Association Between Fast-Food Consumption and Obesity in Elementary Students: Review Article

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Abstract. Sub-optimal diet containing high energy density could be a predisposing factor for obesity in school children. This literature review aimed to examine the relationship between fast-food consumption and obesity in elementary children. Google Scholar and PubMed databases were used for study selection by keywords: fast-food, obesity, and school children. The inclusion criteria applied were full-text articles written in Indonesian or English and published in journals indexed by Sinta or Scopus for the period of 2011–2021. There were 6 studies included in this review. The type of fast food consumed often by the students were biscuits, chocolate, ice cream, cakes, fried chicken, french fries, pizza, hamburgers, sandwiches, and hot dogs. The proportion of obese school children who consumed fast food ranged from 9.7% to 69.4%. A positive relationship between fast food consumption habits and obesity has been reported in all the studies (p-values varied < 0.05).

Keywords: fast-food · school children · obesity · association

1 Introduction

Obesity is a condition of excess fat storage in the body due to excess energy intake than energy expended [1]. It is a global nutrition problem that can be found in all age groups, including school children. The prevalence of obesity has been reported to increase in developing countries by 30% [2]. More than 18% of children and adolescents aged 5–19 years in the world were reported overweight and obese [3]. According to the latest Indonesia basic health survey in 2018, 20% of children aged 5–12 years were overweight and obese, which slightly increased by 1.2% compared to the previous survey in 2013 [4].

Overweight and obesity in childhood tend to persist in adulthood and increase the risk of non-communicable diseases, such as diabetes mellitus type 2, cardiovascular disease, and early mortality later in life [5]. It has been reported that obesity is associated with unhealthy lifestyles and eating habits [6], including the habit of consuming fast food [7]. Fast food is easy to prepare and often served in large portions and is high in energy, fat,

salt, and sugar, but low in fiber and micronutrients [8]. These foods included local fast-food (e.g., fried noodles, *martabak*, meatballs, etc.), modern/western fast-food (e.g., fried chicken, pizza, french fries, hamburgers, sandwiches, and ice cream, etc.) [9], canned foods and snacks [8].

The increase in energy density in fast food is associated with an increase in the risk of obesity [10]. The average energy density of all fast-food menus is approximately > 2 times the energy density of healthy menus [11] which contribute to a high total energy intake [12]. It is reported that the total energy density of all menus at fast-food outlets is approximately 1100 kJ/100 g which is 65% higher than the energy content of a regular diet (670kJ/100 g) and twice the energy density of a healthy diet (525 kJ/100 g) [13]. One serving of fast food contains 400–600 cal or even 1500 cal which can meet calorie needs in a day [14]. The average consumption of fast-food in children and adolescents is 1–2 times a week, with soft drinks, french fries, and fried chicken often consumed [7]. These unhealthy eating patterns have been reported to increase the incidence of obesity in children and adolescents [15]. School children who often consumed fast-food 15 times more likely to be obese than those who rarely consumed the food [16]. Fast food consumption more than 3 times per week tends to increase 3.28 times the risk of being overweight [17]. Limited data are available reviewing studies on this topic which also include articles published in local languages, which might be used to compare the study quality and its outcome. This review examined the association between fast food consumption and obesity in elementary children by involving articles published in Bahasa Indonesia. The methods used were also examined.

2   Methods

A literature search was designed to select appropriate studies through Google Scholar and PubMed using the keywords fast food, obesity, and school children. Inclusion criteria included full-text articles related to fast food and obesity written in Indonesia or English that were published in the last 10 years (2011–2021) in accredited national journals called Sinta 1–4 (http://sinta.ristekbrin.go.id/) or Scopus indexed journals in quartile 1–4, the study used cross-sectional or case-control with the respondents of elementary school children aged 6–12 years. The exclusion criteria were a review article, articles retracted from the journal due to publication ethics issues, and a student's report or thesis. Six studies were selected based on the criteria and included in this review (Fig. 1).

3   Results

Based on the selected studies, the number of respondents varied from 64 to 4895 respondents with maximum age was in grade 5 or approximately 11 years (Table 1.). Five studies used a cross-sectional, the rest used a case-control with setting in elementary schools. The sampling technique mostly used by the studies was random sampling, followed by quota sampling, stratified multistage, random cluster sampling, multistage systematic random sampling and convenience sampling. Three studies were performed in Indonesia, and the others were conducted in Pakistan, Northwest Ethiopia and Korea. Five studies used questionnaire to measure the fast-food consumption, the rest used combination
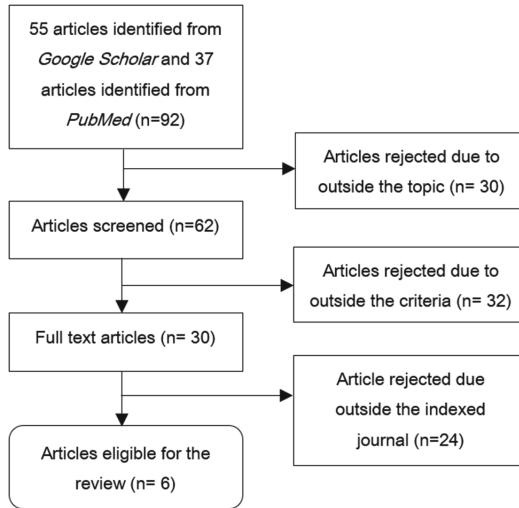
Fig. 1. The article selection process

24-h food recall and food frequency questionnaire. The types of fast-food categorized as biscuits, chocolate, ice cream, cakes, and western fast food such as fried chicken, french fries, pizza, hamburgers, sandwiches, and hot dogs. The category of frequency of consumption of fast food varies from never, rarely, often, 1-2x/month, 1-2x/week, 3x/week, and > 4x/week, and yes or no in consuming fast food (Table 2.).

The percentage of obese school children consuming fast food was reported in 5 studies from 9.7% to 69.4%. A chi-square, multivariate, multivariate logistic regression, multivariable logistic regression, and multinominal logistic regression were the statistical method used to examine the relationship between the fast-food consumption and the obesity. Positive correlations have been reported in all the studies, with p-values varied < 0.05, which indicated that there was a relationship between fast-food consumption and obesity among elementary school children. Five articles also reported odd ratio (OR) or adjusted odd ratio (AOR) results with varying results. They reported that children who consumed fast-food have a risk of 3.667 times become obesity [19], fast-food consumption (OR = 2.42) was a dominant factor that related to the overweight/obesity happen among the students [20], eating fast-food and snacks once or more a week (OR = 1.41) were significant independent predictors of being overweight and obese [21], and odd being overweight/obese were higher in fast-food consumer compared to non-eater (AOR = 3.88) [22] (Table 3.).

Table 1. Characteristics of respondents

Author	Total (n)	Gender (%)		Age (n, %)
		Boys	Girls	
Septiani & Bambang, 2017 [18]	72	n/a	n/a	9 yo: 25 (34.7%); 10 yo: 26 (36.1%); 11 yo: 21 (29.2%)
Junaidi & Noviyanda, 2016 [19]	64	Case: 59.4 Control: 53.1	Case: 40.6 Control: 46.9	Both in case and control groups, majority age < 10 yo of 62.5% and 53.1%, respectively
Febriani & Trini, 2019 [20]		n/a	n/a	Students in grades 3, 4, 5
Mushtaq et al., 2011 [21]	1860	52.5	47.5	Mean = 8.49 ± 1.81 yo
Mekonnen et al., 2018 [22]	616	45	55	Mean = 9.7 ± 1.4 yo
Lee & Ok., 2015 [23]	4895	49.7	50.3	Mean = 8.9 yo

4   Discussion

A causal relationship between 2 variables usually used in an epidemiological study to determine risk factors of developing certain diseases. This is important in order to determine the efforts that individuals, health workers and the government can take to anticipate the emergence of a disease and improve the health quality.

of the community. According to the method used in the Table 2., a cross-sectional design was most method applied to assess the correlation between the fast-food consumption and the obesity in the elementary school children [18, 20–23] and one study used case control [19]. A cross-sectional study measures both independent (risk factor) and dependent variable (effect) simultaneously at one time point according to condition at the time of observation. It has been mainly used to extrapolate a proportion of people in a population who has a particular disease or attribute at any given time, regardless of when the condition first appears, hence it is also known as prevalence study.

Considering the characteristic of the study, it unable be used to measure an incidence or the number of new cases developed in certain period of time [24]. Likewise, the reporting odd ratio (OR) for drawing conclusions from cross-sectional studies [20–23], for example 'x has a 2 times higher probability of risk than y' is considered inappropriate, because this is not a probability ratio, and cross-sectional design cannot measure risk, because both outcome and exposure are measured simultaneously [25]. Odd ratio is only appropriate for case control studies. While for cross-sectional studies, prevalence ratio (PR) is more correct, but is only appropriate if the prevalence is less than 10% [25]. Another advantage of cross-sectional study is relatively quick and less expensive to be done to reach large sample in the population by questionnaires or interview, as in this reviewed article [18, 19, 21–23]. In addition, multiple outcomes and exposures can be

Table 2. The research methods used in the selected studies

Author	Study design	Sampling technique	Research place, country	Instrument used to measure fast-food consumption	Types of fast-food studied
Septiani & Bambang, 2017 [18]	Cross-sectional	Random sampling	01 Tonjong public elementary school, Indonesia	Questionnaire	n/a
Junaidi & Noviyanda, 2016 [19]	Case- Control	n/a	67 Percontohan Banda Aceh public elementary school, Indonesia	Questionnaire	n/a
Febriani & Trini, 2019 [20]	Cross-sectional	Quota sampling	Perguruan Cikini elementary school, Indonesia	24-h food recall and food frequency questionnaire	Fried chicken, burger, hotdog, sandwich, pizza
Mushtaq *et al.*, 2011 [21]	Cross-sectional	Stratified multi-stage random cluster sampling	Elementary school in Lahore, Pakistan	Questionnaire	n/a
Mekonnen *et al.*, 2018 [22]	Cross-sectional	Multistage systematic random sampling	Elementary school in Bahir Dar City, Northwest Ethiopia	Questionnaire	Biscuits, chocolate, ice cream, cake
Lee & Ok., 2015 [23]	Cross-sectional	Convenience sampling	59 Elementary schools in Korea	Questionnaire	Pizza, hamburger, cookies, fried chicken, french fries

Table 3. The statistical analysis reported in the selected studies

Author	Fast-food consumption category	Nutritional status (n,%)		Total (n,%)	Statistical analysis	p-value	OR/AOR (95% CI)
		Obesity	Normal				
Septiani & Bambang, 2017 [18]	Never	4 (11.1)	5 (13.9)	9 (12.5)	Chi-square	0.036	n/a
	1-2 times/week	7 (19.4)	18 (50)	25 (34.7)			
	>twice/week	25 (69.4)	13 (36.1)	38 (52.8)			
Junaidi & Noviyanda, 2016 [19]	Often	20 (62.5)	10 (31.2)	30 (46.8)	Chi-square	0.024	3.667[a]
	Seldom	12 (37.5)	22 (68.7)	34 (53.7)			
Febriani & Trini, 2019 [20]	>3 times/week	n/a	n/a	n/a	Multivariate	0.021	2.42 (1.14-5.12) [a]
	≤3 times/week						
	>4 times/week						
Mushtaq et al., 2011 [21]	<once/week	72 (6.8)	907 (85.4)	n/a	Chi-square, multivariate logistic regression	0.027; <0.05 for OR	n/a
	1-2 times/week	46 (8.4)	441 (80.3)				1.41 (1.07-1.86)[b]
	≥3 times/week	22 (8.8)	196 (78.7)				1.56 (1.09-2.24)[b]
Mekonnen et al., 2018 [22]	Yes	68[c]	405	473 (76.8)	Multivariate logistic regression	<0.05	3.88 (1.42-10.55)[b]
	No	5[c]	138	143 (23.2)			
Lee & Ok., 2015 [23]	≥once/week	291 (47.2)[c]	1.723 (43.6)	n/a	Chi-square, multinominal logistic regression	<0.001; <0.05 for OR	n/a
	Never	265 (43.0)[c]	1.740 (44.1)				1.42 (1.01-2.00)[a]
	1-2 times/month	60 (9.7)[c]	487 (12.3)				1.45 (1.03-2.03)[a]

[a]OR, odd ratio; [b]AOR, adjusted odd ratio; [c]*Overweight*/obesity; CI, confidence interval

studied at the same time [24]. Case-control research design is inherently retrospective, concerning how the risk factor (exposure) learned by using retrospective approach. It is beginning with identifying the client with certain effects or disease (case group) and group without effect (control group), then studied risk factor (exposure) that can explain why the case group affected, while not for the control group [26]. Case-control studies has a stronger point of view in determining cause-and-effect relationships when compared to cross-sectional study [26].

In term of sample technique used in the selected studies are probability sampling [18, 21, 22] and quota sampling [20, 23]. Probability sampling provide an equal chance for subject in population of being selected or not in the process, while quota sampling is a non-probability sampling which is more practical and easier to select samples [26]. One study collected the fast-food data using a 24-h recall combined with FFQ [20]. A 24-h recall is performed by asking individual food consumption for the previous 24 h to assess daily nutrients intake. The FFQ emphasizes the frequency of intake or certain food groups which are usually carried out in a span of one month, six months, to a year to determine individual eating habits. The category of frequency of consumption of fast-food varies from never, rarely, often, one-twice/month, one-twice/week, 3 times/week, and > 4 times/week [26].

The six articles reported that obese children consumed fast food more often than children with normal/non-obese nutritional status with a percentage range of 9.7% to 69.4%. This similar to the latest study which reported that obese elementary school children consumed fast food more often with a percentage of 34.7% than those who rarely eating fast food with a percentage of 1.3% [27]. Obesity in children is influenced by many factors related to the development of children's life style, where they spend a lot their time. Family environment, socioeconomic status, media [28], and parental dietary behavior [29] have been reported to influence a child's eating habit. Currently, the existence of outlets selling fast food and online order food is growing rapidly. Working

or busy parents who have young kids tend to eat fast-food due to their time constraints [30]. Moreover, fast food processing is quick, easy to find, looks clean, and the service is always available anytime [31]. All the studies reported significant association between fast-food consumption and the obesity which is in accordance with the previous studies [32, 33]. The high fat and calorie contents in fas-food increase the prevalence of obesity if consumed in large quantities and frequently.

This review includes published articles not only in internationally indexed journals; but also presents results of studies published in journals indexed by a nationally accredited journal called Sinta which is present in Bahasa Indonesia. It can be used to compare the results of other studies and improve the quality of similar research in the future, especially conducted in Indonesia. Our results were limited to the limited duration and open-access articles which influence the limited number of selected studies in this review.

5   Conclusions

Fast foods commonly consumed by the elementary school children in this review were biscuits, chocolate, ice cream, cakes, fried chicken, french fries, pizza, hamburgers, sandwiches, and hot dogs. A positive association between fast food consumption and obesity in elementary children has been reported in the selected studies.

Authors' Contributions.   HS performed the articles selection, data presentation and drafted the manuscript. SR reviewed the data, provided discussion section, and finalized the manuscript. Both authors reading the final manuscript.

Conflict of Interest.   The authors have no conflicts of interest to declare.

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