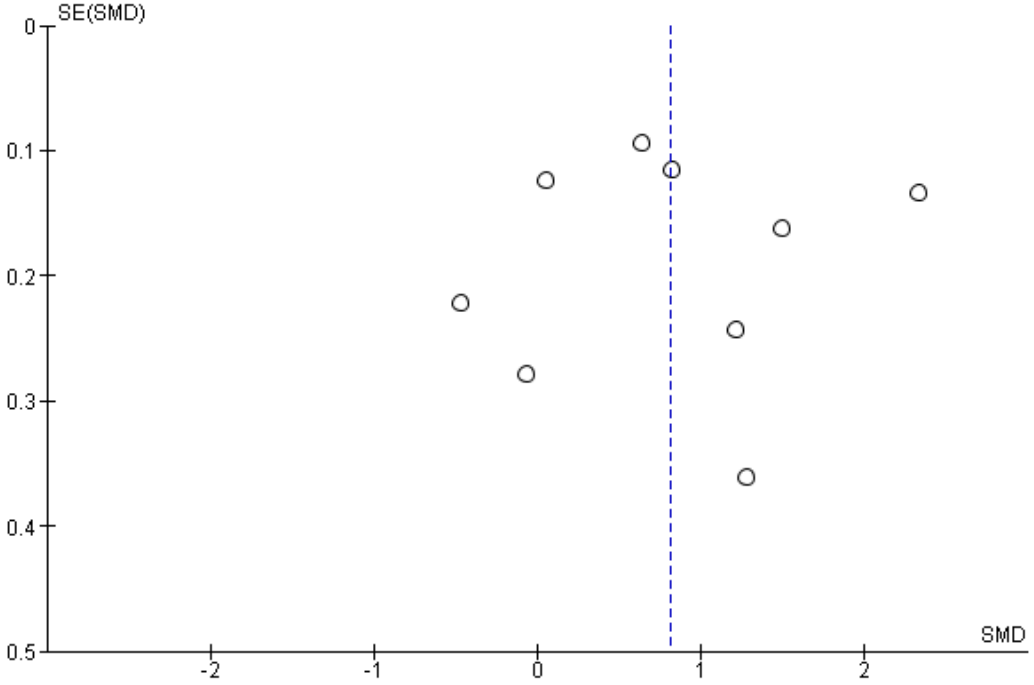

Figure 4. Funnel plot of the effectiveness of web-based health promotion interventions on vegetable consumption in children

Table 1. Critical appraisal checklist

Checklist Questions	Publication (Author and Y		
	Alice et al. (2020)	Dumas et al. (2019)	Grady et al. (2020)
Does this study address a clear study focus?	1	1	1
Is the Randomized Controlled Trial study method suitable for answering study questions?	1	1	1
Are there enough subjects in the study to establish that the findings were not made by chance?	1	1	1
Are subjects randomly allocated to the experimental and control groups? If not, could this be biased?	1	0	0
Are inclusion/exclusion criteria used?	1	1	1
Are the two groups comparable at study entry?	0	0	0
Are objective and unbiased outcome criteria used?	1	1	1
Are objective and validated measurement methods used to measure the results? If not, were the results scored by someone who did not know the group assignment (i.e. was the grading blended)?	1	1	1
Is the effect size practically relevant?	1	1	1
How precise is the estimated effect? Is there a confidence interval?	1	1	1
Could there be confounding factors that have not been taken into account?	0	0	0
Are the results applicable to your study?	1	1	1
Total	0	9	9

Description:

Yes = 1

Table 2. Critical appraisal checklist

Checklist Questions	Publica (Author an	
	Shahril et al. (2013)	**Thompson et al. (2015)**
Does this study address a clear study focus?	1	1
Is the Randomized Controlled Trial study method suitable for answering study questions?	1	1
Are there enough subjects in the study to establish that the findings were not made by chance?	1	1
Are subjects randomly allocated to the experimental and control groups? If not, could this be biased?	1	1
Are inclusion/exclusion criteria used?	1	1
Are the two groups comparable at study entry?	0	0
Are objective and unbiased outcome criteria used?	1	1
Are objective and validated measurement methods used to measure the results? If not, were the results scored by someone who did not know the group assignment (i.e. was the grading blended)?	1	1
Is the effect size practically relevant?	1	1
How precise is the estimated effect? Is there a confidence interval?	1	1
Could there be confounding factors that have not been taken into account?	0	0
Are the results applicable to your study?	1	1
Total	10	10

Description:

Yes = 1

No = 0

Table 4. Primary study descriptions included in the primary meta-analysis study

Author (Year)	Country	Study Design	Sample	P (Population)	I (Intervention)	
Alice et al. (2020)	Australia	Randomized Controlled Trial.	Intervention: 19 Control: 19	Children aged 2-6 years old.	Providing strategies on the website to improve child nutrition by consuming fruit, vegetables, milk and bread.	T v n v
Dumas et al. (2019)	Canada	Randomized Controlled Trial.	Intervention: 42 Control: 42	Children aged 2-12 years old.	Using a website in the form of a blog increases the intake of vegetables, fruit and milk and alternatives.	N f i n
Grady et al. (2020) .	Australia	Randomized Controlled Trial.	Intervention: 19 Control: 19	Children aged 2-6years old.	This study used software (web) of feeding management to increase consumption of vegetables, fruit, milk and meat.	N c n t a
Nystrom et al. (2018).	Canada	Randomized Controlled Trial.	Intervention: 133 Control: 130	Children aged 4,5years old.	This study used software (web) of feeding management to increase children nutrition.	N (i
Overcash et al. (2019).	USA	Randomized Controlled Trial.	Intervention: 37 Control: 45	Children aged 9-12 years old.	Identify strategies through the website provided to increase vegetable consumption in children.	T t t c
Shahril et al	Malaysia	Randomized Controlled Trial	Intervention: 178	Children aged 9-12 years	To see the effectiveness of implementing multi-	T t

Author (Year)	Country	Study Design	Sample	P (Population)	I (Intervention)	
					vegetables and fruits in children.	
Wyse et al. (2014).	Australia	Randomized Controlled Trial.	Intervention: 165 Control: 164	Children aged 3-5years old. .	Telephone calls and software (web) inter-vention were provided to increase the number of portions of vegetables and fruit.	N s g c f
Yoong et al. (2019)	USA	Randomized Controlled Trial.	Intervention: 259 Control: 216	Children aged 2-5years old.	To assess the training on the effectiveness of the intervention using the web to increase the intake of vegetables, fruit, bread and meat in children.	I n i v n

*Variables included in the meta-analysis

DISCUSSION

Vegetables and fruit are food sources that contain many nutrients that humans must consume at every meal. Not only for adults, consuming vegetables and fruit is very important to be consumed from the age of children. The current consumption of vegetables and fruit in children is still very low, according to the Ministry of Health in 2010-2013, it shows that nationally, the behavior of children who consume less vegetables and fruit is still above 90 percent and in 2014, 97.7 percent for Indonesian children consume less vegetables and fruit (Emma and Ekarizky, 2019).

Web-based interventions can reinforce a healthy lifestyle. For the realization of a web-based platform, e-learning software is used. This software provides a responsive design. The content section includes those covering specific topics: general information (main focus: physical activity), clarifying misinformation, healthy nutrition, motivation, and checking. During the intervention, all users received a short email reminder describing the updated content (Stassen et al., 2020).

This systematic review and meta-analysis research raises the theme of the effect of web-based health promotion interventions on vegetable consumption in children. This study discussed data on web-based health promotion interventions considered important because of their scarcity. The number of relevant research published and accessible was still small and also has data access problems (data duplication) (Murti, 2018).

Estimates of the combined effect of web-based health promotion interventions were processed using RevMan 5.3 with the Continous method. This method is used to analyze the effect size or standardized mean difference in the bivariate data of two groups that have been controlled for confounding factors by randomization.

The results of the systematic study and meta-analysis are presented in the form of a forest plot and a funnel plot. Forest plots provide an overview of information from each of the studies examined in the meta-analysis, and estimates of the overall results (Murti, 2018). The forest plot shows the large variation (heterogeneity) between study results visually (Akobeng in Murti, 2018).

Systematic reviews and meta-analyzes in this study were carried out with the aim of increasing the generalizability of the findings and getting convincing conclusions from various similar research results regarding web-based health promotion interventions increasing the consumption of vegetables in children from statistical results (Standardized Mean Difference= 0.82; CI 97% 0.26 to 1.37; p=0.004).

This study was supported by Buller et al. (2014) which states that the internet as a new technological tool for communicating health in the community by increasing the consumption of eating fruit and vegetables involves 755 people in rural America, the intervention is carried out for 4 months, and it is found that nutrition website can influence and increase the consumption of fruits and vegetables.

AUTHOR CONTRIBUTION

Sinar was the main researcher who selected topics, explored and collected the data. Yulia Lanti and Bhisma Murti played a role in analyzing data and reviewing research documents.

CONFLICT OF INTEREST

There was no conflict of interest in this study.

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This study used personal fund of the main researcher.

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