The consumption of Indonesian local food and its relationship with body mass index among female university students

Nurnaningsih Herya Ulfah[1,2], Pokkate Wongsasuluk[1,3]

[1]College of Public Health Sciences, Chulalongkorn University, Bangkok, Thailand
[2]Public Health Department, Faculty of Sport Science, Universitas Negeri Malang, East Java Province, Indonesia
[3]Health and Social Sciences and Addiction Research Unit (HSSRU), Chulalongkorn University, Bangkok, Thailand

Article Info

ABSTRACT

The study aimed to determine trend of Indonesian local food consumption and its association with body mass index (BMI) among female university students. It was cross-sectional study that involved 217 Indonesian female university students (18-25 years old) in April-May 2021 using conventional sampling by a self-administered online questionnaire in Malang City, East Java, Indonesia. Sociodemographic and dietary habits were collected along with body BMI data. Descriptive and Ordinal Logistic Regression were applied to analyze the data. The results showed the average BMI of 217 participants was 21.28+3.30 kg/m2. From 167 local Indonesian food that were identified, local cuisine with high carbohydrates and sugar such as fried noodles, meatballs, mixed vegetable soup, biscuits/pastry, fritters with topping, and iced milk tea with topping had a positive impact on overnutrition. Interestingly, chicken porridge had an inverse association with overnutrition. The ordinal regression results depicted the length of stay in study area had a significant association with BMI. However, meal frequency and snack time consumption also affected BMI. The preferred high-carbohydrate food is significantly associated with overnutrition ($p < 0.05$). It is crucial to adjust nutritional education and people's food menu in reducing high-carbohydrate and sugar food to provide healthy food for university students.

Corresponding Author:

Pokkate Wongsasuluk
College of Public Health Sciences, Chulalongkorn University
Institute Building 3 (10th – 11th floor), Chulalongkorn soi 62, Phyathai Rd., Bangkok 10330, Thailand
Email: Pokkate.W@chula.ac.th

1. INTRODUCTION

Young adults or late adolescents are people in their late teens or early twenties to their thirties age. They were typically defined as 18-24 years old [1], [2]. Most of this age is related to an assortment of life events connected with increasing weight, including independent life (enrolling in college or starting to work), getting married, and creating a family. Additionally, this age also addresses youthful gathering with many unique factors leading to dietary consumption: university life may relate to expanded independence in food choice, low food budgets, and openness to new communities of people and food cultures [3]. Likewise, adolescents participated in high proportions of particular behavior known to increase weight, such as eating fast food, alcohol drinking, consuming sweetened beverages, and doing sedentary activities [4], [5].

According to WHO data in 2016, more people are obese in all regions other than sub-Saharan Africa and Asia. However, in 2018, It showed that most of the Association of Southeast Asian Nations (ASEAN) countries experienced an increasing trend of overnutrition [6]. The national data proved that the obesity rate

inclined in the Indonesian adult population 2018 from 15.4% in 2013 to 21.8% in 2018 [7], [8]. In detail, the overweight prevalence (body mass index (BMI) ≥23-27) in the population aged ≥18 years is 35.4%, while the obese people with a BMI ≥27 is 21.8% (women is higher than men, 29.3% and 14.5%, respectively) [9]. In addition, the Indonesian dietary survey in university students showed 59.30% of female university students always eat outside rather than male students (14.94%) and consumed less vegetables and these factors associated with obesity [10], [11].

To support these data, the survey results in Malang district, Indonesia, depicted a high level of junk food consumption frequency for out-of-state overweight and obese girls who live in rented apartments [12]. Excess food consumption with a lack of physical activity is one of the causes of obesity in adolescent girls. Afterwards, people with low physical activity have a three times greater chance of being overweight than those who did strenuous activity [13].

The type of junk food that Indonesian female students often consumed was fried chicken. On the other hand, fiber consumption was classified as low. It also showed that they could not control their food because many food variants are available and easy to access [12], [13]. Those diet patterns will lead them to overweight and obesity in the end. Another research showed that females who have steadily overweight during their adult period between the 20s and 50s had practically five times higher possibility of getting chronic diseases such as diabetes, hypertension, cardiovascular disease, and stroke than those with normal BMI for a similar adulthood period [14]. Those findings described how important young adult age is like a golden time to prevent unhealthiest conditions in future lives. Many studies explained dietary intake [3], [4] and other factors such as lifestyle [14] associated with BMI, while few studies described the type of menus that might contribute to BMI. To solve this problem, Indonesia launched the national movement to reduce the obesity prevalence, or better known in Indonesian as the Nusantara Movement Presses Obesity Rates (*Gerakan Nusantara Tekan Angka Obesitas/GENTAS*) [15]. However, this program is not effective to manage the obesity program. Therefore, the research objectives were to assess the Indonesian local food trend consumption and its association with BMI among Indonesian female young adults. The results of this study can be a guideline of Indonesian local food consumption, related with over carbohydrate and sugar menus. Moreover, the trend of consumption may be useful for health promotion to prevent the chronic disease related with obesity among young adults.

2. RESEARCH METHOD

This study was a cross-sectional using online survey. It was conducted in April 15-30, 2021, using Google Forms as a web survey platform. The link to an online survey was accessed through social media, such as Facebook, Instagram, and WhatsApp student groups. In this study, we used proportional formulation for unknown population and the total sample needed for this research was 214 participants [16]. However, we received 230 responses then we verified the data based on inclusion and exclusion criteria that informed in first page such as female college students in Malang City, Indonesia, willing to fill the form, did not practice a specific diet and consume any medication for chronic and mental diseases. Then we analyzed 217 responses. Ethical approval was obtained from the Indonesian Ethics Committee Bhakti Wiyata (No:100/PP2M-KE/I/2021) and Chulalongkorn University (029.1/64). Data cleaning process is shown in Figure 1.
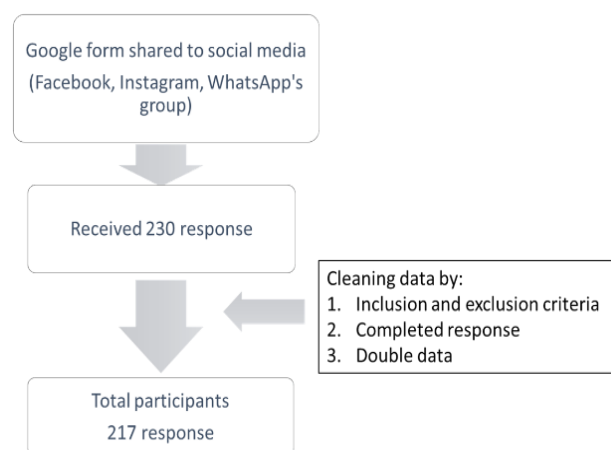

Figure 1. Data cleaning process

2.1. Dependent variable

The dependent variable in this research was body mass index (BMI). We calculated the BMI from weight and height data in survey form. There were three categories of BMI we used [17]: i) underweight (BMI<18.5); ii) normal (BMI: 18.5–25.0); and iii) overnutrition (BMI>25.0).

2.2. Independent variable

There were 22 independent variables named sociodemographic factors (age, living arrangements, length of stay in Malang City, major of study and living allowance), and dietary habits (meal frequency, snack, and sweet drink consumption). Furthermore, we included the most favorable food consumption such as fried rice, fried noodle, meatball, chicken porridge, single vegetable soup, mixed vegetables soup, biscuits/pastry, crackers, bread, fritters with topping, ice milk tea, and soft drink with topping and ice/hot tea consumption.

2.3. Instrument

The questionnaire was used to assess the dietary habits, food menus and characteristics of young adults in Indonesia. There were 230 self-administered questionnaires were answered. After cleaning all data that met exclusion criteria such as gender, age, the exact answer, following a certain diet and lack of any data, the final data set was 217 respondents. The online questionnaire was conducted by reviewing literature [18], [19] and validated by three experts (two nutrition and one public health expert) who underwent Universitas Negeri Malang and Chulalongkorn University. It used the item objective congruence (IOC), which the cut point 0.89 (cut of point was >0.7) [20]. Because all questionnaire was related to facts, the questionnaire did not need a reliability test [21]. This online questionnaire consisted of three parts: sociodemographic factors, BMI, and dietary habits. In addition, the favorite menu questions were open questionnaire short answers.

2.4. Data analysis

Data cleaning was applied, and the missing data will not be imputed. The descriptive statistics were applied to present the characteristic of participants, the type of local food, and other variables. A normality test was conducted for continuous data. Discretization was made to several variables, including length of stay in the urban area, living allowance, meals frequency, and BMI classification. Bivariate analysis was conducted to identify the independent variable's unadjusted effect on BMI value, including the correlation test and Mann Whitney test. The BMI classification was used as the dependent variable, and to identify the associated factors and the effect of local food consumption on BMI classification, an ordinal regression was performed.

3. RESULTS AND DISCUSSION

3.1. Participant's characteristic

In the beginning, 230 respondents were participated in this study, however only 217 completed the questionnaire and fulfilled the eligibility criteria. The respondent's average age was 21.51 ± 1.37, and the mean of BMI was 21.28+3.30 kg/m2. Most participants are lived alone. The sociodemographic and health factors of respondents were examined with BMI among female students. Above 60% of participants spend less than three years living in the study area, which is considered an urban area. A quarter of the recruited total participants were affiliated with the health science program and a bigger portion of the participants had no food allergy. Detailed information is presented in Table 1.

This study revealed that the prevalence of overnutrition among female university students was lower than the national estimated prevalence of overweight in this group (28 out of 217 or 12.9%). Sociodemographic factors have an association with BMI, although the results are inconsistent in the final ordinal logistic regression. Malang City is one of the famous culinary tourism places in East Java, Indonesia. The majority of Jave ethnic makes everyone like to eat carbohydrates and sugar in high-level especially in young adults. In line with a study in East Java about junk food consumption among Indonesian students, the student would like to eat fritters and deep-fried food than fruit and salad. The consumption of carbohydrates and fat were higher than fiber [12].

The bivariate analysis showed that living arrangements were correlated with BMI, although the ordinal regression logistic showed different results. A study in Sumatra, Indonesia, revealed a supporting association [22], although a study in Riau stated that students who lived alone and with their parents were not different in terms of BMI. It was assumed that these groups had similar daily activities and spent most of their time at the campus [23]. Further analysis showed that female adolescent students who lived <3.5 years in the study area experienced obesity 1.93 times compared to those who lived ≥3.5 years. The study area has the characteristic of the urban area. This finding was similar with studies in Korea and China, it found that

acculturation impacts nutrition status [24], [25] when the student at the beginning of their university life tend to immerse themselves in the existing culture, the longer they stay, they can adjust themselves to suit their individual preferences. Moreover, there was no association between study major and BMI among female students either in bivariate or ordinal logistic analysis. This result was supported by a study in the U.K. that stated that even medical school students were more likely to have unhealthy eating [26]. Living allowance did not have an association with BMI. This result is different compared to a study in the U.S. states that there was a significant association between incomes with obesity prevalence in white women [27]. One assumption to support this issue is the higher the living allowance the higher the ability of the student to afford a variety of food.

Table 1. Sociodemographic and food allergic of participants (n=217)

Variables	Total participants (n %)	Body mass index (BMI) status			p-value
		Underweight/% (n=47)	Normal/% (n=142)	Overnutrition/% (n=28)	
Age (years mean±SD)	21.51±1.37				0.002*
Living arrangements					0.010*
Living with parents	106 (48.85)	31 (14.29)	62 (28.57)	13 (5.99)	
Living alone	111 (51.15)	16 (7.37)	80 (36.87)	15 (6.91)	
Length of stay in study area (years)					0.000*
<3.5 years	135 (62.21)	20 (9.22)	94 (43.32)	21 (9.67)	
≥3.5 years	82 (37.79)	27 (12.44)	48 (22.12)	7 (3.23)	
Study Major					0.660
Health science	55 (25.35)	11 (5.07)	34 (15.67)	10 (4.61)	
Non-health science	162 (74.65)	36 (16.59)	108 (49.77)	18 (8.29)	
Living allowance per month					0.487
<$ 104.45	178 (82.02)	41 (18.89)	114 (52.53)	23 (10.60)	
$ 104.45–208.90	39 (17.96)	6 (2.76)	28 (12.90)	5 (2.30)	
Food Allergic					0.447
Have allergic	51 (23.50)	11 (5.07)	36 (16.59)	4 (1.84)	
Don't have allergic	166 (76.50)	36 (16.59)	106 (48.85)	24 (11.06)	

*Significant based on Spearman rank test (α = 0.05) BMI was treated as continuous data.
SD= Standard Deviation

3.2. Food trend consumption

The local foods consumed the most as the main course was fried rice followed by Soto (the chicken soup), and rice with salad plus peanut sauce (*Nasi pecel*) the top ten rank dominated by high carbohydrate, where the least were dominated by protein-rich food as shown in Figure 2.
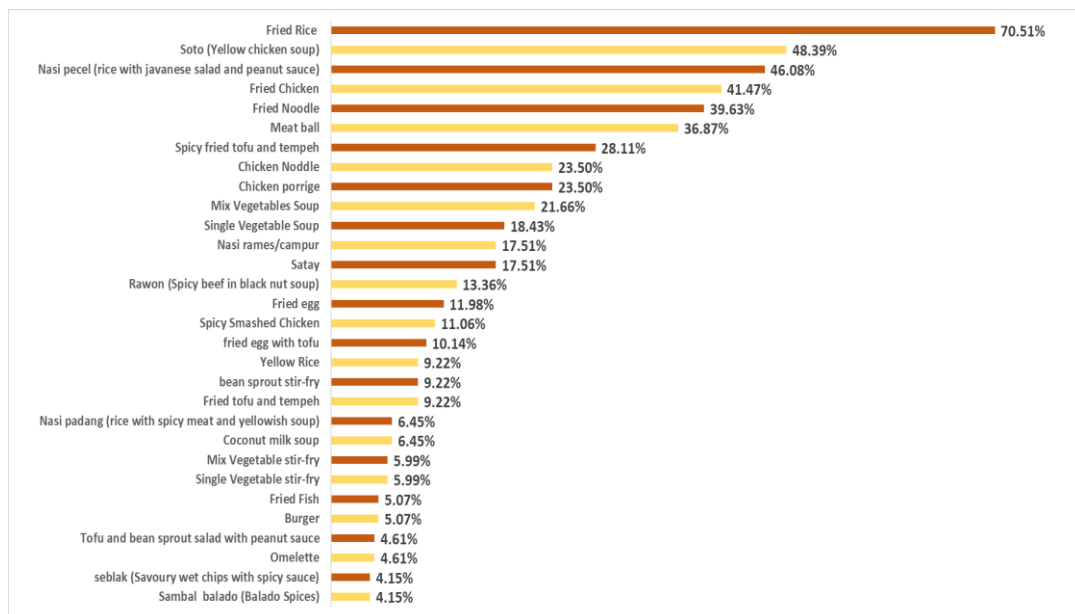

Figure 2. Top 15 Indonesian female student's favorite main courses

This pattern was like the main course menu where high-carbohydrate snacks are among the top list such as consumes biscuit/pastry (41.5%), crackers (41%) and bread (20.3%) as presented in Figure 3. In addition, according to survey, it depicted participants like to drink sugar-rich beverages such as ice milk tea with topping, ice chocolate, and soda among the top tier whereas fruit-based beverages were the least favorite. Unfortunately, only 3.69% of participants preferred water.
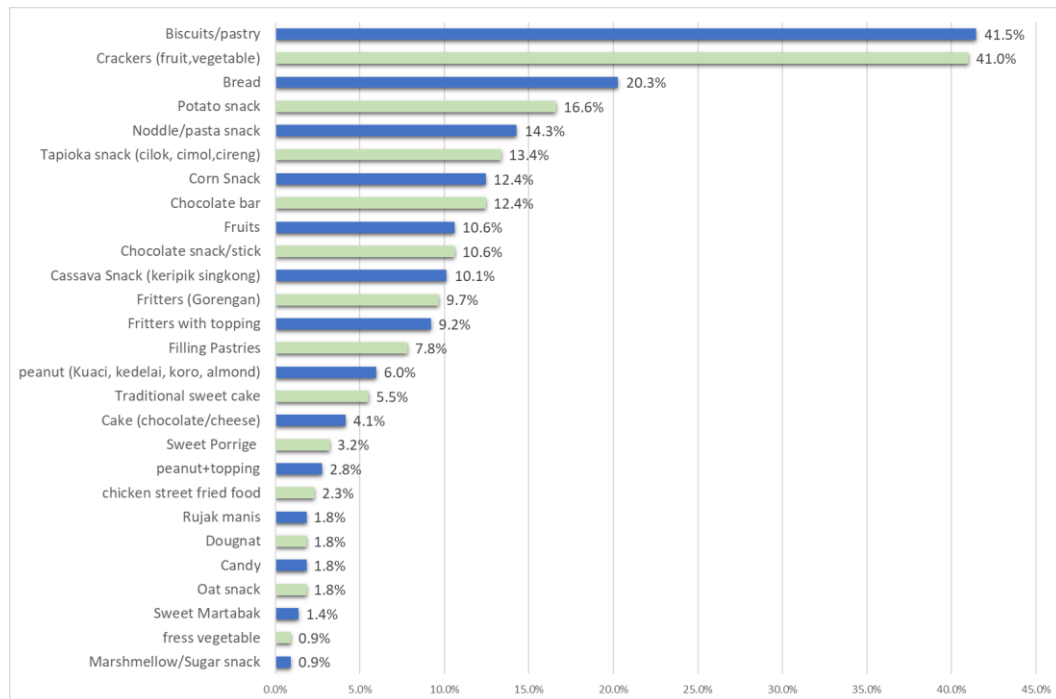

Figure 3. The top 15 Indonesian female student's favorite snacks

The results of this study confirm that most of female students consume high carbohydrate and sweet beverages. Consumption high carbohydrate and sweet beverages with over time can contribute to weight gain, increased heart disease risk and type 2 diabetes [28].

3.3. Dietary habits

The participant's dietary habit is presented in Table 2. The table shows that the students took the meal more than twice a day. A bigger number of participants ate snacks daily. Participants who took sweet beverages consumption accounted for more than one-third of the total participants.

Table 2. Participants dietary habits

Variables	Total participants n (%)	Body mass index (BMI) status			p-value
		Underweight (n=47)	Normal (n=142)	Overnutrition (n=28)	
Main course frequency (mean±SD)	2.33±0.553				0.000*
Snack consumption					0.013*
2 times per month	52 (23.97)	5 (2.30)	39 (17.98)	8 (3.69)	
1-2 times per week	16 (7.37)	4 (1.84)	8 (3.69)	4 (1.84)	
3-6 times per week	41 (18.89)	9 (4.15)	28 (12.90)	4 (1.84)	
1-2 times per day	77 (35.49)	17 (7.84)	52 (23.96)	8 (3.69)	
> 3 times per day	31 (14.28)	12 (5.53)	15 (6.91)	4 (1.84)	
Sweet beverages consumptions					0.151
Yes	77 (35.47)	18 (8.29)	54 (24.88)	5 (2.30)	
No	140 (64.53)	29 (13.36)	88 (40.55)	23 (10.62)	

*Significant based on Spearman rank test (α=0.05) BMI was treated as continuous data.

3.4. Factors associated with BMI

This study found that there were several factors that significantly associated with BMI among respondents. For dietary consumption, the increase of one unit of meals frequency, the odds of obesity were 0.5 greater than those who eat less frequent, assuming that the entirety of variant factors in the model was

constant. This interesting finding should be interpreted carefully. The author's concern is that frequency of meals might not be important, but the crucial thing is what these respondents ate. Those young female adults who prefer to consume fried noodles had 2.23 times of being overnutrition compared to respondents who did not like to consume fried noodles. According to the Indonesian food database, calories for 80–129 gr fried noodles had 350–590 Kcal depending on topping used (such as meatball, beef, sausage, chicken, or seafood) [29]. Furthermore, the common topping of fried noodles such as meatballs is also associated with a higher BMI class (adjusted odd Ratio 2.33). This experience was similar in respondents who liked mixed vegetable soup (adjusted odd Ratio 3.47) to those who did not like those food menus.

The Diabetes Global survey showed that more than half of Asians suffered because of diabetes [30]. One of the cause factors was higher consumption of carbohydrate sources such as rice and noodle [31]. Mixed vegetables in Indonesia consisted of many condiments, not only green vegetables but also vegetables that have high levels of carbohydrate such as potato (87 Kcal per 100 gr), corn (86 Kcal per 100 gr) [29]. Indonesian people consumed the mix vegetables with rice and fried food such as fried chicken, crackers, or fried fish. It can be concluded that when the respondents finished this food, they will receive around 350-550 Kcal each meal [29]. If this adolescent food consumption trend were not changed, it would impact their future health conditions, such as diabetes, cardiovascular disease, and other chronic diseases [32], [33]. In contrast, the participants who liked to consume chicken porridge might have had different experiences where the odds ratio of having overnutrition is less than one (adjusted odd Ratio 0.28).

Furthermore, the odds of being obese for female students who had consumption snack more than three times per day, 1-2 times per day, and 3-6 times per week were 0.25 to 0.27 higher than the female who had snacks consumption two times per month, in the assumption of all variables in the models were consistent. This finding proved an association between snacking time and BMI. It is contrary to results with non-obese girl's cohort study in Massachusetts, U.K. that showed no association between energy-dense snack and weight status [34]. However, there was controversial finding regarding the snack consumption and weight status. Some studies showed correlation, while others proved that it did not have any correlation. Hence, this topic should be explored more [35]. In detail, respondents who consumed snack menus such as biscuits or pastries had a 3.17 higher chance to get obese compared to those who did not consume biscuits. This trend was in line with respondents who liked to eat crackers (2.57), bread (OR: 5.56), and fritters with topping favorite consumption (16.62) compared to those who did not consume snack. All those menus contained more sugar and carbohydrate than fiber. It had approximately 45-300 Kcal for each piece of those snacks [29]. Even the snack calories contribution to overweight is still debated. If adolescents consumed those snacks more than the estimated required calories per day, it would have the possibility to increase their weight [34].

The ordinal logistic regression analysis was conducted to explore the association between BMI and sociodemographic, dietary habits, and type of food consumed by the participants. First, the parallelism assumption showed the p-value=0.358 (p-value>α) means the dependent variable and parameter estimation values pass all the categories on the same line. The second result was the model of fitting, which showed Chi-square statistic (p-value) was<0.000 (p-value<α). It indicated that the final model provides improvement over the baseline intercept, the only model. The third result was Pearson's Chi-square presented p-value=0.108 (p-value>α), meaning that the data and the model predictions were similar, and the model fits the data well. The R-square value (Nagelkerke) was 0.637. It can be concluded that the parameters (independent variables) in the model can explain 63.7% variance of the dependent variable (BMI). The parameter table showed that 12 variables had p-value<0.05 as shown in Table 3.

From the ordinal regression, living less than 3.5 years in the study area, higher meal frequency, and food with high-carbohydrate content (fried noodles, meatballs, biscuits, crackers, bread, pastry, fritters, and ice milk tea with topping) was associated with higher odds of having higher BMI. Interestingly, the simple local cuisines with more balance nutritional composition were associated with lower BMI, such as chicken porridge. However, the researchers observed that a higher frequency of snack intake was associated with lower BMI.

Lastly, this result study found no association between favorite drinking sweet beverages and BMI. Three favorite sweet drinks were examined, it is proven that those female students who liked to drink ice milk tea with topping such as bubble, whipped cream, and caramel could have overnutrition 20.33 times greater than those who did not like milk tea. Ice milk tea has at least 374 Kcal each 16 oz (500 ml), and it can be higher if adding the topping [29]. In addition, most regular bubble ice milk tea has 102.5 gr of sugar. Compared to Indonesian dietary advice that sugar consumption per day should be 50 gr, 16 oz of bubble ice milk tea was over the standard (around 200%). It supported other studies that stated that excessive carbohydrate and sugar consumption in adolescence could contribute to chronic disease in their future lives, such as diabetes, liver, and cardiovascular disease [36].

This study reveals that obesity in young adults in Indonesia associated with their meal and snack frequency. It also associated with favorite food, consisting of carbohydrates (fried noodles, bread as snack) and sugar such as milk tea and fritters with topping. Furthermore, there are some limitations of this study. This study method was a cross-sectional study. Hence, it cannot explain the cause-effect among variables. In addition, because of an online survey, it can be possible to cause response bias, especially when stating about the favorite food.

Table 3. Univariate ordinal logistic model results using three BMI levels as a response

Variable	Level	β	Odds ratio (95%CI)	p-value
Age	Respondent's age	0.107	1.11 (-0.169, 0.383)	0.449
Living arrangement	Living with parents	0.672	1.96 (-0.424, 1.767)	0.229
	Living alone	Ref		
Length of stay in Malang City	<3.5 years	1.929	6.88 (0.754, 3.104)	0.001*
	≥3.5 years	Ref		
Study major	Health science	-0.209	0.81 (-1.062, 0.645)	0.632
	Non-health science	Ref		
Living allowance	<$104.45	-0.387	0.68 (-1.339, 0.565)	0.425
	$104.45–208.90	Ref		
Meal frequency	Meal frequency per day	-0.693	0.50 (-1.373, -0.013)	0.046*
Fried rice consumption	Favorite	0.779	2.18 (-0.020, 1.578)	0.056
	Not favorite	Ref		
Fried noodle consumption	Favorite	0.824	2.23 (0.003, 1.646)	0.049*
	Not favorite	Ref		
Meatball consumption	Favorite	0.845	2.33 (0.085, 1.604)	0.029*
	Not favorite	Ref		
Chicken porridge consumption	Favorite	-1.281	0.28 (-2.226, -0.335)	0.008*
	Not favorite	Ref		
Single vegetable soup	Favorite	0.421	1.52 (-0.483, 1.325)	0.361
	Not favorite	Ref		
Mixed vegetables soup	Favorite	1.246	3.47 (0.288, 2.204)	0.011*
	Not favorite	Ref		
Snack frequency	More than 3 times per day	-1.385	0.25 (-2.587, -0.183)	0.024*
	1-2 times per day	-1.345	0.26 (-2.324, -0.365)	0.007*
	3-6 times per week	-1.311	0.27 (-2.451, -0.171)	0.024*
	1-2 times per week	-0.214	0.81 (-1.643, 1.216)	0.777
	2 times per month	Ref		
Biscuits/pastry consumption	Favorite	1.154	3.17 (0.366, 1.943)	0.004*
	Not favorite	Ref		
Crackers consumption	Favorite	0.945	2.57 (0.158, 1.733)	0.019*
	Not favorite	Ref		
Bread consumption	Favorite	1.716	5.56 (0.674, 2.758)	0.001*
	Not favorite	Ref		
Fritters with topping consumption	Favorite	2.811	16.62 (1.428, 4.195)	<0.001*
	Not favorite	Ref		
Sweet drink consumption	Favorite	-0.747	0.47 (-1.618, 0.124)	0.093
	Not favorite	Ref		
Ice milk tea with topping consumption	Favorite	3.012	20.33 (1.915, 4.108)	<0.001*
	Not favorite	Ref		
Soft drink with topping consumption	Favorite	1.050	2.85 (-0.268, 2.369)	0.118
	Not favorite	Ref		
Ice/hot tea consumption	Favorite	-0.306	1.38 (-0.455, 1.067)	0.430
	Not favorite	Ref		

*Significant based on ordinal regression logistic (α = 0.05) BMI was treated as categorical data

4. CONCLUSION

This study provides insight into the trend food consumption among female university students associated with BMI. This study proved that 12 variables associated with BMI among female students in Malang City, Indonesia, such as length of stay in Malang City, meal frequency, fried noodle consumption, chicken porridge consumption, mixed vegetables soup, snack frequency, biscuits/pastry consumption, crackers consumption, bread consumption, fritters with topping consumption, and ice milk tea with topping consumption. Even this study was conducted in Malang, it can represent Indonesian food because Malang is one of the favorite cities in Indonesia to visit and residence. Hence, it has many foods that reflect Indonesian cuisine. Based on these findings, the authors recommend adjusting the type of food that has a balanced nutritional composition to be offered to this target population, rather than restricting the frequency of meals. In addition, there should be an intervention program to improve the knowledge of female university students about balancing their meal consumption.

ACKNOWLEDGEMENTS

REFERENCES

[1] State Adolescent Health Resource Center (SAHRC), "Understanding Adolescence: Late Adolescence/Young Adulthood," University of Minnesota, 2013.

[2] J. Nyman, "Health and Wellbeing Needs of Young Adults age 18-25," in "Joint Strategic Needs Assessment (JSNA) Report," The Royal Borough of Kensington and Chelsea, The City of Westminster, 2017. https://www.jsna.info/sites/default/files/Young Adults JSNA RKBC WCC.pdf (accessed Oct. 12, 2020).

[3] E. F. Sprake *et al.,* "Dietary patterns of university students in the UK: a cross-sectional study," *Nutrition Journal*, vol. 17, no. 1, p. 90, Dec. 2018, doi: 10.1186/s12937-018-0398-y.

[4] A. Lanoye, A. A. Gorin, and J. G. LaRose, "Young adults' attitudes and perceptions of obesity and weight management: implications for treatment development," *Current Obesity Reports*, vol. 5, no. 1, pp. 14–22, Mar. 2016, doi: 10.1007/s13679-016-0188-9.

[5] M. J. Park, J. T. Scott, S. H. Adams, C. D. Brindis, and C. E. Irwin, "Adolescent and young adult health in the United States in the past decade: little improvement and young adults remain worse off than adolescents," *Journal of Adolescent Health*, vol. 55, no. 1, pp. 3–16, Jul. 2014, doi: 10.1016/j.jadohealth.2014.04.003.

[6] World Health Organization, "Adolescent health in the South-East Asia Region," WHO. [Online]. Available: https://www.who.int/southeastasia/health-topics/adolescent-health (accessed Oct. 17, 2020).

[7] Indonesian Ministry of Health, "Health reported survey and guideline," Riskesdas. 2018.

[8] Indonesia Ministry of Health, "National health survey report (Riskesdas) 2013," in "Laporan Riskesdas," 2020. [Online]. Available: https://www.litbang.kemkes.go.id/laporan-riset-kesehatan-dasar-riskesdas/.

[9] Indonesian Health Research Department, "East Java province health Report (Riskesdas 2018)," Jakarta, 2019. [Online]. Available: https://ejournal2.litbang.kemkes.go.id/index.php/lpb/article/view/3752.

[10] G. I. Wanghi, L. Leytle, Z. P. Kabututu, A. R. Buhendwa, and K. E. Sumaili, "Prevalence and determinants of overweight and obesity among school-aged children and adolescents," *International Journal of Public Health Science (IJPHS)*, vol. 9, no. 4, pp. 379–389, Dec. 2020, doi: 10.11591/ijphs.v9i4.20445.

[11] C. N. Rachmi, H. Jusril, I. Ariawan, T. Beal, and A. Sutrisna, "Eating behaviour of Indonesian adolescents: a systematic review of the literature," *Public Health Nutrition*, vol. 24, no. S2, pp. 84–97, Jun. 2021, doi: 10.1017/S1368980020002876.

[12] P. Septiana, F. A. N, and C. S. W, "Junk food and fiber consumption among overweight and obese young women living in boarding house (In Indonesia: *Konsumsi junk food dan serat pada remaja putri overweight dan obesitas yang Indekos*)," *Jurnal Kedokteran Brawijaya*, vol. 30, no. 1, pp. 61–67, 2018.

[13] J. A. Praditasari and S. Sumarmi, "Fat Intake, Physical Activity and Obesity among Adolescent Girls in SMP Bina Insani Surabaya (In Indonesia: *Asupan lemak, aktivitas fisik dan kegemukan pada remaja putri di Smp Bina Insani Surabaya*)," *Media Gizi Indonesia*, vol. 13, no. 2, pp. 117–122, 2018.

[14] L. Lu *et al.,* "Long-term overweight and weight gain in early adulthood in association with risk of endometrial cancer," *International Journal of Cancer*, vol. 129, no. 5, pp. 1237–1243, Sep. 2011, doi: 10.1002/ijc.26046.

[15] Indonesian Ministry of Health, "Guidance of "Gerakan Nusantara Tekan Angka Obesitas (Gentas)," Jakarta: Indonesian Ministry of Health, 2017. [Online]. Available: http://p2ptm.kemkes.go.id/uploads/2017/11/PedumGentas.pdf. (accessed Oct. 20, 2020).

[16] Lwanga, S. Kaggwa, Lemeshow, Stanley, and World Health Organization, Sample size determination in health studies: a practical manual. World Health Organization, 1991.

[17] Indonesian Ministry of Health, "Cut of point for body mass index (BMI) for indonesian people," Kemenkes RI. [Online]. Available: http://www.p2ptm.kemkes.go.id/infographic-p2ptm/obesitas/tabel-batas-ambang-indeks-massa-tubuh-imt (accessed Oct. 20, 2020).

[18] T. Kreutzer, "Generation mobile: online and digital media usage on mobile phones among low-income urban youth in South Africa," *Retrieved on March*, vol. 30, no. 2009, pp. 903–920, 2009.

[19] R. R. S. iguna Muhammad, Rachmawati, Meike Prawiradilaga, "Association of quantity and type of fritters as morning snack with BMI among Army Yonzipur," in *Special Procedding*, 2015, pp. 479–486.

[20] S. Laksana, "Instrumentation." Assumption of University Thailand." 2016. [Online]. Available: http://www.education.au.edu/wp-content/uploads/2016/09/instrumentation.pdf (accessed Dec. 07, 2021).

[21] O. Bolarinwa, "Principles and methods of validity and reliability testing of questionnaires used in social and health science researches," *Nigerian Postgraduate Medical Journal*, vol. 22, no. 4, pp. 195–201, 2015, doi: 10.4103/1117-1936.173959.

[22] H. Farhan, "Prevalence of Obesity in Medicine student Universitas Muhammadiyah Sumatera Utara: comparing student who lived with their parents and lived alone (In Indonesia: P*erbandingan Kejadian Obesitas Pada Mahasiswa-Mahasiswi Fakultas Kedokteran Universitas Muhamm*)." Thesis, Universitas Muhammadiyah Sumatera Utara.

[23] Muharni, Mairyiani, Hasfourni, and Ryanti, "Differences in eating patterns, physical activity and nutritional status between students's who lived with their parents and lived alone at the Health Polytechnic of the Ministry of Health, Riau," *Jurnal Proteksi Kesehatan*, vol. 4, no. 1, 2015.

[24] J. Lee, R.-R. Gao, and J.-H. Kim, "Acculturation and changes in dietary behavior and anthropometric measures among Chinese international students in South Korea," *Nutrition Research and Practice*, vol. 9, no. 3, pp. 304–312, 2015, doi: 10.4162/nrp.2015.9.3.304.

[25] S. S. Puji, "Factors related with dietary pattern among public health students in Universitas Islam Negeri Syarif Hidayatullah Jakarta." Thesis, UIN Syarif Hidayatullah, Jakarta, 2014.

[26] M. Chourdakis, T. Tzellos, G. Papazisis, K. Toulis, and D. Kouvelas, "Eating habits, health attitudes and obesity indices among medical students in northern Greece," *Appetite*, vol. 55, no. 3, pp. 722–725, Dec. 2010, doi: 10.1016/j.appet.2010.08.013.

[27] C. L. Ogden *et al.,* "Prevalence of obesity among adults, by household income and education — United States, 2011–2014," *MMWR. Morbidity and Mortality Weekly Report*, vol. 66, no. 50, pp. 1369–1373, Dec. 2017, doi: 10.15585/mmwr.mm6650a1.

[28] Heart Research Institute, "All about carbs." https://www.hri.org.au/health/your-health/nutrition/all-about-carbs# (accessed Dec. 07, 2021).

[29] Indonesia Ministry of Health, "Indonesian food composition data," Indonesian Ministry of Health. https://www.panganku.org/en-EN/beranda (accessed Nov. 05, 2021).

[30] A. Misra, K. Rastogi, and S. R. Joshi, "Whole grains and health: perspective for Asian Indians," Journal Association Physicians India, vol. 57, pp. 155–62, 2019.

[31] Y. L. M. Zuñiga *et al.,* "Rice and noodle consumption is associated with insulin resistance and hyperglycaemia in an Asian population," *British Journal of Nutrition*, vol. 111, no. 6, pp. 1118–1128, Mar. 2014, doi: 10.1017/S0007114513003486.

[32] R. D. Williams, Jr., M. Odum, and J. M. Housman, "Adolescent energy drink use related to intake of fried and high-sugar foods," *American Journal of Health Behavio*r, vol. 41, no. 4, pp. 454–460, Jul. 2017, doi: 10.5993/AJHB.41.4.10.

[33] F. Cembranel, C. de O. Bernardo, S. G. I. Ozcariz, and E. D'Orsi, "Impact of the diagnosis of diabetes and/or hypertension on healthy food consumption indicators: a longitudinal study of elderly persons," *Revista Brasileira de Geriatria e Gerontologia*, vol. 20, no. 1, pp. 33–44, 2017.

[34] S. M. Phillips *et al.,* "Energy-Dense snack food intake in adolescence: longitudinal relationship to weight and fatness," Obesity Research, vol. 12, no. 3, pp. 461–472, Mar. 2004, doi: 10.1038/oby.2004.52.

[35] N. I. Larson, J. M. Miller, A. W. Watts, M. T. Story, and D. R. Neumark-Sztainer, "Adolescent Snacking behaviors are associated with dietary intake and weight status," *The Journal of Nutrition*, vol. 146, no. 7, pp. 1348–1355, Jul. 2016, doi: 10.3945/jn.116.230334.

[36] R. A. Forshee, P. A. Anderson, and M. L. Storey, "Sugar-sweetened beverages and body mass index in children and adolescents: a meta-analysis," *The American Journal of Clinical Nutrition*, vol. 87, no. 6, pp. 1662–1671, Jun. 2008, doi: 10.1093/ajcn/87.6.1662.

BIOGRAPHIES OF AUTHORS

Nurnaningsih Herya Ulfah 🆔 🔳 SC P Lecturer in Universitas Negeri Malang Indonesia. She is Ph.D. Student in College of Public Health Science Chulalongkorn University Thailand. She interested in Health policy and technology in Public Health. She can be contacted at email: nurnaherya.fik@um.ac.id.

Pokkate Wongsasuluk 🆔 🔳 SC P is a Full Lecturer in College of Public Health Sciences Chulalongkorn University. She has expertise in Environmental Health, Risk Assessment, Heavy Metals, Technology and Application. She can be contacted at email: Pokkate.W@chula.ac.th.