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Nutritional Status, Sugar-Sweetened Beverage Consumption and Physical Activity Level in Male and Female College Students Living in Dormitory

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ABSTRACT

Introduction: The global prevalence of obesity is on the rise, including in Indonesia. High energy intake from sugar is a growing concern worldwide due to its association with weight gain, tooth decay, and non-communicable diseases. A prior study revealed that, according to the WHO recommendation, 10.9% of Indonesian adults consumed energy from sweetened beverages. This study aimed to assess the consumption of sweetened beverages by male and female college students in Indonesia.

Method: The study was conducted at Universitas Indonesia and involved 107 subjects aged 19-21 who resided in student dormitories.

Result: The result found the median BMI in females was higher than in males. In females, 3 out of 10 students were overweight-obese, while 1 out of 10 in males. Interestingly, the median daily intake of sweetened beverages was significantly higher in males than females; 387 (25–1580) vs 246 (0–762) ml/day (p=0.001). Added sugar content in beverages in males was higher than half of the Indonesian recommendation (28.4 [1.9–134.4] vs 19.2 [0–61.1]), which contributed to energy as much as 170.9 (12.4–625.7) kcal/ day or about 8.9% of total energy intake than female (108.5 [0–394.4] kcal/day). Compared to Indonesian guidelines, 12% of male subjects consumed added sugar higher than 50 g/day. Simultaneously, 7 out of 10 subjects consumed energy from sweetened beverages higher than 10% of their total energy intake (WHO recommendation). The BMI and prevalence of overweight obesity were higher in females, while the sweetened beverage was higher in males. The physical activity in males might cause it to be higher than in females. Although male had higher energy intake from SSB, their energy output through physical activity was balanced with energy input.

Conclusion: These findings alerted that the university as an educational institution should take action to prevent this issue since the prevalence of overweight-obesity and sweetened beverage consumption has occurred at a young age.

Keywords: added sugar; college students; gender; obesity; sweetened beverages.
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INTRODUCTION

The escalating global incidence of overweight and obesity persists annually. The worldwide prevalence of overweight and obesity stands at 38.9% among the adult population.[1] In Indonesia, the prevalence of overweight and obesity has surged to 35.4% among individuals aged over 18 years, marking a twofold increase from figures reported in 2007.[2] Overweight and obesity status precipitates various adverse outcomes such as diabetes, hypertension, sleep apnea, morbidity, and mortality.[3] Elevated energy intake from sugar has emerged as a significant global concern due to its association with unhealthy dietary patterns, weight gain, dental caries, and non-communicable diseases.[4-7]

Based on data from Statistics Indonesia in 2018, the employment status of the Indonesian population aged 15-24 years was predominantly occupied by students, including those enrolled in college.[8] In the United States and some Southeast Asian nations, around 30% of college students are overweight. Findings from the National Health Research conducted in 2018 revealed that within the 19-24 age bracket, the prevalence rates of overweight and obesity stood at 15% and 21%, respectively.[2] This situation warrants attention as obesity during youth often persists into adulthood.[3]

Evidence suggests that multiple factors influence overweight, including genetics, age, gender, physical activity, sleep duration, and dietary habits.[5,9,10] Globally, there is significant concern regarding the excessive intake of free sugars, which profoundly influences overall energy consumption. A previous study revealed that 10.9% of Indonesians aged 18 years and above consumed energy from free

sugar in beverages more than the WHO recommendations.[11] Free sugar intake contributed substantially to energy intake from beverages, constituting 76% of the total energy in sugar-sweetened beverages (SSBs).[5,12] Simultaneously, another study indicated that the highest beverage intake came from regular sweetened beverages, which contributed 74 kcal/day to energy intake.[11] Gender comparisons revealed that SSB intake was double in males compared to females, with proportions of 34% and 15%, respectively.[13] Wicaksari et al. discovered that females consuming ≥50 g/day of added sugar exhibited a significantly higher body mass index (BMI) than males, with an odds ratio of 1.262.[14] In light of these findings, there is an urgent need to investigate the nutritional status, physical activity levels, and consumption of sugar-sweetened beverages among male and female college students in Indonesia. Hence, this study aims to explore these factors in male and female college students residing in dormitories in Indonesia.

METHOD

This study is part of a more extensive cross-sectional study titled "*Hubungan Pengetahuan dan Perilaku Konsumsi Makanan-Minuman dengan Status Hidrasi dan Status Gizi Mahasiswa Universitas Indonesia*." It serves as a further descriptive analysis of the survey conducted by Wicaksari et al.[14] This study was conducted at Universitas Indonesia, West Java, Indonesia, between March and June 2019. Universitas Indonesia was purposively selected by considering its location in the urban area of West Java and its proximity to the capital city of Indonesia, where unhealthy lifestyles may prevail. The study population was undergraduate students residing in dormitories, who were selected using the consecutive sampling method. Inclusion criteria encompassed undergraduate students, aged 19-21 years, residency in the dormitory for at least one month, and Indonesian citizenship. Subjects participating in weight loss programs supervised by health professionals, those reducing consumption of sweet food and beverages, individuals who did not complete the procedures, and those with energy intake <500 kcal/day were excluded from the study.

Table 1. Calculation of Sugar-Sweetened Beverages Consumptions

SSB consumption	Calculation
SSB intake per day (ml/day)	$= \frac{\sum \text{SSB intake (D1+D2+D3+D4+D5+D6+D7)}}{7}$
Added sugar in SSB per day (g/day)	$= \frac{\sum \text{Added sugar (D1+D2+D3+D4+D5+D6+D7)}}{7}$
Energy intake from SSB (kcal/ day)	$= \frac{\sum \text{energy from SSB (D1+D2+D3+D4+D5+D6+D7)}}{7}$
Calorie percentage from SSB (%) of TEI	

SSB = sugar sweetened beverage, D = Day–1,2,3,4,5,6,7

The variables in this study include gender, nutritional status, sugar-sweetened beverage consumption, and physical activity level. Nutritional status was determined by body mass index (BMI), calculated from anthropometric measurements comprising body weight and height. Anthropometric measurements were obtained using the SECA 876 body weighing scale with a precision of 0.1 kg and the ShorrBoard® with a precision of 0.1 cm. SSB consumption was assessed using a 7-day fluid record, while physical activity level was obtained using the Short International Physical Activity Questionnaire (IPAQ). Sugar-sweetened beverage consumption was defined by total daily intake in milliliters per day (ml/day), added/ free sugar content from the beverage in grams per day (g/day), energy intake from SSB in kilocalories per day (kcal/day), and the percentage of energy derived from SSB intake as a proportion of total energy intake (% energy of TEI). Table 1 illustrates the calculation for SSB consumption.

The study performed training enumerators to ensure uniformity in the perception of research procedures among all personnel. All enumerators were ensured the same perception of study procedures and instruments. The broader research proposal underwent review and approval by the Ethics Committee of the Faculty of Medicine, University of Indonesia. This ethical clearance is integral to a more considerable study titled "*Hubungan Pengetahuan dan Perilaku Konsumsi Makanan-Minuman dengan Status Hidrasi dan Status Gizi Mahasiswa Universitas Indonesia*," identified by reference number 1318/ UN2.F1/ ETIK/ 2018. Data collection commenced after obtaining permission from the dormitory administration and consent from the subjects, as evidenced by their signatures on a letter of authorization.

Nutrisurvey 2007 was software for obtaining energy intake from SSB data. All data were inputted to Ms. Excel 2010 and were analyzed using SPSS 20. Numerical data were performed by median (min-max), while categorical data were performed by n (%). The statistical analysis to assess the difference between nutritional status, SSB consumption, and physical activity in male and female subjects was conducted using the Independent/ Mann-Whitney test and Chi-square test. A p-value less than 0.05 was considered to be statistically significant.

RESULT

One hundred seven subjects participated in the study, of which 53% were female. Data in Table 2 informs that body weight and height were significantly higher in males than females. After calculating the BMI, it shows a reverse finding that the BMI was higher in females, although it did not show a significant difference (p=0.054). Both males and females had underweight and overweight subjects, and the proportion of overweight was higher in females (29.8%) and underweight was higher in males (24%). The data on physical activity level shows that male subjects had a higher proportion of moderate-high physical activity levels than females.

Data in Table 2 also informs that daily intake of SSB was 387 ml/day (~2 glasses) in males and 246 ml/day (~1.25 glasses) in females, which was statistically significantly different (p=0.001). The significant difference in its daily intake as the beverage was also evidenced by the added/free sugar and energy content in males were significantly higher in males than females: 28.4 vs. 19.2 g/day (p=0.002)

Table 2. Nutritional Status, SSB Consumptions, and Physical Activity Level in Male and Female Subjects (n=107)

Variable	Median (Min-Max) or n (%)		p-value
	Male (n=50)	Female (n=57)	
Weight (kg)	56.5 (43.0–88.0)	50.4 (33.7–111.8)	<0.001*[a]
Height (cm)	169.8 (154.4–178.6)	154.0 (143.8–164.8)	<0.001*[b]
BMI (kg/m^2)	19.9 (15.1–29.5)	21.2 (15.9–41.3)	0.054[a]
Nutritional status (n, %)			
Underweight (BMI <18.5 kg/m^2)	12 (24.0)	8 (14.0)	0.160[c]
Normal (BMI 18.5-22.9 kg/m^2)	30 (60.0)	32 (56.1)	
Overweight-obese (BMI ≥23.0 kg/m^2)	8 (16.0)	17 (29.8)	
Physical activity level (n, %)			
Low (<600 METs)	30 (60.0)	42 (73.7)	0.132[c]
Moderate-high (≥600 METs)	20 (40.0)	15 (26.3)	
SSB intake (ml/day)	387 (25–1580)	246 (0–762)	0.001*[a]
Added sugar in SSB (g/day)	28.4 (1.9–134.4)	19.2 (0–61.1)	0.002*[a]
Energy from SSB (kcal/day)	170.9 (12.4–625.7)	108.5 (0–394.4)	0.012*[a]
Total energy intake (kcal/day)	1810 (1024–3361)	1543 (693–3489)	0.001*[b]
Calorie percentage from SSB (%)	8.9 (0.6–35.7)	7.2 (0–37.2)	0.166[a]

[a]Using Mann–Whitney test; [b]Independent t-test; [c]Chi-square t-test *significantly different (p<0.05); BMI=body mass index (kg/m^2); METs=metabolic equivalent tasks; SSB=sugar sweetened beverage

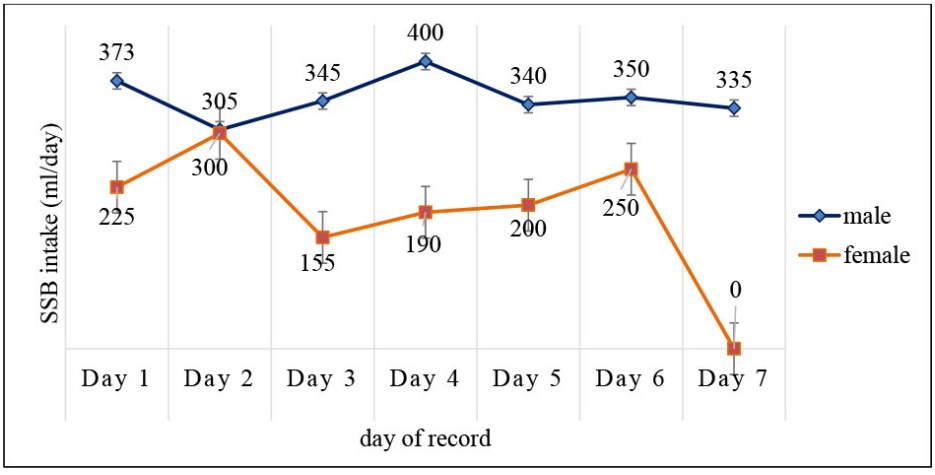

Figure 1. The trend of SSB intake within 7 days of record in male and female.

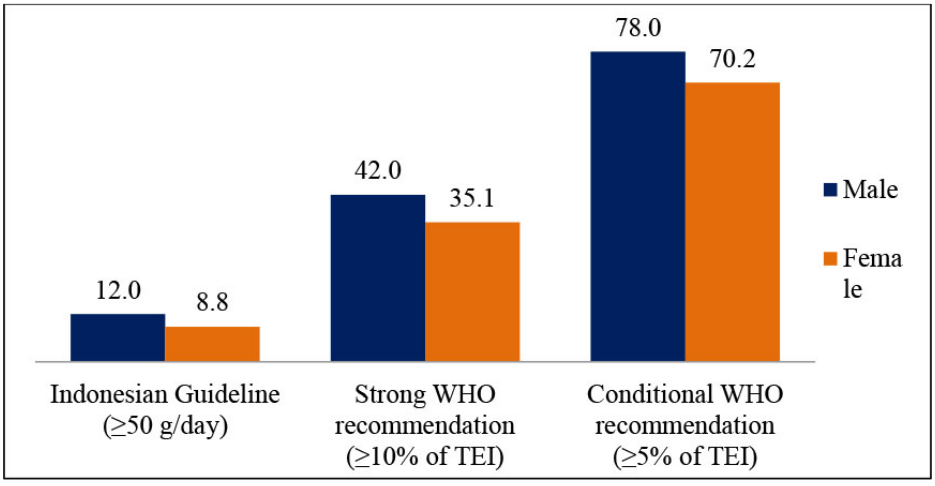

Figure 2. Percentage of Subjects with SSB Consumption Higher than Recommendations in Male and Female.

and 170.9 vs. 108.5 kcal/day (p=0.012). The total energy intake was significantly higher in males (1810 kcal/day) than in females (1542 kcal/day), with energy from SSB contributing as much as 8.9% of total energy intake (TEI) in males and 7.2% in females.

Data in Figure 1 shows the trend of SSB intake (ml/day) within 7 days of record. The graphic shows that males consumed more SSB than females on almost all days; the p-value was 0.005 (day1), 0.567 (day2); 0.022 (day3); 0.008 (day4); 0.040 (day5); 0.076 (day6); 0.006 (day7), respectively. The added sugar content in SSB compared to Indonesian guidelines shows that 1 out of 10 subjects (both males and females) consumed more than 50 g/day (p value=0.583) (Figure 2). Simultaneously, 4 out of 10 subjects consumed energy from SSB higher than 10% of total energy intake (p=463), or 7-8 out of 10 subjects consumed higher than 5% of TEI (p=358).

DISCUSSION

The study found the median age of subjects was 19 years old categorized the period as young adult. Anthropometrically, body weight and height were significantly higher in males, while BMI was not significantly different between groups. The proportion of overweight-obesity was higher in the female group (29.8% vs. 16.0%), while sugar-sweetened beverages consumption in ml per day, gram per day, calorie per

day, and caloric percentage per day were significantly higher in males. Graphically, according to consecutive 7-day fluid records, males consumed more SSB than females on almost all days; the p-value was 0.005 (day1), 0.567 (day2); 0.022 (day3); 0.008 (day4); 0.040 (day5); 0.076 (day6); 0.006 (day7), respectively.

This study was dominantly participated young adult age. Young adults in the transition stage from adolescence to adulthood are known as a vulnerable group since significant lifestyle changes occur in this period, such as leaving home, going to university/ college, starting work, getting into a relationship and marriage, and pregnancy.[15,16] Young adults tend to have standard body mass index, both male and female, which also has the highest rate of normal nutritional status.[17,18] Interesting fact is that half of the subject in this study had normal status. In contrast, another half of the subjects were underweight or overweight-obese.

In comparison between males and females, National Health Research (*Riskesdas*) 2018 found similar findings that the proportion of underweight was higher in males (10.8% in males vs 7.8% in females) and overweight-obese was higher in females (26.6% in males vs 44.4% in females).[2] The prevalence in this study might be lower than national, while the trend was similar in that females tend to have a higher proportion of overweight-obese than males. The proportion of overweight and obese has reached almost 30% in females. Interestingly, the median age of subjects was 19 years old, and 23.4% of the subjects were overweight. This proportion was higher than the national, which showed 15.5% among the 19-year-old population.[2] Similar result to the previous study that BMI and overweight–obese rate were higher among women (23.7 kg/m^2, 48.8%) than men (22.6 kg/m^2, 36.9%).[10] A previous study explained that women had a higher prevalence of overweight and obesity related to their biological factors to reproduction, which store fatter than men.[19] The interaction between estrogen, leptin, and thyroid hormones in women affects their energy expenditure, which tends to be lower than that of men. Lower energy expenditure in women induces higher fat storage than in men.[10] Higher body fat leads to an overweight obesity rate becoming higher in women than men.

The nutritional status serves as an indicator reflecting the equilibrium between energy intake from dietary sources and energy expenditure through physical activity and physiological processes. Dietary elements significantly contribute to the escalating prevalence of obesity, including factors such as high-calorie consumption, sugar-sweetened beverage consumption, frequent intake of snack foods, limited fruit consumption, large portion sizes, frequent consumption of fast food, and alcohol intake.[3,20] Consumption of refined foods, fatty and fried foods, sweetened foods, and beverages has also been identified as a risk factor for obesity among both men and women.[10] The association between excessive body weight and free sugar intake stems from the surplus energy derived from added sugar intake in sugar-sweetened beverages.[5]

Sugar-sweetened beverages, recognized as a significant contributor of added sugar, are often consumed rapidly yet provide minimal nutrients, leading to heightened calorie intake.[3,21] Consumption of these beverages has been linked to weight gain due to their contribution to overall energy intake.[5,14] In this study, sugar-sweetened beverage consumption was notably higher among males than females. This trend may be attributed to the habit among college students of staying up late at night and consuming caffeine. In the United States, 92% of college students reportedly consume caffeine in various forms.[22] The primary source of caffeine is coffee, with males consuming a higher amount (120 mg/day) compared to females (111 mg/day), followed by energy drinks (53 mg vs. 30 mg in males and females, respectively). Students cited several reasons for consuming caffeine, including its stimulatory effect to stay awake (79%), enjoyment of its taste (68%), social aspects (39%), improved concentration (31%), increased physical energy (27%), enhanced mood (18%), and stress relief (9%).[22]

In males, the median intake of added sugar from SSB was 28.4 grams per day, which represents half of the national recommendation (Table 2). The Ministry of Health of Indonesia advises that adult consumption of added sugar should not exceed 50 grams per day. Wicaksari et al. demonstrated that young adults who consume more than 50 grams per day of added sugar have a significantly higher body mass index (BMI), with an odds ratio of 1.810.[14] Consequently, 12% of male participants were at a 1.810-fold higher risk of having a higher BMI as they advanced in age compared to those who consumed less than 50 grams per day of added sugar (Figure 2).

The median added sugar intake in females was 19.2 grams per day, lower than the male intake. Nonetheless, previous data indicated that females exhibited a significantly higher body mass index (BMI) by a factor of 1.263 compared to males. Conversely, although sugar-sweetened beverage (SSB) consumption in females was notably lower than in males, their physical activity level was also lower. This disparity is likely to contribute to a positive energy imbalance in females.

The World Health Organization (WHO) provides recommendations on free sugar intake, categorized into two types: solid and conditional, applicable to adults and children.[5] The strong recommendation advises that free sugar consumption should be less than 10% of total energy intake (TEI), while the conditional recommendation suggests a restriction to less than 5% of TEI. The guideline for restricting free sugar intake to less than 10% of TEI is supported by evidence regarding the association between free sugar intake and body weight (based on low and moderate quality evidence) and dental caries (based on meager and moderate quality evidence).[5] According to this study's findings, 4 out of 10 male and female subjects exceed the recommended intake, thus increasing their risk of weight gain and dental caries. These findings emphasize the importance for educational institutions, such as universities, to monitor sugar-sweetened beverage (SSB) consumption and physical activity levels among students, even though most students may have an average weight status.

Several factors contribute to unhealthy eating habits, including high intake of

sugar-sweetened beverages (SSBs) among young adults. These reasons include time constraints, living independently away from home, financial instability, lack of culinary skills and knowledge, and easy access to unhealthy and convenient food options such as fast foods and beverages.[23] Students residing in dormitories, for instance, experience a heightened sense of independence in choosing their meals without parental oversight, which may incline them toward unhealthy dietary choices.[23] In addition, due to time constraints, young adults often prioritize other activities over food preparation. Consequently, when they prepare meals, they prefer to choose instant food and beverages or purchase fast food and drinks. During periods of heightened stress, such as examination weeks, college students may increase their consumption of sweetened coffee or tea. Furthermore, if the food environment within the campus area offers a wide variety of food options at affordable prices, this can further influence young adults to consume higher quantities of sugar-sweetened beverages.[23]

The high prevalence of subjects exhibiting low levels of physical activity may be attributed to the nature of their daily activities as college students, which primarily involve prolonged periods of sitting in class. Their academic schedules typically span from 7 a.m. to 4 p.m. on weekdays. Moreover, providing an internal campus bus service, offered as complimentary transportation, facilitates easy access to various areas within the campus. Bus stops are strategically located at each faculty building and key landmarks such as student dormitories, the campus mosque, and the train station adjacent to the campus, each situated approximately 200 meters apart. As a result, students need only a brief 5-minute walk to reach these bus stops. This accessibility to transportation likely contributes to the reduction in their overall physical activity levels.

As educational institutions, universities have a vested interest in monitoring the prevalence of overweight and obesity among their student population. Gender disparities have emerged as a notable factor influencing awareness levels regarding this issue.[24] Despite females exhibiting a significantly lower intake of sugar-sweetened beverages (SSBs), their lower levels of physical activity and higher prevalence of overweight and obesity serve as indicators for increasing awareness regarding the importance of balancing energy intake and output. Conversely, while the nutritional status of male subjects is predominantly characterized by under-normal weight, they should be mindful of reducing their consumption of SSBs. In brief, heightened awareness among females will likely lead to increased healthcare service utilization, thereby fostering a better understanding of their health status.

CONCLUSION

Body mass index (BMI) and the prevalence of overweight and obesity in females were elevated, whereas males exhibited higher consumption of sweetened beverages. This discrepancy may be attributed to the higher levels of physical activity observed in males than females. Despite males consuming more energy from sweetened drinks, their energy expenditure through physical activity appears to counterbalance their energy intake. These findings emphasize the urgency for universities to take proactive actions to address this issue, given the occurrence of overweight and obesity and increased consumption of sweetened beverages at a young age.

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CONFLICT OF INTERESTS

The authors declare no conflicts of interest. All co-authors have thoroughly reviewed and approved the manuscript's contents, and there are no financial interests to disclose. We affirm that the submitted work is original and is not concurrently under consideration for publication elsewhere.

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AUTHOR CONTRIBUTION

SAW: Concepts, Design, Definition of intellectual content, Literature search, Clinical studies, Data acquisition, Data analysis, Statistical analysis, Manuscript preparation, Manuscript editing, Manuscript review, Guarantor

DNC: Concepts, Design, Definition of intellectual content, Clinical studies, Data analysis, Manuscript editing, Manuscript review

HK: Concepts, Design, Definition of intellectual content, Clinical studies, Data analysis, Manuscript editing, Manuscript review

DS: Concepts, Design, Clinical studies, Manuscript editing, Manuscript review.

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