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MAIN SOURCES OF SUGAR INTAKE OF ADOLESCENTS IN DAERAH ISTIMEWA YOGYAKARTA PROVINCE, INDONESIA

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ABSTRACT

Background: There was 16.9% of population in Daerah Istimewa Yogyakarta (DIY) Province with excess sugar intake, higher than national prevalence 4.8%. Nevertheless, there has not been studied yet about sugar intake of adolescents in this province. The adverse effects of excessive sugar intake leads to cardiovascular diseases (CVDs) and type 2 diabetes mellitus, directly and indirectly through body weight and fat gain in later life. Twenty to forty percent of overweight adolescents are twice likely to develop CVD and seven times greater risk of atherosclerosis. Thus, it is important to prevent NCDs since the behaviours established during adolescent have life-long consequences particularly regarding NCDs in DIY Province. This study aims to assess the daily sugar intake and the main sources of sugar of adolescents in DIY province, Indonesia.

Methods: This is an observational study with cross sectional design with the targeted population of all the adolescents aged 15 to 17 years old in urban and rural area of Daerah Istimewa Yogyakarta province, Indonesia. Four schools were chosen with the total sample of 380 students. Four instruments were used in this study i.e. general information questionnaire, semi-quantitative food frequency questionnaire (SFFQ), digital weighing scale and BIA analysis, and microtoise. Mann Whitney test was used to analyze the difference of daily sugar intake between urban and rural area. Statistical tests were considered as significant at $P < 0.05$.

Results: Means of daily sugar intake of adolescents were 107.0 g and 87.4 g in urban and rural area respectively. In urban area, the minimum intake of sugar was 15.2 g/day and the maximum intake of sugar was 317.2 g/day. Whereas in rural area, the minimum intake of sugar was 17.2 g/day and the maximum sugar intake was 87.4 g/day. There was a significant difference between average daily sugar intake of adolescents in urban and rural area ($P = 0.004$).

Conclusion: The main sources of sugar intake of adolescents both in urban and rural area were sweetened beverages, additional foods and sweet snacks respectively.

Keywords: Sugar intake, adolescents, semi-quantitative food frequency questionnaire (SFFQ).

INTRODUCTION

The idea about adverse effects of sugar intake is being researched widely. Various study had spoken about reducing sugar intake due to its adverse effects. Likely The World Health Organization in its guideline about sugar intake for adults and children, recommends to reduce the consumption of sugar. It is supported by evidences that showed the increasing of body weight due to increasing amount of sugar intake and vice versa [1]. Moreover, it was found that obesity, metabolic syndrome and fatty liver disease are increased by consumption of sugar sweetened beverages [2]. Additionally, added sugar was

associated with metabolic syndrome despite the total energy intake, physical activity and body mass index [3]. The adverse effects of excessive sugar intake also lead to cardiovascular diseases (CVDs) and type 2 diabetes mellitus, directly and indirectly through body weight and fat gain [4]. Whereas, CVDs and diabetes together with cancer and chronic respiratory disease have been the top killers in the South-East Asia with the estimated rate of death was 8.5 million every year (62%) with 48% among all deaths were below 70 years old [5]. In Indonesia, CVDs was the number one cause of death with 34% prevalence [6]. It is studied that 20-40% of overweight adolescents are twice likely to develop CVD and seven times greater risk of atherosclerosis. Thus, it is important to prevent NCDs since the behaviours established during adolescent have life-long consequences particularly regarding NCDs [7].

There was 16.9% of population in DIY Province with excess sugar intake, which was much higher than national prevalence 4.8% [8]. In Indonesia's first total diet study, they used one-day household 24-hour food recall to assess the food intake including sugar. Hence, the method that they used could not reflect the real situation [9]. Furthermore, there has not been studied yet about sugar intake in adolescents at provincial level particularly Daerah Istimewa Yogyakarta (DIY) province which is necessary due to its high prevalence of excess sugar intake. Therefore, this study aims to assess the daily sugar intake and the main source of sugar of adolescents in DIY province, Indonesia. Moreover, this study also aims to compare the different of average daily sugar intake between urban and rural area in DIY province. The alternative althypothesis is there is a different of average daily sugar intake between urban and rural area in DIY province.

METHODS

This is an observational study with cross sectional design. Targeted population in this study is all the adolescents aged 15 to 17 years old in urban and rural area of DIY province, with the total population of 246.396 adolescents [10]. The sample was purposively selected from urban and rural area particularly in Jogjakarta City and Bantul District due to high prevalence of central obesity in each area (39.6% in Jogjakarta City and 26.1% in Bantul District) [11]. Based on Yamane equation, calculated sample size was 400 students, which randomly selected from two schools in urban and two schools in rural area in DIY province, Indonesia. The selected schools in urban area were SMA N 6 Yogyakarta and SMA Bopkri 2 Yogyakarta, and the selected schools in rural area were SMA N 1 Imogiri and SMA Muhammadiyah Imogiri.

The inclusion criteria are the students aged 15 to 17 years old in grade 10th and 11th and have been staying for more than one year in DIY province to ensure that the eating habit comes from available food in this area. While the exclusion criteria are the students who are pregnant or previously diagnosed with any disease which need certain diet modification.

There were four instruments used in this study: general information questionnaire, semi-quantitative food frequency questionnaire (SFFQ), digital weighing scale and BIA analysis, and microtoise. General information questionnaire was used to collect the basic demographic data such as: age, sex and one week expenses. SFFQ which had been validated and checked the reability in previous study was used to obtain the data about daily sugar intake [12]. This SFFQ was used to ask the portion and amount of certain foods for one month backward. There were 50 types food asked in this SFFQ which was classified into 5 food groups: Packaged Foods, Sweet Snacks, Sweetened Beverages, Fresh Fruits, Additional and Carbohydrates. The amount of sugar from those foods was calculated by using *Nutrisurvey* software developed by Hofenheim University and SEAMEO RECFON (Southeast Asian Ministries of Education Organization Regional Centre for Food and Nutrition) and manual market survey. To obtain the average daily consumption, the frequency of each item will be multiplied by the average serving size and amount of sugar content, then transformed into daily intake. Microtoise with 0.1 cm sensitivity was used to measure the height of each respondent, with the brand *OneMed Diagnostics, Indonesia*. *Omron HBF 375 Karada Scan Body Composition Monitor, Japan* was used to measure the body weight, body mass index (BMI) and body fat percentage of each respondent.

In data analysis, descriptive statistics were used to analyze the characteristic of respondents. Furthermore, since the data of average daily sugar intake was not normally distributed, Mann Whitney test was used to analyze the difference of daily sugar intake between urban and rural area. Statistical tests were considered as significant at $P < 0.05$. This study has been reviewed and approved by Research Ethics Committee of Universitas Respati Yogyakarta, Indonesia.

RESULTS

Total participants joined the data collection were 427 students. Nevertheless, there were 380 (95%) participants had completed data. Those 5% incompleting data were caused by the absence of participants on anthropometry measurement day.

Table 1. Number and percent of Basic Characteristic of Respondents

Variable	Urban	Rural	Total
Number	195 (51.3%)	185 (48.7%)	380
Gender			
Male	83 (46.6%)	95 (53.4%)	178
Female	112 (55.4%)	90 (44.6%)	202
Age (year)			
15	47 (74.6%)	16 (25.4%)	63
16	96 (51.9%)	89 (48.1%)	185
17	52 (39.4%)	80 (60.6%)	132

As shown in table 1, there were 51.3 and 48.7 percent of students in urban and rural area in this study. Based on gender, there were 178 male and 202 female in this study which consist of 46.6 and 53.4 percent male in urban and rural area. All the student in this study was aged between 15 to 17 years old.

Table 2 shows the mean and standard deviation values of anthropometric and general information of adolescents in urban and rural area.

Table 2. Mean and Standard Deviation of Anthropometric and General Information of Respondents

Variable	Urban	Rural	Total
Height (cm)	160.9 (± 9.2)	159.2 (± 7.4)	160.1 (± 8.4)
Weight (kg)	56.3 (± 13.8)	55.7 (± 11.1)	60 (± 12.6)
BMI (kg/m ²)	21.7 (± 4.3)	22.0 (± 4.2)	21.8 (± 4.3)
One Week Expense (IDR) ^a	140k ($\pm 160k$)	58k ($\pm 35k$)	100k ($\pm 120k$)
Male Total Body Fat (%)	15.7 (± 7.0)	16.3 (± 7.0)	16.0 (± 7.0)
Female Total Body Fat (%)	25.6 (± 4.0)	25.6 (± 5.1)	25.6 (± 4.5)

^a: Significantly different at $P < 0.05$ based on Mann Whitney test

All anthropometric characteristics showed no significant difference between adolescents in urban and rural area, except that adolescents in urban area had one week expense which was higher in urban than in rural.

Table 3. Comparison of Daily Sugar Intake (g) in Urban and Rural Area

Variable	Median (P25 th , P75 th) ^b	Min, Max	Mean	Standard Deviation	P value
Urban	94.2 (25.6, 140.2)	15.2, 317.2	107.0	63.5	0.004 ^a
Rural	78.9 (52.4, 114.0)	17.2, 253.8	87.4	44.8	

^a: Significantly different at $P < 0.05$ based on Mann Whitney test.

^b: P25th, P75th are the 25th Percentile and 75th Percentile

Table 3 shows that the mean daily sugar intake of adolescents were 107.0 g and 87.4 g in urban and rural area respectively. In urban area, the minimum intake of sugar was 15.2 g/day and the maximum intake of sugar was 317.2 g/day. Whereas in rural area, the minimum intake of sugar was 17.2 g/day

and the maximum sugar intake was 87.43 g/day. There was a significant difference between average daily sugar intake of adolescents in urban and rural area ($P= 0.004$).

The food groups that most consumed by the adolescents then were ranked to see the main sources of sugar intake. There were six food groups that had been asked to the respondents: packaged food, sweet snacks, sweetened beverages, fresh fruits, additional foods and carbohydrates. Top 3 of food groups as the main sources of sugar intake that displayed in table 4.

Table 4. Daily Sugar Intake and Percent Contribution from Main Sources of Sugar Intake in Urban and Rural area

Food Groups	Urban		Rural		Total	
	Intake (g)	% Contribution	Intake (g)	% Contribution	Intake (g)	% Contribution
Sweetened_Beverages	46.0	43.0	33.6	38.4	40.0	40.7
Additional Foods	27.5	25.8	29.6	33.8	28.5	29.8
Sweet_Snacks	22.1	20.7	14.7	16.8	18.5	18.7
Total	31.9	89.5	17.2	89.0	29.0	89.2

Table 4 shows the main sources of sugar intake comes from sweetened beverages, additional foods and sweet snacks respectively. Firstly, there was on average 46.0 g of sugar intake from sweetened beverages among all the adolescents in urban area which contributes to 43.0% of total sugar intake. Whereas in rural area, there was on average 33.6 g of sugar intake from sweetened beverages which contributes to 38.4% of total sugar intake. In total, sweetened beverages contributes to 40.7% of total sugar intake among all students with average of 40.0 g/day. Secondly, in additional foods there was average intake of 27.5 g among all students in urban area which contributes to 25.8% of total sugar intake. Whereas in rural area, there was 29.6 g of average intake of sugar from additional foods which contributes to 33.8% of total sugar intake. In total, additional foods group contributes to 29.8% of sugar intake among all students with average intake of 28.5 g/day. Thirdly, average sugar intake from sweet snacks in urban area was 22.1 g with the contribution of 20.7% of total sugar intake. Whereas in rural area, there was 14.7 g of average sugar intake from sweet snacks and contributes to 16.8% of total sugar intake. In total, there was in average 18.5 g of sugar intake from sweet snacks which contributes to 18.7% of sugar intake among all the students. Additionally, in total these three groups contribute to 89.5% and 89.0% of total sugar intake in urban and rural area respectively.

Data in table 5 shows the top five food that contribute the most as main sources of sugar intake among three food groups aforementioned. Additionally, there were five foods that contribute the most in daily sugar intake of the adolescents. In urban area there were instant tea, chocolate drink, UHT milk, white sugar and chocolate biscuits. Whereas those in rural area there were instant tea, instant coffee, fruit drink, white sugar and palm sugar.

DISCUSSION

Based on anthropometric measurements it was shown that there were no different in all anthropometric measurements in adolescents live in urban and rural area. Commonly it was expected that urban environment in Indonesia seem to be obesogenic, for urban location is used to be considered as the place with greater variety of food choices available including processed and fast foods [13][14]. Nevertheless, there was no different for every anthropometric measurement in this study. There were only one week expense that was different. This confirms that the respondents in urban have higher socioeconomic status and different lifestyle. Thus they have different habit in spend their money in one week.

The result from average daily sugar intake shows that there was a significant difference between urban and rural area. This finding was similar to a study among children in DIY province in 2011 which stated that children living in urban area were significantly consumed sugar 5 times higher then in rural area in a day as the consequence of urbanization and economic growth [15]. The average intake of sugar in

urban and rural area in this study are higher than previous study among children and adolescents in Medan Province and East Java Province which found that the average intake of sugar were 60 g/day and 58.8/day respectively [16][12]. This finding also strengthens the finding from Indonesia Total Diet Study which showed that DIY Province has the highest rate of sugar intake among all provinces in Indonesia. It stated that there was 16.9% of population in DIY Province with excess sugar intake, which was much higher than national prevalence 4.8% [8]. Indonesian Health Ministry in its decree recommends not to consume sugar more than 50 g/day or 4 table spoon (tbs)/day. Nevertheless, this study finds that average intake of sugar were 107.0 g/day and 87.4 g/day or 9 tbs/day and 7 tbs/day in urban and rural area respectively. There are some consequences regarding this high intake of sugar such obesity, dyslipidemia and other CVDs risk factor. As found in one study in US adolescents that intake of sugar at usual level is positively associated with dyslipidemia in US adults and adolescents. Moreover, insulin resistance is higher among overweight adolescents with greater intake of sugar [17]. Thus, it is essential to promote reducing sugar intake among adolescents in DIY province.

In order to promote reducing sugar intake among adolescents in DIY province, it is necessary to figure out the main source of sugar in this group. Table 4 shows the 3 food groups as the main sources of sugar in this group. They were sweetened beverages, additional foods and sweet snacks as the main sources respectively. These three food groups contribute nearly 100 percent of the sugar intake (90% and 80% in urban and rural). Moreover, sweetened beverages contributes for almost 50% of sugar intake (43.0% and 38.4% in urban and rural). Therefore, these food groups should have more concern in reducing sugar intake. Furthermore, it is necessary to concern more about sweetened beverages, additional foods and sweet snacks, particularly instant tea, chocolate drink, UHT milk, white sugar and chocolate biscuits in in urban area and instant tea, instant coffee, fruit drink, white sugar and palm sugar in rural area.

As the limitation, the results from this study do not provide the broad information regarding factors affecting sugar intake in adolescents such as personal behavior and environmental factors (e.g. food availability, convenient foods within homes, schools and restaurant) [18]. Nevertheless, the information about main source of sugar could be beneficial for the parents, school and public health department to limit the accessibility and availability of those main source of sugar as well as promote the healthy food consumption.

CONCLUSION

Average daily sugar intake of adolescents between urban and rural area in DIY province, Indonesia were 107.0 g/day or 9 tbs/day and 87.4 g/day or 7 tbs/day respectively. The main sources of sugar intake of adolescents both in urban and rural area were sweetened beverages, additional foods and sweet snacks respectively. It is suggested that the parents, school and public health department to limit the accessibility and availability of those main source of sugar as well as promote the healthy food consumption.

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