



# Association between the Habitual Snack Consumption at School and the Prevalence of Overweight in Adolescent Students in Tasikmalaya, Indonesia

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## Abstract

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**BACKGROUND:** Worldwide, more than 340 million children and adolescents have overweight problems, and snacking habits are likely contributing factors. However, little is known about habitual snack consumption in school, especially regarding snack types that may lead to overweight.

**AIM:** Our study aims to analyze the association between habitual snack consumption and the prevalence of overweight in junior high school students.

**METHODS:** An observational study with a cross-sectional design was conducted in Tasikmalaya, West Java, Indonesia, involving 397 participants from five public junior high schools. The habitual snack consumption included the consumption habits of various types of snacks (sweet fried snacks, salty fried snacks, sweet non-fried snacks, salty non-fried snacks, fruits, and sugar-sweetened beverages) measured by a food frequency questionnaire (FFQ) and categorized into rarely and often. The overweight status was determined based on the BMI-for-age z-score (BAZ) and categorized into not-overweight and overweight. We analyzed the data using a logistic regression test.

**RESULTS:** The habits of often consuming sweet fried snacks ( $p < 0.001$ ;  $^{\circ}\text{OR} = 5.448$ ; 95% CI = 2.303–12.886), salty fried snacks ( $p = 0.040$ ;  $^{\circ}\text{OR} = 3.662$ ; 95% CI = 1.063–12.621), and sugar-sweetened beverages ( $p = 0.026$ ;  $^{\circ}\text{OR} = 3.100$ ; 95% CI = 1.143–8.407) were risk factors associated with overweight.

**CONCLUSION:** The habit of often consuming sweet fried snacks was a risk factor for being overweight with the greatest odds. Therefore, education on healthy snacks could be included in school learning materials to prevent overweight in adolescent students.

## Introduction

Many countries face a double burden of nutritional problems characterized by under- and over-nutrition. Worldwide, more than 340 million children and adolescents between the ages of 5 and 19 encounter the challenges of being overweight and obese [1]. Adolescents with overweight tend to remain overweight as adults [2]. Being overweight plays an essential role in non-communicable diseases (NTDs) in cardiovascular diseases, diabetes, and all causes of mortality [3]. Lowering overweight prevalence can reduce the economic impacts of being overweight in the future [4].

Snacks with high-energy-dense foods containing carbohydrates and fats, mainly saturated fats, are one of the causes of overweight [5]. Over time, the habit of snacking increases among adolescents [6]. Adolescents with overweight consume snacks more frequently than those not overweight [7]. Regular snacking may help children and adolescents to meet dietary recommendations [8] but may also contribute

to excess energy intake in line with evidence for the wide availability of energy-dense snack foods and beverages [9]. Adolescent students spend time in school from 7.30 am until 3 pm, and snacks can help to eliminate hunger [10]. Moreover, snacks with high-energy content are inexpensive [11], [12] to fit with the pocket money of students [13]. Unfortunately, many schoolchildren often consume high salt and sugar snacks [14] such as chips, biscuits, candies, carbonated drinks, and chocolate [15].

In adolescents, an increased prevalence of overweight occurs not only in high-income countries (HICs) but also in low-middle countries (LMICs) [16]. In LMICs, the prevalence of overweight is more common in high-income than low-income populations [17]. Moreover, among school students, the prevalence of overweight in public schools was 3 times lower than in private schools [18]. The increasing prevalence of overweight in Southeast Asian countries has shown an alarming trend over the past 10–15 years [19]. Being one of the low-middle-income countries in the Southeast Asian region, Indonesia has an increasing prevalence

of overweight in adolescents aged 13–15 years. The prevalence of overweight increased from 8.3% in 2013 [20] to 11.2% in 2018 [21].

Tasikmalaya has the highest percentage of low-income populations (11.6%) in West Java Province [22], the most populous province in Indonesia. In 2018, the prevalence of overweight adolescents aged 13–15 in West Java Province (12%) was higher than the national prevalence (11.2%) [21]. We question if snack habits at school are related to overweight adolescents from all of the above findings. Therefore, we aim to analyze the correlation between habitual snacks consumption in school and the prevalence of overweight in junior high school students.

## Materials and Methods

### *Study design and participants*

The Ethics Commission of the Universitas Bakti Tunas Husada (BTH) Tasikmalaya approved our research protocol (174/kepk-bth/VIII/2021). Furthermore, participants signed an informed assent, and then, parents signed informed consent after receiving information about the research objectives before data collection began.

In public junior high schools, we conducted this observational study with a cross-sectional design in Tasikmalaya City, West Java, Indonesia. Five out of 25 (20%) public junior high schools agreed to participate in this study. The minimum samples calculation with a 5% level of precision required 371 participants, but 409 participants were recruited for a possible 10% non-response. A proportional random sampling technique was used to determine the participants. The participants were selected through screening using the inclusion criteria, that is, healthy students aged 12–15 years and willing to participate in this study. Initially, we included 409 participants. However, 12 participants with underweight status ( $BAZ < -12SD$ ) were excluded from data analysis because underweight was not the same as normal weight. None of the participants was obese ( $BAZ > +2SD$ ). Finally, there was 397 participants for data analysis.

### *Demographic and health behavior data*

We used a questionnaire to collect demographic and health behavior data as confounding variables. The demographic data included age (years), gender, and grade. After collecting the age data, we first calculated the mean age to determine the cutoff point. Based on this cutoff point, age was categorized into  $<$  the mean (13 years old) and  $\geq$  the mean (13 years old). Using the mean value as a cut-off point is the easiest way

to categorize a variable [23]. Gender was categorized into male and female, while grade was categorized into Grades VII and VIII.

Health behavior data included breakfast habits and sports habits. Breakfast habits were defined as consuming food or energy drinks such as milk before going to school, and it was categorized into “yes” and “no.” Sports habits were determined by asking participants about sports activities during the week (minimum 30 min per exercise and performed 3 times a week), and it was categorized into “yes” and “no.”

### *Overweight status*

We measured overweight status as a dependent variable by calculating the body mass index-for-age z-score (BAZ). We measured body weight (kg) and height (cm) using a Seca 803 digital weighing scale (0.1 kg accuracy) and a Charder HM200P portable stadiometer (0.1 cm accuracy), respectively. All participants, both male and female, had no footwear during measurement. Overweight status was grouped into not overweight if  $BAZ < +1SD$  to  $\geq -2SD$  and overweight if  $BAZ \geq +1SD$  to  $< +2SD$ .

### *The habitual snack consumption*

In this study, snacks were defined as food and beverage produced or sold by vendors in permanent or non-permanent buildings in schools. The habitual snack consumption as an independent variable included the consumption habits of various types of snacks and was determined using a food frequency questionnaire (FFQ). The food frequency questionnaire consists of a list of snacks and the frequency of snack consumption [24]. Before the study started, we surveyed the various types of snacks sold at five schools and produced a list of snacks. Furthermore, we grouped the various types of snacks into 1 = sweet fried snacks; 2 = salty fried snacks; 3 = sweet non-fried snacks; 4 = salty non-fried snacks; 5 = fruits, and 6 = sugar-sweetened beverages. The frequency of snack consumption was recorded as daily, 3–4 times a week, 1–2 times a week, and never. Finally, we categorized the habitual snacks consumption into 0 = rarely if consumed  $< 3$  times a week and 1 = often if consumed  $\geq 3$  times a week [25].

### *Statistical analysis*

All data (age, gender, grade, breakfast and sports habits, and the habitual snack consumption) are dichotomous, which means that there are only two possible categories (i.e.,  $<13$  years vs.  $\geq 13$  years, male vs. female, VII vs. VIII, yes vs. no, and rarely vs. often, respectively); thus, we presented the data using frequency and percentage values. Bivariable logistic regression was used to determine the relationship

between age, gender, grade, breakfast and sports habits, and habitual snack consumption, respectively, with overweight status. The bivariable analysis also calculated the crude odds ratio (cOR) with a 95% confidence interval (CI). Furthermore, variables with  $p < 0.25$  in the bivariable logistic regression analysis were included in the multivariable logistic regression. The adjusted odds ratio (aOR) was calculated with a 95% confidence interval (CI).

## Results

We successfully collected all the data of participants (397). The participant's age was nearly the same between  $<13$  years and  $\geq 13$  years. The female participants were twice as much as the male, and the number of students from Grade VII was similar to Class VIII. More than half of the participants have the habit of having breakfast before going to school, but only a third of the participants had the habit of sport. The BMI-for-age z-score showed that the prevalence of overweight was 10.1%.

Most participants often consumed salty fried snacks, salty non-fried snacks, and sugar-sweetened beverages. The habit of often and rarely consuming sweet snacks, both fried and non-fried, was almost the same. Fruits were the least consumed snack at school (Table 1).

**Table 1: Characteristics of the study participants**

Variables	n	%
Demographic		
Age (years)		
<13	202	50.9
$\geq 13$	195	49.1
Sex		
Male	130	32.7
Female	267	67.3
Grade		
VII	175	44.1
VIII	222	55.9
Health behavior		
Breakfast habits		
No	128	32.2
Yes	269	67.8
Sport habits		
Yes	120	30.2
No	277	69.8
Overweight status		
Overweight	40	10.1
Not overweight	357	89.9
The habitual snack consumption		
Sweet fried snacks		
Rarely	208	52.4
Often	189	47.6
Sweet non-fried snacks		
Rarely	230	57.9
Often	167	42.1
Salty fried snacks		
Rarely	100	25.2
Often	297	74.8
Salty non-fried snacks		
Rarely	60	15.1
Often	337	84.9
Fruits		
Rarely	328	82.6
Often	69	17.4
Sugar-sweetened beverages		
Rarely	117	29.5
Often	280	70.5

The bivariable analysis showed that

demographic and health behavior data, including age, gender, grade, breakfast, and sports habits, were not correlated with overweight status ( $p > 0.05$ ). The habitual consumption of sweet non-fried snacks, salty non-fried snacks, and fruits was also not related to overweight status ( $p > 0.05$ ). Meanwhile, there was a correlation between habitual snacks consumption of sweet fried, salty fried, and sugar-sweetened beverages with overweight status ( $p < 0.05$ ).

Forty overweight participants, 33 (17.5%), often consumed sweet fried snacks, while 7 (3.4%) rarely consumed sweet fried snacks. The number of overweight participants who often consumed salty fried snacks was 37 (12.5%). Notably, 3 (3.0%) of them rarely consumed salty fried snacks. Thirty-five (12.5%) overweight participants often consumed sugar-sweetened beverages and 5 (4.3%) of them rarely consumed sugar-sweetened beverages (Table 2).

In the multivariable logistic regression model, we put six of 11 predictor variables of overweight having  $p < 0.25$  in bivariable analysis. The final multivariable logistic regression showed that the significant variables associated with overweight were breakfast habits, sweet fried snacks, salty fried snacks, and sugar-sweetened beverages. Table 3 showed that frequently consuming sweet-fried snacks had the highest aOR value compared to other variables (aOR=5.448; 95% CI=2.303–12.886).

## Discussion

Overweight is an excess of body weight due to abnormal or excessive fat accumulation [1]. Determination of overweight in children and adolescents uses BMI according to age and sex specific and is often referred to as BMI-for-age [26]. Adolescents' overweight is a vital risk factor for overweight adults, and they experience an increased risk of morbidity and mortality [3]. The prevalence of overweight in low-middle-income countries (LMICs) continues to increase in high-income countries (HICs) [16].

Our study determined overweight status using anthropometric standards from the Ministry of Health of Republic Indonesia [27]. The prevalence of overweight in our study (10.1%) was lower than but close to the national prevalence of overweight in adolescents aged 13–15 years (11.2%) and West Java Province (12%) in 2018 [21]. The number is of concern considering that Tasikmalaya is a sub-urban area with the most low-income population (11.6%) in West Java Province, Indonesia [22]. Moreover, our participants come from public schools with fewer overweight students than private schools [28]. Therefore, it is important to intervene in factors related to being overweight,

**Table 2: Risk factors of overweight status in a bivariable analysis**

Variables	Overweight status		p-value	cOR <sup>a</sup> (95% CI)
	Not overweight, n (%)	Overweight, n (%)		
<b>Demographic</b>				
<b>Age</b>				
≤ge	183 (90.6)	19 (9.4)	-	1.00
>13	174 (89.2)	21 (10.8)	0.652	1.162 (0.604–2.236)
<b>Gender</b>				
Male	112 (86.2)	18 (13.8)	-	1.00
Female	245 (91.8)	22 (8.2)	0.085 <sup>†</sup>	0.559 (0.288–1.083)
<b>Grade</b>				
VII	155 (88.6)	20 (11.4)	-	1.00
VIII	202 (91.0)	20 (9.0)	0.472	0.767 (0.399–1.476)
<b>Health behavior</b>				
<b>Breakfast habits</b>				
No	110 (85.9)	18 (14.1)	-	
Yes	247 (91.8)	22 (8.2)	0.072 <sup>†</sup>	0.544 (0.281–1.055)
<b>Sport habits</b>				
Yes	113 (94.2)	7 (5.8)	-	
No	244 (88.1)	33 (11.9)	0.070 <sup>†</sup>	2.183 (0.937–5.085)
<b>The habitual of snack consumption</b>				
<b>Sweet fried snacks</b>				
Rarely	201 (96.6)	7 (3.4)	-	1.00
Often	156 (82.5)	33 (17.5)	<0.001 <sup>*†</sup>	6.074 (2.617–14.098)
<b>Sweet non-fried snacks</b>				
Rarely	208 (90.4)	22 (9.6)	-	1.00
Often	149 (89.2)	18 (10.8)	0.692	1.142 (0.592–2.204)
<b>Salty fried snacks</b>				
Rarely	97 (97.0)	3 (3.0)	-	1.00
Often	260 (87.5)	37 (12.5)	0.013 <sup>*†</sup>	4.601 (1.387–15.268)
<b>Salty non-fried snacks</b>				
Rarely	56 (93.3)	4 (6.7)	-	1.00
Often	301 (89.3)	36 (10.7)	0.346	1.674 (0.573–4.890)
<b>Fruits</b>				
Rarely	297 (90.5)	31 (9.5)	-	1.00
Often	60 (87.0)	9 (13.0)	0.370	1.437 (0.651–3.174)
<b>Sugar-sweetened beverages</b>				
Rarely	112 (95.7)	5 (4.3)	-	1.00
Often	245 (87.5)	35 (12.5)	0.018 <sup>*†</sup>	3.200 (1.221–8.385)

<sup>a</sup>cOR: Crude odds ratio, <sup>\*</sup>Significant at  $P < 0.05$ , <sup>†</sup>Included in multivariable logistic regression test, 1.00 as a reference.

especially factors that can be changed, such as health behavior [29].

In our study, breakfast habits which are health behavior are a protective factor against being overweight. In line with our findings, meta-analysis studies also confirmed that breakfast habits are significantly associated with a reduced risk of being overweight [30]. Breakfast can immediately cancel the overnight fast so that it can improve appetite and satiety [31]. Conversely, skipping breakfast makes fasting times longer and increases ghrelin concentrations. Ghrelin is a peptide hormone that stimulates hunger and has an appetite-stimulating effect, enhancing human food response [32]. Skipping breakfast is associated with changes in appetite and decreased satiety, leading to subsequent overeating [33]. Moreover, skipping breakfast is suggested to be associated with consuming food of low nutritional value accompanied by high-energy density [34].

Our study found that frequent consumption of sweet fried snacks was the most significant risk factor for being overweight. Diets containing carbohydrates and fat are more effective at producing weight gain when both macronutrients are offered rather than when only one is available [35]. A study in a school setting found that energy-dense snacks (high in fat and sweet) were widely available [9]. In line with our findings, the SUN study reported that consuming fried foods > 4 times/week developed overweight compared to < 2 times/week [36]. Nisak *et al.* also revealed similar results that consumption of fried snacks increases the risk of being overweight in junior high school students in Surabaya, Indonesia [37].

Frying is a common cooking method [38]. Through Maillard's reaction in the frying method, food becomes more attractive because of changes in color, taste, and texture [39]. However, the frying method reduces the water, protein, vitamin, and mineral but increases the fat content of food [40]. The presence of fat in food causes an increase in energy density [41]. Evidence suggests that excessive consumption of energy-dense foods high in fat and carbohydrates can lead to weight gain [38]. Sugar is a high-energy-dense carbohydrate, easily absorbed by the body [42] and commonly added to improve food palatability [43].

**Table 3: Risk factors of overweight status in the final multivariable logistic regression model**

Variables	p-value	aOR <sup>a</sup>	95%CI
Gender	0.114	0.559	0.271–1.150
Breakfast habits	0.037 <sup>*</sup>	0.465	0.226–0.956
Sport habits	0.107	2.081	0.855–5.069
Sweet fried snacks	<0.001 <sup>*</sup>	5.448	2.303–12.886
Salty fried snacks	0.040 <sup>*</sup>	3.662	1.063–12.621
Sugar-sweetened beverage	0.026 <sup>*</sup>	3.100	1.143–8.407

<sup>a</sup>aOR: Adjusted odds ratio, <sup>\*</sup>significant at  $P < 0.05$ .

In our study, the number of participants who frequently consumed sugar-sweetened beverages (SSBs) was 2-fold higher than those who rarely consumed SSB. Many people in the developing countries show high levels of SSB consumption [44] and more among adolescents [45]. Our findings showed the correlation between consumed SSB and overweight. Ruanpeng *et al.* study demonstrated a significant association between sugar-sweetened beverages and overweight [46]. Te Morenga *et al.* also reported that the intake of sugar-sweetened beverages determines body weight [47]. Added sugars in the diet contribute

to the overall energy density of diets and may increase a positive energy balance [48]. The sugar-sweetened beverage is a potential risk factor for overweight in children and adolescents [49], [50].

The limitations of our study are that the cross-sectional design used did not describe a causal relationship since the variables were measured once at a single point time. We also did not measure all confounding variables. This study measured demographic and health behavior factors (age, gender, grade, and breakfast and sports habits) as predictors of overweight in addition to snack consumption habits, but we did not measure other predictors such as parents' overweight. It is better to consider measuring the variables we have not measured for future research. The strengths of our study are the representativeness and adequate sample size and the random selection of participants. Our study adds to the evidence that eating sweets and fried snacks at school increase the likelihood of being overweight in adolescent school students and are widespread in many parts of the world.

## Conclusion

The habitual consumption of sweet fried and salty fried snacks and sugar-sweetened beverages is risk factors significantly associated with overweight in public junior high school students. The most dominant risk factor associated with being overweight is consuming sweet fried snacks. Education regarding the consumption of healthy snacks should be introduced regularly. Furthermore, topics on healthy snacks should be introduced in learning materials of related classes.

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