



PRIMARY RESEARCH

Meta-analysis: Effect of health media types on children's knowledge about balanced nutrition

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Abstract

Imbalance in food intake has become a problem that often arises in nutrition. This can occur in various age groups, including school-age children, and impacts malnutrition or overweight (obesity). Knowledge of nutrition plays an important role in determining the health status of the community, especially children. Health media is one of the solutions to increase knowledge. The types of health media that are often used are flash cards and poster media. To determine the effect of the type of health media on children's knowledge about balanced nutrition. A meta-analysis study using a pre-test-post-test design using a control group. The data was obtained from Google Scholar, PubMed, and the Garuda portal databases. 10 Journals were selected according to the inclusion criteria. Statistical test using revman 5.4. The effect off picture card media on children's knowledge was $Z = 3.13$ $p = 0.0025$, 95% Confidence Interval (CI) = 0.48-2.07, meanwhile poster media was $Z = 1.7$ $p = 0.09$, 95% CI = -0.05 - 0.71. Picture card media was more effective than the control group. Poster media did not differ in effectiveness compared to the control group.

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INTRODUCTION

Imbalance in food intake is a problem that often arises in the field of nutrition. This problem is often experienced by various age groups, including school-age children. Balanced nutrition is defined as the daily composition of food containing nutrients in terms of type and amount according to the needs of the body, while taking into account the principles of food diversity, physical activity, clean living behavior and regularly monitoring body weight with the aim of achieving a normal weight so as to prevent nutritional problems (Ministry of Health of the Republic of Indonesia, 2014).

School-age children are a group that is vulnerable to nutritional problems, because in this group children require large amounts of nutrients that are associated with increasing their growth process (Susilowati, 2016). Nutritional intake at this age often does not work perfectly, due to many factors that influence children's eating behavior (Nuryanto,

Niken, & Siti Fatimah, 2014). Inadequate nutritional intake in children can be a serious problem.

Currently, school-age children face two nutritional problems. First, the problem of malnutrition which results in the lack of achievement of physical growth and intelligence. Second, the problem of overnutrition which if left unchecked can cause degenerative diseases in children (Devi, 2012; Waheed & Jam, 2010).

According to basic health research data in 2013, the national prevalence of underweight children aged 5-12 years was 11.2%, which was distributed with 4% as very thin and 7.2% classified as underweight. In addition, nationally the prevalence of short children aged 5-12 years was 30.7%, which was distributed to 12.3% classified as very short and 18.4% classified as short. Then, at the age of 5-12 years the prevalence of overweight children is high, namely 18.8%, distributed to 10.8% classified as obese and 8% classified

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as very fat/obese ([Ministry of Health of the Republic of Indonesia, 2013](#)).

According to data from the Health Office of South Kalimantan Province in 2020, the percentage of underweight children under five for South Kalimantan Province reached 6.5%, where Banjar Regency with the highest case finding was 10.9% and Banjarmasin City with the lowest case finding of 1.7% ([South Kalimantan Provincial Health Office, 2020](#)). The prevalence of school-age children classified as underweight occurs at the age of 6-14 years in South Kalimantan Province. In boys this prevalence ranges from 15.8% (range: 10.3-21.2%) while in girls the prevalence of underweight ranges from 13.8% (6.8-19.1%). Several districts/cities have prevalence rates that exceed the prevalence rates of South Kalimantan province for boys who are classified as thin. The regencies/cities include Barito Kuala, North River Hulu, Tanah Bumbu, Tabalong, South River Upstream, and Central River Upstream. Meanwhile, for girls who are classified as thin, the prevalence rate in several districts/cities also exceeds the prevalence rate in the province of South Kalimantan, including the districts of South Hulu-Sungai, Middle Hulu-Sungai, Barito Kuala, New Town, Tabalong, and North Hulu-Sungai ([Research and Development Agency for Health Ministry of Health RI, 2009](#)).

Malnutrition problems that occur in school-age children will have an impact on their physical and health conditions. Children will become weak faster, get tired more quickly and often get sick. Children will be absent more often because they have difficulty following and understanding lessons. Many school-age children have to repeat their lessons due to the impact of lack of nutritional intake ([Nutritional Adequacy Ratei, 2004](#)).

Furthermore, the problem of obesity in Indonesia is also a serious problem. The results of research from the Research and Development Agency in 2013, the prevalence of overweight children aged 5-12 years nationally is still high at 18.8%, which is classified as obese as much as 10.8% and very obese 8.8% ([Ministry of Health of the Republic of Indonesia, 2013](#)). In South Kalimantan Province, the prevalence rate for boys who are overweight is around 7.6% (range: 4.3-15.9%). Meanwhile, the prevalence rate for girls who are overweight ranges from 4.8% (2.2-7.9%). Several districts/cities have prevalence rates that exceed the prevalence rates of South Kalimantan province for boys classified as overweight. These regencies/cities include Kota Baru, Tanah Laut, Tapin, Hulu Sungai Selatan, Hulu Sungai Tengah, Tanah Bumbu and Banjarbaru. Meanwhile, for girls who are classified as overweight, the prevalence rate in several districts/cities also exceeds the prevalence

rate in the province of South Kalimantan, including in the districts of Kota Baru, Banjar, Tapin, Hulu Sungai Selatan, and Hulu Sungai Tengah ([Research and Development Agency for Health Ministry of Health RI, 2009](#)).

The problem of being overweight or obese in children can be the cause of anemia ([Heryati & Setiawan, 2014](#)). Anemia that appears in school-age children can have a negative impact on their learning achievement. Anemia causes a decrease in children's learning concentration due to a lack of oxygen intake carried by hemoglobin. In anemia, the hemoglobin level is low, so the oxygenation process in the brain and central nervous system decreases ([Mughtar, Briawan, & Karsin, 2000](#)). In addition, obesity has other side effects that can reduce cognitive function or the function of thinking in children which is thought to be the result of complications of obesity in children, for example, diabetes, Obstructive Sleep Apnea Syndrome (OSAS), respiratory problems, psychosocial problems (low self-esteem, self-isolation, and depression) ([Centers for Disease Control and Prevention, 2009](#); [Wendt & Kinsey, 2009](#)) and less in socializing ([Datar, Sturm, & Magnabosco, 2004](#); [Waheed, Kaur, Ul-Ain, & Qazi, 2013](#); [Ziauddin, Khan, Jam, & Hijazi, 2010](#)).

One of the causes of the emergence of nutritional problems in children is the lack of knowledge about nutrition. Nutrition knowledge has an important role in improving the health status of the community, especially children. Knowledge according to Notoatmodjo in [Kholid \(2012\)](#) is the result of "knowing" that occurs after someone senses a certain object. Sensing can occur through the behavior of seeing, smelling, hearing, touching and feeling. The senses of sight and hearing are most often used to acquire knowledge. In addition, knowledge can also be obtained from the educational process, personal experience, the experience of people in the surrounding environment, as well as from the media. One way to increase knowledge about nutrition is through health media.

Health media is a tool to deliver education about health to the public, groups, or individuals ([Komalasari, 2017](#); [Shahbaz, Tiwari, Jam, & Ozturk, 2014](#)). Health media has a role in building a good atmosphere for behavioral changes related to health. With the health media, the community, including children, can gain knowledge about better health. The types of health media that are quite often used to increase children's knowledge about balanced nutrition are flash cards and poster media.

Picture card media is one type of health media in the form of cards used by teachers or extension workers to introduce vocabulary, pictures and educational sentences. The card contains a variety of pictures and vocabulary that of-

ten appears in the environment, such as the names of family members or pictures of animals and plants. Flashcards or picture cards in several terms can be found in the form of edutainment cards, vegetable cards, quartet cards, card games containing educational messages. Various studies have been conducted by several researchers related to the effect of picture card media on children's knowledge about balanced nutrition. Research conducted by [Fadhilah, Hartini, and Gunawan \(2017\)](#); [Maslakah and Setiyaningrum \(2017\)](#); [Mustikaningsih, Supadi, Jaelani, Mintarsih, and Tur-silowati \(2019\)](#); [Rahmah, Noviardi, Prihatin, Hunandar, and Rahmawati \(2019\)](#); [Selviyanti, Ichwanuddin, Judiono, Suparman, and Tiara \(2019\)](#); [Setiana, Handayani, and Sum-inar \(2019\)](#) shows that there is an effect of flashcard media in increasing children's knowledge of balanced nutrition. Meanwhile, in the study of [dos Santos Chagas, Melo, Botelho, and Toral \(2020\)](#) said it was not effective in increasing knowledge about food nutrition in children.

Poster media is also one type of health media in the form of print media that contains information or messages. Media posters are usually affixed to walls, public places, and public transportation. Posters are in the form of sheets of paper which usually have a size of 60Ccm x 90Ccm. In it are written sentences and pictures to convey the intended education/message, so that it can influence and motivate the behavior of those who see it. Several studies have been conducted on the effect of poster media on children's knowledge about balanced nutrition. Research conducted by [Indraswari \(2019\)](#) and [Trianasari, Herawati, and Gunawan \(2018\)](#) explained that poster media has an influence in increasing knowledge of balanced nutrition in school students. Meanwhile, the research conducted by [\(Fonseca, Bertolin, Gubert, & da Silva, 2019\)](#) showed different results that no significant changes were observed in the score of knowledge about nutrition in children.

From some of the collected literature, it is found that there are differences in research results from the effect of the type of health media on children's knowledge about balanced nutrition. Of the 10 articles obtained, 6 articles stated that the media picture cards had an influence on children's knowledge about balanced nutrition. Meanwhile, another article

stated that picture card media had no significant effect on children's knowledge about balanced nutrition. Likewise with poster media, 2 articles stated that poster media had an influence on children's knowledge about balanced nutrition, while 1 other article stated that it had no effect.

The existence of this evidence gap becomes the basis for mapping research results related to the effect of types of health media on children's knowledge about balanced nutrition, so it is necessary to conduct a meta-analysis study related to this problem.

METHODOLOGY

The research taken in this meta-analysis is a research with experimental pretest-posttest research design with control group design. In this meta-analysis, what is examined is the effect of the type of health media in the form of picture card media and poster media as the intervention group and its comparison with the control group on children's knowledge of balanced nutrition. The outcome measured in this meta-analysis is the effect of the type of health media on children's knowledge of balanced nutrition in the form of the Mean value, Standard Deviation, and *p*-value. The population in this study are national and international journals in the google scholar, pubmed, and garuda portal databases. related to the research title "Meta Analysis: The Effect of Types of Health Media on Children's Knowledge of Balanced Nutrition". The sample in this study amounted to 10 national and international research articles registered with the title of Meta Analysis: The Effect of Types of Health Media on Children's Knowledge of Balanced Nutrition.

The sampling technique in this study used a purposive sampling technique, namely the sampling technique was limited to certain types in order to provide the information desired by the researcher and meet the criteria determined by the researcher [\(Now & Bougie, 2017\)](#). The statistical test uses the software used in conducting the meta-analysis, namely the Review Manager application version 5.4 (RevMan 5.4). The article search and article selection process in this study are depicted in the form of a Flow diagram of Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) as shown in Figure 1:

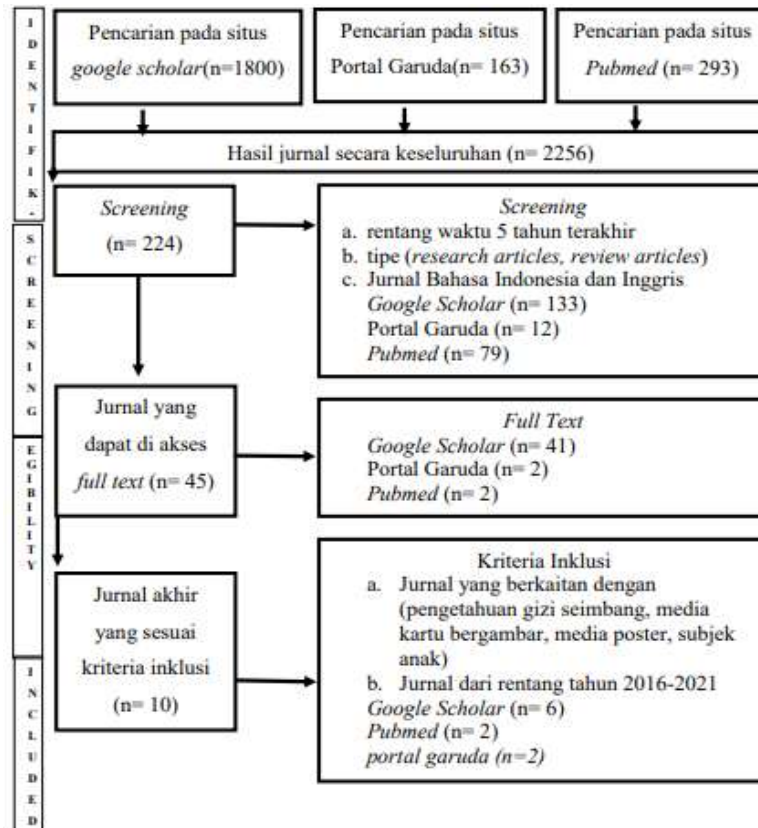


FIGURE 1. PRISMA diagram/chart

Journal search using prism flow charts assisted by the application sorting each search engine: GoogleScholar, pubmed, garuda portal using the keywords "(picture card media OR flashcard OR edutainment card, OR quartet card OR vegetable card OR game card) AND (media poster OR pictorial representation), AND (children OR adolescents) AND (knowledge of balanced nutrition OR nutritional knowledge)". Use advanced search options to limit results. Found more than 2256 articles about the effect of types of health media on children's knowledge about balanced nutrition, then screening was carried out according to media type variables and adjusted to inclusion criteria, found 45 articles. The criteria for selecting articles in journals include international journals that have a Scopus index and/or web of science, national journals that have been accredited and have an index of Sinta 1-4, articles with the previous 5 years, and the number of articles cannot be less than 10 article. The criteria for the journals reviewed are research articles

that use Indonesian or English with children as the subject and types of research articles with the theme of the effect of health media types on children's knowledge about balanced nutrition. After reviewing and meeting the requirements for statistical tests, 10 articles were obtained to be analyzed.

RESULTS AND DISCUSSION

Research Characteristics

10 research journals were divided into two groups, seven researches on the effect of picture card media on children's knowledge of balanced nutrition and three research journals on the effect of poster media on children's knowledge of balanced nutrition.

Research Characteristics The effect of flashcard media on children's knowledge of balanced nutrition is described in seven research journals that were reviewed using the RevMan 5.4 program. The following is a description in the form of a Table 1:

TABLE 1. Research characteristics effect of flash card media on children's knowledge about balanced nutrition

No.	Researcher	Measurement	Treatment Group			Control Group			<i>p</i> Value
			Mean	<i>SD</i>	N1	Mean	<i>SD</i>	N2	
1.	(Selviyanti et al., 2019) Intervention: flashcard control: leaflet	Questionnaire General message of balanced nutrition	80.21	10.81	23	77.39	10.78	46	0,000
2.	(Maslakah & Setiyaningrum, 2017) Intervention: flashcard Control: discourse	Balanced nutrition general guideline questionnaire	22.84	11.83	31	5.42	4.21	31	0,000
3.	(Mustikaningsih et al., 2019) Intervention: Education card control: discourse	Balanced nutrition general guideline questionnaire	21.83	11.78	30	11.83	11.33	30	0,001
4.	(Rahmah et al., 2019) Intervention: quartet card control: discourse	breakfast habits questionnaire, breakfast energy and protein intake, nutritional knowledge about breakfast	11.25	2.49	24	5.00	1.48	24	0,001
5.	(Fadhilah et al., 2017) intervention: vegetable card control: discourse	Questionnaire of knowledge about vegetables, the need for vegetable portions	82	10.14	30	74.7	11	30	0,000
6.	(Setiana et al., 2019) Intervention: flashcard control: fairytale	Nutritional knowledge questionnaire	40.78	3.15	32	31.84	3.98	32	0,000
7.	(dos Santos Chagas et al., 2020) Intervensi: rango card Control: No intervention	Nutritional knowledge questionnaire	4.2	0.5	117	4.2	0.6	202	0,474

Then the characteristics of the research. The effect of poster media on children's knowledge about balanced nutrition is described in three other research journals that are reviewed

and deserve to be inputted using the RevMan 5 program. The following is the description in Table 2:

TABLE 2. Research characteristics effect of poster media on children's knowledge about balanced nutrition

No.	Researcher	Measurement	Treatment group			Control Group			<i>p</i> Value
			Mean	<i>SD</i>	N1	Mean	<i>SD</i>	N2	
1.	(Indraswari, 2019) Intervention: poster Control: nutrition card	Balanced nutrition knowledge questionnaire	11.57	1.95	14	11	1.96	15	0,005
2.	(Trianasari et al., 2018) Intervention: poster Control: PGS tile board	Balanced nutrition knowledge questionnaire	78.62	9.187	26	70.92	10.885	26	0,000
3.	(Fonseca et al., 2019) Intervensi: poster Control: no intervention	Questioner about principles of healthy eating, food classification, representations of healthy, unhealthy meals, their sugar, salt, and fat content	6.82	2.317	273	6.46	2.72	188	0,199

Results of Analysis and Interpretation

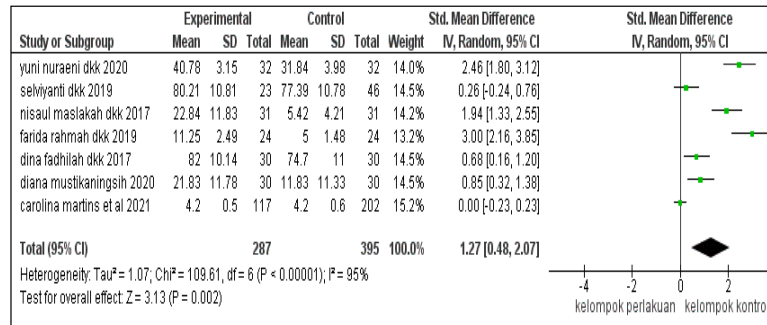


FIGURE 2. Forest plot effect of flash card media on children's knowledge about balanced nutrition

Based on the forest plot, Figure 2 shows the results of the high heterogeneity test analysis ($I^2 = 95\%$; $p < 0.00001$) so that it uses random effect models. The results of the statistical test showed that the summary effect was 1.27 with a 95% CI = 0.48 to 2.07; the value of the overall effect $Z = 3.13$, $p = 0.002$. The summary effect position is more than 0 which means that the picture card media is more effective than the control group that does not use the picture card media in increasing children's knowledge about nutrition. In Figure 2 the CI value is 95% with a range of 0.48 to 2.07. Because it does not cross the 0, then the study is statistically significant.

Hypothesis testing is seen from the test value for overall effect (Z score). The overall effect or the combined effect is the conclusion of the effect of several research results. Test for overall effect is a statistical test whether the combined effect is significant or not. The combined effect is said to be significant if the p value is less than 0.05 and the overall effect CI does not touch the vertical line (Dahlan, 2019). In the forest plot of Figure 2, the Z value is 3.13 and the p value is 0.002. Statistically, the combined effect will be significant if the p value < 0.05 and this illustrates that the null hypothesis is rejected, which means that there is an influence between the flash card media on children's knowledge about balanced nutrition.

The results of this study explain that there is an influence between the media with picture cards (flashcards) on children's knowledge about balanced nutrition. Picture card media (flashcard) was more effective than the control group in this study, namely leaflets, lecture method, fairy tale method and without intervention. Picture card media (flashcards) are more effective than leaflets because leaflet media makes children only see and listen to what the teacher/instructor has to say so that students can only capture 50% of the information. Different from a group of children who were given counseling using flashcard media. Where children are not only given counseling at the end of

the counseling, they are also given games in groups, then directed to do something real, they are taught to play roles and simulate with their friends so that the ability to remember and understand the material from the types of activities carried out can reach 90% (Selviyanti et al., 2019). In accordance with Dale's theory (1946) which argues that experience can be used as a learning resource according to certain levels/levels which will be in the form of a cone of experience (cone of experience) with the top level being reading (10%), listening (20%), seeing pictures or watching videos (30%), attending seminars or watching demonstrations (50%), attending workshops (70%), and simulations or field work practices (90%) (Witt, 1954).

The media with picture cards (flashcards) is more effective than the lecture method because in the lecture method, children only listen. While the picture card media makes children more active in absorbing information because children can see the media, hold the media, read messages, listen to presenters, conclude the content of the material and be more active during question and answer sessions (Fadhilah et al., 2017). Likewise, when compared to the fairy tale method, picture card media is more effective because children get a more concrete experience from picture card games (Setiana et al., 2019).

This is in line with the opinion of experts that other stimuli from the visual senses given to a person can increase the absorption of material by 30% compared to reading text which is only 10% (Contento, 2010). It is also supported by Saeidi and Mozaheb (2012) who revealed that flashcard media is very good for children who are in the developmental stage because flashcards can make the classroom atmosphere fun. Through these media children can learn while playing, so that children are more interested in learning and learning becomes more fun (Retnawati, 2018). So it can be concluded that the type of health media from picture card media has an influence on children's knowledge about balanced nutrition.

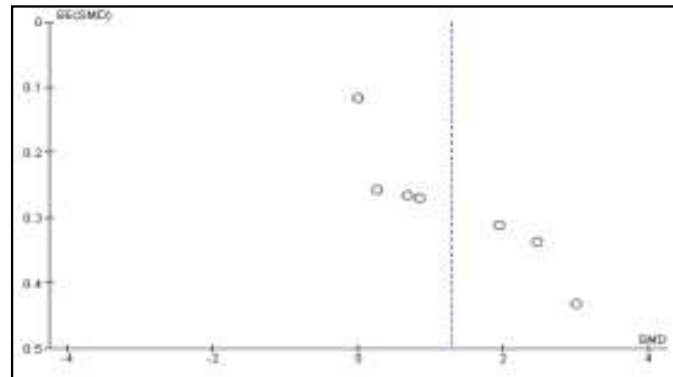


FIGURE 3. Funnel plot effect of flash card media on children's knowledge about balanced nutrition G

In the funnel plot in Figure 3, it can be seen that the plots are not symmetrical on the right and left of the vertical line where the distance between the plots is not the same and there are 4 plots on the left of the vertical line and 3 plots on the right. This indicates a publication bias. Publication bias in this study may occur at the stage of sample selection and specification and intervention in experimental studies (Retnawati, 2018). In the previous interpretation, it was explained that the research sample was larger in the study of dos Santos Chagas et al. (2020), thus causing the funnel plot point to be higher. Different interventions from experimental treatment in each study also have an ef-

fect on bias. Meta-analysis with quantitative data through a random effects model approach, although the combination of this information can produce an accurate statistical data analysis, publication bias is still unavoidable (Rumokoy, Salaki, Memah, Adiani, & Toar, 2020). This can happen in this study because of the inconsistency of the results of research studies that describe differences in values and have varying data, as well as describe the existence of a negative relationship/correlation and a positive relationship/correlation (Waluyohadi, 2019).

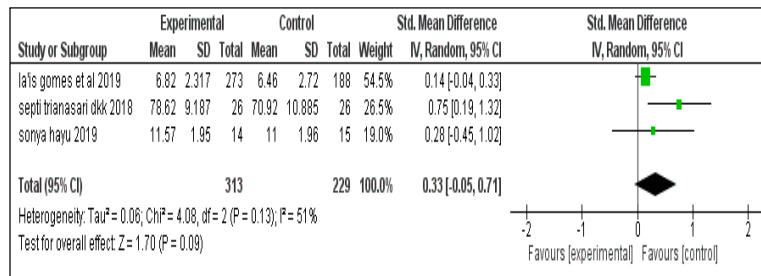


FIGURE 4. Forest plot effect of poster media on children's knowledge about balanced nutrition

Based on the forest plot, Figure 4 shows the results of the heterogeneity test analysis are quite high ($I^2 = 51\%$; $p = 0.13$) so that random effect models are used. The results of the statistical test showed that the summary effect was 0.33 with a 95% CI = -0.05 to 0.71; the value of the overall effect $Z = 1.7$ $p = 0.09$. The summary effect position is 0 which means that the poster media is no different in effectiveness than the control group which does not use poster media in increasing children's knowledge about nutrition. In Figure 4 the CI value is 95% with a range of -0.05 to 0.71. Because the CI value crosses the 0, then the study is not statistically significant.

Hypothesis testing is seen from the test value for overall effect (Z score). The test for the overall effect is said to have meaning when the p value is less than 0.05 and the overall effect CI does not touch the vertical line (Dahlan, 2019). In the forest plot of Figure 4 the Z value shows the number 1.70 and the p value = 0.09. In statistical interpretation, the combined effect value is said to be meaningless if the p value > 0.05 and this figure explains that the null hypothesis is accepted, meaning that there is no difference between poster media and media that does not use posters on children's knowledge of balanced nutrition.

The poster media in this study were compared with the control group, namely the PGS plot board, nutrition card, and without intervention. Poster media did not differ in effectiveness compared to control media for PGS plot boards because the PGS plot board media (Guidelines for Balanced Nutrition) had been packaged as attractively as possible and adapted to the needs and characteristics of children. The PGS plot board media is also able to facilitate the delivery of material and make it easier for children to understand and even recall the material taught to them. Meanwhile, the selection of poster media for counseling still has shortcomings, including the short message content and material that needs to be understood so that children need an explanation to understand the material/message of the poster (Trianasari et al., 2018).

Poster media did not differ in their effectiveness with control media (nutrition cards) because there were similarities in the scores on the results of the knowledge questionnaire in the research of (Indraswari, 2019). The control group (nutrition card) and the treatment group (poster) both showed an increase in the value of knowledge. The results of the questionnaire in the study showed that nutrition counseling using posters or nutrition card media was equally effective in increasing the knowledge about nutrition of respondents (Indraswari, 2019). This is in accordance with Dale's theory that the knowledge gained from reading and viewing pictures is only 30% (Witt, 1954). Because both are visual media, they provide the same effectiveness.

In accordance with the results of research from Trianasari et al. (2018) that there was an increase in the value of knowledge about balanced nutrition in elementary school students before and after being given poster media but it was not more effective than other media. The reason is that poster media has a weakness that lies in the lack of attractiveness and creativity of the posters that are made so that

the message content is not conveyed properly, and causes children to think less critically (Trianasari et al., 2018).

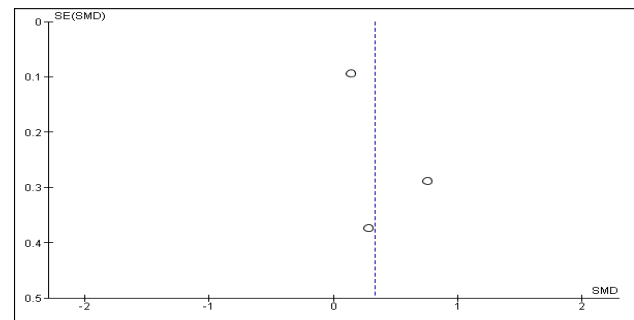


FIGURE 5. Funnel plot effect of poster media on children's knowledge about balanced nutrition

In the funnel plot of Figure 5, it can be seen that the plots are not symmetrical on the right and left of the vertical line where the distance between the plots is not the same and there are 2 plots on the left of the vertical line and 1 plot on the right. This indicates a publication bias. Publication bias in this study may occur at the stage of sample selection and specification and intervention in experimental studies (Retnawati, 2018). In the study of Fonseca et al. (2019) the research sample was larger than other studies, causing the funnel plot point to be higher and not symmetrical.

CONCLUSION

Analysis of the effect of picture cards on children's knowledge of balanced nutrition showed that flash cards as an intervention group were more effective than the control group who did not use picture cards in increasing children's knowledge of balanced nutrition. Analysis of the effect of poster media on children's knowledge of balanced nutrition showed that poster media as an intervention group did not differ in effectiveness compared to the control group that did not use poster media in increasing children's knowledge about balanced nutrition. So it can be concluded that the type of health media has an influence on children's knowledge about balanced nutrition.

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