Adolescents school students in Java and Sumatra are in greater risk of obesity

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Abstrak

Latar belakang: *Indonesia masih menghadai beban ganda masalah gizi berkaitan dengan obesitas yang meningat sementara masalah kurang gizi masih terjadi, termasuk pada remaja. Hasil penelitian masih terbatas, dalam hal aspek demografi dan geografi di Indonesia, sementara strategi pencegahan obesitas pada remaja membutuhkan intervensi yang lebih optimal. Tujuan: Studi ini bertujuan untuk memberikan gambaran masalah obesitas berdasarkan karakteristik populasi dan perilaku berisiko di region yang berbeda.*

Metode: *Studi ini menggunakan data sekunder dari survei kesehatan berbasis sekolah tahun 2015 yang dikembangkan oleh CDC Amerika dan WHO, dengan modifikasi sesuai kondisi Indonesia. Analisis mencakup 10,544 pelajar kelas 7 – 12 dengan representasi populasi nasional di tiga regional/pulau di Indonesia. Uji statistik yang digunakan adalah chi-square dan log regression.*

Hasil: *Model logistik menunjukkan pelajar remaja yang tinggal di pulau Jawa mempunyai risiko yang lebih tinggi untuk mengalami obesitas (adjusted OR 2.1;95%CI 1.3-3.3) dibandingkan pada pelajar yag tinggal di pulau Sumatra dan luar pulau Jawa dan Sumatra, sementara perilaku berisiko seperti aktivitas fisik dan perilaku diet tidak menunjukkan hubungan yang bermakna dengan kejadian obesitas.*

Kesimpulan: *Disparitas masalah obesitas terjadi pada remaja di tiga pulau besar di Indonesia, di tingkat kelas yang berbeda dan perilaku diet berisiko yang berbeda. Strategi pencegahan diperlukan lebih mengarah pada intervensi berbasis sekolah dengan memperhatikan faktor geografis tempat tinggal di pulau Sumatra dan lainnya serta tingkat atau kelas yang berbeda.* ***(Health Science Journal of Indonesia 2019;10(2):119-27)***

Kata kunci: *Obesitas, remaja, perilaku diet, region, aktivitas fisik*

Abstract

Background: Indonesia faces burden of nutrition related diseases as obesity is increasing while malnutrition still exists, including in adolescents. Research are limited in term of which specific demography and geography aspects in Indonesia while stronger strategic intervention to prevent obesity in adolescents is needed. **Objective:** This study aims to describe proportion of obesity in indifferent adolescents characteristic and eating behaviour in different regions.

Method: This study used data from Indonesia 2015 Global School-based Health Survey developed by US CDC and WHO) with modification based on Indonesia specific. The analysis included 10,544 students covered national representative and three regions of school students (grade 7 to 12) in Indonesia. Statistical analysis used chi square and log regressions.

Results: The logistic model showed adolescents students living in Java island has significantly higher risk of obesity (adjusted OR 2.1;95%CI 1.3-3.3) compare to their peers in outside Java and Sumatra Island, while behavior risk factors such as physical activity and dietary habit were not significantly associated with obesity.

Conclusions: Issues disparity of obesity in adolescents occurred in the three main Islands in Indonesia, in different school grades and in those with different dietary risk behaviours. Intervention strategy to address adolescents obesity issues will need to be directed toward school-based settings with taking into account specific approaches for students in Sumatra and other main islands in Indonesia as well as specific for junior and senior high school. ***(Health Science Journal of Indonesia 2019;10(2):119-27)***

Keywords: Obesity, adolescents, dietary behaviour, region, physical activity

Issues of obesity among adolescents have been rising recently in most of the world including less developed countries. Previously, a common assumption appeared that obesity occurred mostly in developed countries where high calorie food source and sedentary life style were very common even for the lowest income group. In fact, issues of obesity occurred within different perspectives between developed and less developed countries. A survey among adolescents in California showed that obesity prevalence significantly increased among lower income adolescents.[1] The prevalence of obesity was relatively low but increasing in less developed countries, including in Indonesia. In this case, non-communicable diseases are threatening and leading to social and economic impact of the population. Obesity adolescent increased the risk of certain obesity-related chronic diseases.[2]

In addition, several studies have been described that adolescents obesity contributed to higher academic and mental health problems such as lower self esteem, anxiety, depressive disorders and risk of suicide attempts.[3]

In terms of nutrition related issues, Indonesia still facing a double burden, where stunting is still high and obesity is on the rise. In general, factors related to obesity include low awareness of the harmful impact on obesity, stress-related eating, which lead to imbalance dietary intake or unhealthy diet during early age or infancy[4,5,6,7], as well as sedentary behaviours. Particularly for Indonesia, adult obesity related to post maternity period (for female) and cultural belief or value toward modern dietary lifestyle. Most of female obesity was related to short distance of child bearing period when dietary behaviour aimed to increase body weight for successful pregnancy which remained the same after the birth delivery due to unchanged dietary behaviours and most likely hormonal related contraceptive used. From the perspective of cultural factors, most people still believe that eating fast food, drinking soft drinks and other packaging drinks considered as 'modern' eating behaviour. Particularly for younger age groups, the high risk dietary habit along with parental eating behavior[8,9], as well as sedentary life style such as spent excessive time working on electronic devices such as TV, mobile phone or computers, may lead to adolescents of childhood obesity.

Obesity prevention may not effectively work using general single 'recipe'. It will requires adolescents specific strategies focusing on adolescent's characteristics and values related to eating behaviour, physical activities, and physical image. The perception of obesity causal factors are also different among those from lower and higher income populations, which may lead to the need for specific intervention for specific economic status subgroups.[10] Therefore it is necessary to study issues magnitude of adolescents obesity and it's characteristics and risk factors associated with adolescents. Specifically in Indonesia, adolescents characteristic dietary different may be varied across different islands, as Indonesia has seven main Islands. This paper aimed to describe behaviour risk determinants of obesity among adolescents. This paper aims to described behaviour risk deteriminants of obesity among adolescents, particularly in different social demographic and three different regions in Indonesia.

METHOD

Study design and population

A cross sectional study was carried out from January to November 2015 to provide accurate data on the proportion of sexual behaviour and its relationship with other health behaviours and protected factors among students. The 2015 Indonesia Global School-Based Health Survey (GSHS) is a school-based survey primarily for 12 to 17 years and conducted by the National Institute of Health Research and Development (NIHRD), Ministry of Health Indonesia. The GSHS was developed by WHO in collaboration with UNICEF, UNESCO, and UNAIDS, and with technical assistance from the US Centres for Disease Control and Prevention (CDC) Atlanta. Population in this survey comprised all junior and senior high school students (Year 7-12) across Indonesia with a total sample of 11,110 students.

The GSHS survey used a two-stage cluster sampling technique to generate a representative sample of students from class 7 to 12. In the first stage, CDC Atlanta selected a number of schools with probability proportional to school enrolment size using a specific computerised sample selection algorithm. Seventy-five schools spread across three regions (Sumatera, Java-Bali, and outer Sumatra and Java-Bali), 26 provinces and 68 districts were nominated. In the next stage, systematic sampling was employed to randomly select intact classrooms using a random start from each participated school. All classrooms within each selected school were included in the sampling frame, and all students in the sampled classrooms were eligible to participate in the study. Inclusion criteria in this study were all the students in grade 7 to 12 who registered in the selected class and schools and were attended at the school during the data collection. Exclusion criteria were those who were having illness and difficulty in response to the survey questions.

Data collection and variables

The 2015 Indonesia GSHS core questions include alcohol use, dietary behaviours, drug use, hygiene, mental health, physical activity, protective factors, sexual behaviours, tobacco use, violence and unintentional injury. Each core question consists of 3-7 questions. These core modules were used to address students' demographics, health behaviours and protective factors among students. The age variable is measured in years. In addition, the weights and heights were also measured among all students using standard portable electronic scales and stadiometers to collect information on the Body Mass Index (BMI). Obese was determined as had BMI > +2SD from median for BMI by age and sex.

In this study, Students completed the self-administered questionnaire during one class period between 20-30 minutes and record their responses directly in a computer-scannable answer sheet. The standardised instrument was used to collect the information on students' health-risk behaviours after being carefully adapted from the GSHS questionnaires. Prior to study, the questionnaires were initially translated into Bahasa Indonesia.

The variables used in this study are described in Table 1. The dependent variables were obesity, whereas independent variables included socio-demographics (age, gender, grade), behaviour risk factors such as physical inactivity and unhealthy diet. Detail explanation of each variable can be seen in table 1.

Data analysis

Data were coded and analysed using SPSS version 17. Descriptive analysis was done to obtain frequencies and proportions for the students' obesity status, socio-demographic characteristics and behaviour risk factors. Missing values were omitted during calculations of proportions. To assess the associations between obesity and all independent variables, bivariate and multivariate logistic regression were performed. In the bivariate analysis, a statistical significance was indicated from the P values less than 5%. The adjusted odds ratios (ORs) for the multistage stratified cluster sample design of the study, and two-sided 95% confidence intervals were accordingly reported. In the analysis, sample weights were also used to adjust for differences in the probability of selection between students.

Ethical consideration

Ethical approval was obtained from the National Ethics Commission on Health Research, National Institute of Health Research and Development Number LB.02.01/5.2/KE.158/2015. The survey put high concern on ethical aspects such as voluntary, confidentiality and knowledge based data utilization. Students were informed that they could withdraw from the study at any time before or during data collection and refuse to answer any questions, which they felt uncomfortable. To maintain confidentiality, no personal identifier was provided in the questionnaire and answer sheet.

Table 1. Variables related to the obesity in school-children based on GSHS, Indonesia, 2015

Variables	Questions	Response options
Obesity		
Height	The height measurement was conducted by trained survey administators using microtoise. The measurement result was reported by the students in the question: "How tall are you without your shoes on?"	Minimum recorded height:119 cm Maximumrecorded height:196 cm
Weight	The weight measurement was conducted by trained survey administators using weight scales. The measurement result was reported by the students in the question: "How much do you weigh without your shoes on?"	Minimum recorded weight: 22 kg Maximum recorded weight:45 kg
Socio-demographics		
Gender	"What is your sex?"	1 = Boy; 2 = Girl
Grade	"In what class are you?"	1 = *Kelas* 7 to 6 = *Kelas* 12 (coded 1 = 1 to 3; 2 = 4 to 6)
Dietary behavior		
Ate from fast food restaurant	"During the past 7 days, on how many days did you eat food from a fast food restaurant, such as KFC, McDonald, Texas Fried Chicken, California Fried Chicken, Burger King, or A and W?"	-
Usually drink carbonated drink	"During the past 30 days, how many times per day did you usually drink carbonated soft drinks, such as Coca-Cola, Sprite, Fanta, or Big Cola?"	1 = I did not drink carbonated soft drinks during the past 30 days to 7 = 5 or more times per day (coded 1 = 1 to 2; 2 = 3 to 7)
Consume vegetable	"During the past 30 days, how many times per day did you usually eat vegetable such as carrots, cabbage, spinach, or kangkong?	1 = did not eat vegetables; 2. Eat vegetable at least one or less.
Consume fruits	"During the past 30 days, how many times per day did you usually eat fruit such as pineapples, bananas, oranges or watermelons?	1 = did not eat fruits; 2. Eat vegetable at least one or less.
Physical activity		
Physically active	"During the past 7 days, on how many days were you physically active for a total of at least 60 minutes per day?"	1 = 0 days to 8 = 7 days (coded 1 = 6 to 8; 2 = 1 to 5)
Sit ≥3 hours per day	"How much time do you spend during a typical or usual day sitting and watching television, playing computer games, talking with friends, or doing other sitting activities, such as play station?"	1 = Less than 1 hour per day to 6 = more than 8 hours per day (coded 1 = 1 to 2; 2 = 3 to 6)

RESULTS

The total number of students who participated in this study was 10,544 students. This study showed the gender distribution of 48.9% males and 51.1% females. Most of the students in this study were in grade 7 to 9 (76.8%) or around the age of 13 to 15 years, while 12.23% is in grade 10 to 12.

The overall proportion of obese among the students was 5.2% whereas it was higher among males than females, in Java region and in grade 7 to 9. Adolescents characteristic distribution showed that proportion of obese was higher in those who practised unhealthy behaviour such as did not eat vegetables (7.1%), ate fast food once or more in a day (5.7%), sitting 3 hours or more per day (5.5%).

From Table 2, it is illustrated that proportion of obesity among those practiced unhealthy behaviours such as not physically active and consume unhealthy diet in the three regions, except for the region of Outside Java and Sumatra. In the region of outside Java and Sumatra the proportion of obesity and physical activity, showed uncommon results whereas the proportion of obesity was higher in those who were active (4.3% vs 2.9%). This may related to design bias whereas this study does not provide data on intensity and time components for causality relationship. The proportion of obesity in relation to unhealthy diet showed a similar pattern between the three regions. However, the pattern showed oppositely in java in terms of obesity and consumption of fast food.

Table 2. Proportion of obese by dietary behaviours and adolescents characteristics, Indonesia Global School-based Health Survey 2015

		P value	Proportion of Obese	95% Confidence Interval	
				Lower	Upper
Overall			5.2%	4.3%	6.2%
did not eat vegetables	yes	0.079	7.1%	3.7%	13.1%
	no		5.1%	4.3%	6.1%
did not eat fruits	yes	0.648	5.0%	3.5%	7.1%
	no		5.2%	4.3%	6.2%
ate from fast food restaurant one or more days	yes	0.011	5.7%	4.8%	6.8%
	no		4.6%	3.6%	6.0%
Physically active	yes	0.489	5.7%	4.1%	7.8%
	no		5.1%	4.3%	6.1%
usually drank carbonated drink	yes	0.194	5.0%	4.0%	6.2%
	no		5.3%	4.3%	6.5%
sitting >= 3 hrs per day	yes	0.076	5.5%	4.3%	7.0%
	no		5.1%	4.2%	6.1%
Sex	male	0.000	6.2%	5.0%	7.7%
	female		4.2%	3.6%	5.0%
School grade	grade 7 to 9	0.073	5.3%	4.3%	6.5%
	grade 10 to 12		4.8%	3.2%	7.0%
Region					
	Java	0.007	6.1%	4.8%	7.8%
	Sumatra		4.2%	3.2%	5.7%
	Other		3.0%	2.1%	4.3%

Table 3. Un-adjusted odds ratio of obese by dietary behaviours and physical activity stratified by regions, Indonesia Global School-based Health Survey 2015

	Proportion of Obesity								
	n	%	95% CI		n	OR	95% CI		P value
PA and/or sedentary									
Java									0.791
active	18	5.9%	3.7%	9.3%	267	.956	.625	1.462	
not active	212	6.1%	4.8%	7.8%	3349	Reff			
Sumatra									0.508
active	5	2.9%	1.1%	7.7%	156	.667	.222	2.004	
not active	139	4.3%	3.2%	5.8%	3233	Reff			
Outside Java and Sumatra									0.612
active	7	4.3%	2.1%	8.6%	197	1.479	.686	3.188	
not active	98	2.9%	2.0%	4.2%	3352	Reff			
unhealthy diet									
Java									0.451
no diet risk	75	5.8%	4.1%	8.1%	1262	.912	.680	1.224	
Have diet risk*	155	6.3%	4.9%	8.0%	2354	Reff			
Sumatra									0.729
no diet risk	56	4.1%	2.9%	5.9%	1376	.964	.720	1.290	
Have diet risk*	88	4.3%	3.2%	5.8%	2013	Reff			
Outside Java and Sumatra									0.839
no diet risk	39	3.0%	1.9%	4.7%	1360	.983	.672	1.439	
Have diet risk*	66	3.0%	2.1%	4.3%	2189	Reff			
fast food consumption									
Java									0.636
consume fast food >=1 per day	61	5.8%	4.0%	8.3%	1008	.925	.685	1.248	
Consume fast food <1 per day or none	169	6.2%	4.9%	7.9%	2608	Reff			
Sumatra									0.480
consume fast food >=1 per day	38	4.8%	3.2%	7.0%	811	1.186	.927	1.517	
Consume fast food <1 per day or none	106	4.1%	3.1%	5.3%	2578	Reff			
Outside Java and Sumatra									0.731
consume fast food >=1 per day	25	3.2%	2.0%	4.9%	796	1.075	.801	1.444	
Consume fast food <1 per day or none	80	3.0%	2.1%	4.2%	2753	Reff			

*soft drink >=1per day or fast food >=1 perday;

Table 4. Un-adjusted odds ratio of obese by dietary behaviours and physical activity stratified by grades, Indonesia Global School-based Health Survey 2015

	Proportion of Obesity								
	n	%	95% CI		n	OR	95% CI		P value
grade 10 to 12									0.535
active	16	7.2	4.1	12.2	224	.996	.547	1.814	
not active	168	7.2	5.0	10.2	2752	Reff			
grade 7 to 9									0.430
active	14	4.0	2.1	7.8	389	.948	.516	1.745	
not active	277	4.3	3.5	5.2	7147	Reff			
unhealthy diet									
grade 10 to 12									0.281
no diet risk	72	6.8	4.6	10.0	1278	.911	.609	1.364	
Have diet risk*	112	7.4	5.0	10.8	1698	Reff			
grade 7 to 9									0.430
no diet risk	98	4.0	2.9	5.4	2702	.894	.651	1.228	
Have diet risk	193	4.4	3.6	5.4	4834	Reff			
fast food consumption									
grade 10 to 12									0.394
consume fast food >=1 per day	47	7.6	5.0	11.3	684	1.081	.796	1.469	
Consume fast food <1 per day or none	137	7.0	5.0	9.9	2292	Reff			
grade 7 to 9									0.799
consume fast food >=1 per day	76	4.3	3.2	5.6	1920	1.014	.780	1.318	
Consume fast food <1 per day or none	215	4.2	3.4	5.3	5616	Reff			

*soft drink >=1per day or fast food >=1 perday;

Table 5. Adjusted odds ratio of obese by dietary behaviours and adolescents characteristic, Indonesia Global School-based
Health Survey 2015

	Adjusted Odds Ratio	95% Confidence Interval		
		P value	Lower	Upper
PA and/or sedentary				
Active	1	0.846		
not active	1.035		.727	1.472
Sex		0.000		
Male	1			
Female	.944		.752	1.187
Region		0.007		
Outside Java and Sumatra	1			
Java	2.102		1.337	3.306
Sumatra	1.431		.886	2.311
unhealthy diet		0.961		
no diet risk	1			
Have diet risk*	1.072		.874	1.315

*soft drink >=1per day or fast food >=1 perday;

The association between obesity and behaviour risk factors was not showing significant and clear direction across different school grades. The pattern was similar in the two grades category (grade 10-12; grade 7 – 9). In Indonesia setting, grade 10-12 refers to senior high school and grade 7-9 refers to junior high school. The proportion of obesity was not showing significant different behaviour risk factors such as diet and physical activity across the different grade.

The adjusted odd ratio showed that adolescents students who stay in Java Island have significantly higher propotion of obesity after controlled by other indicatiors such as sex and behaviour risk factors of diet and physical activity (OR: 2. 1; CI:1.3-3.3).

DISCUSSIONS

The main findings of this study described that adolescents living in Java and Sumatra Island were actually leading to greater risk of obesity compared to other adolescents living in other Islands in Indonesia. Meanwhile, in addition to this fact, this study found indicators that show higher proportion of obesity, such as in those who did not eat vegatebles at least once a day.

Geographical determinant is most likely contributing to almost all health indicators in Indonesia in term of its association towards accessibility of sufficient quality health care delivery, communication technology available for adequate health education, and access to food. Indonesia is an island country that has seven main regions such as Sumatra, Java and Bali, Nusa Tenggara Barat, Nusa Tenggara

Timur, Maluku - North Maluku, Sulawesi and Papua-Papua Barat. Population distribution is still an issue for Indonesia, as more than 80% of total Indonesian population reside in Java Island and country's development is more massively growing compare to other islands in Indonesia. Although, this condition also contributes to adolescents nutritional status including obesity.

It is indicated that the proportion of obesity among adolescents showed significantly higher in boys than in girls and boys. This finding was similar to the obesity study among adolescents aged 11-16 years in Canada on 2002 that showed the prevalence of obesity was 4.6% and it was higher in boys (p < 0.00) than girls[11] and also surveys in nine countries (Canada, Qatar, Taiwan, Cyprus, Czech Republic, Germany, Greece, Italy, Australia, Denmark, Hungary) showed prevalence of overweight among boys was ≥10% higher than girls.[12] On the contrary, some other countries, such in African countries, showed the prevalence of adolescents was higher in females than in males.[13]

Similar findings also found in other cross sectional study among adolescents aged 11-18 years in Southwest French, whereas prevalence of obese was higher among boys.[14] Another cross sectional study in Taiwan, that showed the prevalence of obese adolescents (13-16 years) was 7.2%.[15] The higher proportion of obesity in males compared to females adolescents was most likely related to diferent diet and physical activity patterns as well as physical maturation. Dietary pattern among male adolescents was more likely toward high fat and sugar dietary habit.[16] A survey in urban Saudi showed the

prevalence of obesity among adolescents was 24.1% in males and 14% in females adolescents aged 14 – 19 years. The gender different was mostly likely related to female has more concern on physical image that may lead to stronger dietary behaviour control in females.[17] Another study had shown that gender and obesity was related to different value, culture and stigma of obesity between male and female perspectives, whereas female put higher value of body image than male.[18]

Physical inactivity did not significantly related to adolescent obesity. The physical activity prevalence seems to be slightly different between male and female adolescents. A similar finding was found in a national survey in Lebanon, that showed no significant different obesity between active and less active adults.[19] Another study in South West French showed that overweight and obesity was significantly higher among adolescents with sedentary activity, (OR 1.33, 1.02–1.74, $P < 0.05$).[14] The relationship between obesity and physical inactivity may related to different physical maturation between males and females, which may lead to greater obesity risk on male adolescents than females. However, this study did not include indicator of physical maturation in the conceptual analysis as it is focused more on the behaviour risk indicators.

This study showed that insufficient intake of fruit and vegetable were not significantly related to obesity in adolescent while consumed fast food was significantly related to obesity. Similar result was found from a cross sectional study in Kajang Malaysia, that showed no significant different of body weight status and nutrition intake among adolescents[20] as well as a study in Australia[16], however other study showed that mediteranian diet that rich of fruits showed lowering risk of obesity.[21] Exessive food intake and lack of physical activity are the two main risks of obesity. Several studies have shown a relationship between diet and physical activity toward obesity.[22,23,11] A study among Jordanian adolescents showed that consumption of fried food and perceived stress level were positively correlated with overweight and obesity.[24]

However, as this study was limited to the fruit and vegetable intake pattern that was not including the quantity of the intake and other nutrient intakes such as fat, protein and carbohydrate food sources. Fruit and vegetable intake was fibre source foods that contribute to the macro nutrient absorption process in which sufficient and regular intake of them will bring positive to normal blood glucose and lipid profiles. This mechanism path was not directly related to obesity.

Fat intake was more likely directly associated with obesity due to its metabolism process and characteristic that allowed it to be stored in the form of fat tissue in the body. Consuming fast food one or more days per week in adolescents can be lead to higher risk of overweight and obesity among adolescents. A study in Iran also found that a higher intake of fast food lead to greater risk of overweight and obesity.[25] Higher food consumption is also known related to brain function reffered to executive disfunction that leads to the inability to control eating behaviours although further research is required for more detail causal relationship between executive function and obesity in adolescents.[26]

Consumption of fast food is one of common behaviours among adolescents in Indonesia as well as in many other countries as part of the modern lifestyle and food technology development. As one of the growing countries, Indonesia faces challenging issues in population health and environment along with the resources and infrastructure developments. National resources development such as in industrial sectors was influenced by the global development that also contributed to social and economic change in Indonesia. This study showed that similar pattern of relationship between fast food consumption and obesity in Sumatra island and outside Java and Sumatra, but not in Java where the proportion of obesity is higher in those who ate fast food less than one portion per day or none, although it is not significantly related. This finding may relate to other confounding factors that may occure in Java such as consumption of other high carbohydrate rich food that specifically common among certain culutural or tradition or ethnic.

National level policies and integrated efforts in food and nutrition have been developed in the form of a National Action Plan on Food and Nutrition 2015-2019. These policies and initiatives are typically designed to alter the food and physical activity environments to provide healthier choices for individuals within population.[27] School health activity or so-called *Upaya Kesehatan Sekolah* (UKS) is a program established by the government to provide support and motivation for children to implement a healthy life style as well as to provide healthy environment for the children.[28] Health

promotion initiatives therefore could be carried out in schools under the UKS program through integrated health education. Variety health education programs can be applied such as "Smart choices" and "Kitchen garden" as selection strategies for a healthy diet.[29]

On one hand, "Smart choices" program encourages schools to provide media such as posters about food and drinks categories. This program aims to educate children which food or drinks whether should be carefully consumed or should be eaten in large amounts. On the other hand, "Kitchen garden" program allows schools to provide small garden for children to plant vegetables, then cook them into healthy foods in the school kitchen.[29] Yet, these programs could not be properly carried out without supportive environment and adequate human resources and infrastructure. There is a need for high commitment between schools and other stakeholders to enforce health promotion initiatives among children so the prevalence of obesity in school children can be reduced as much as possible.

In conclusion, geographical determinant is an important component to develop a more specific intervention to prevent obesity among adolescents. Targetted adolescents in Java Island will bring wider impact on adolescents health, without ignoring specific needs from other regions.

Acknowledgment

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