

## The Relationship of Breakfast Habits, Coffee Consumption, and Sleep Duration with Obesity Incidence in University Students

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### ABSTRACT

The increasing prevalence of adult obesity in Indonesia from 14,8 to 21,8% in 2013-2018 impacts in a higher incidence of various non-communicable diseases. Lifestyle changes such as sleeping habits, breakfast, exercise, and coffee consumption can escalate the risk of obesity. Purpose: The purpose of this study was to determine the relationship between breakfast habits, coffee consumption, and sleep duration with the incidence of obesity among Ahmad Dahlan University students. This study was an observational study with a cross-sectional design with a purposive sampling method. The subjects are 459 students of Universitas Ahmad Dahlan. The research instrument used was a self-administrated online questionnaire that asked about the habits of breakfast, sleep, and coffee consumption. Anthropometric data were obtained from the results of the latest anthropometric measurements of each research subject. The research data were processed using statistical applications using the chi-square test with a significance value of  $p < 0.05$ . Results: Breakfast habits, frequency, sources, timing, and menu were unrelated to nutritional status ( $p > 0.05$ ). Other health habits such as sports habits and sleep duration also did not find any significant relationship with nutritional status ( $p > 0.05$ ). However, coffee consumption was related to nutritional status ( $p = 0.001$ ). This relationship was found in female subjects ( $p = 0.014$ ). The conclusion of this study is that breakfast habits and sleep duration are not related to the nutritional status of students, while coffee drinking habits are related to the nutritional status of students, especially female students.

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### INTRODUCTION

Overnutrition is a nutritional problem in the world. Indonesia is one of the countries facing the problem of overnutrition with the increasing prevalence of obesity in various age groups. Based on Riskesdas data, it was known that in 2007 the prevalence of adults who were overweight was 8.6%, which continued to increase to 11.5% in 2013 and 13.6% in 2018. According to the Ministry of Health, the overweight category was people who have Body Mass Index (BMI) is 25.1-27.0, the person said to be severely obese if the BMI is  $> 27$  (Kemenkes RI, 2018). Overnutrition at each period of the life cycle has an adverse impact as a risk of several non-communicable diseases (NCD) such as diabetes mellitus, hypertension, heart disease, stroke, kidney failure, and cancer. In the study of Utami et al. (2020), it was stated that respondents who were obese based and visceral fat tended to

have higher blood pressure. Moreover, it was found that a higher BMI affected the incidence of type II diabetes mellitus (Isnaini & Ratnasari, 2018).

The causes of overnutrition/overweight are excessive calorie intake and low physical activity. Excessive intake is caused by various things, such as the habit of consuming excessive fat and sugary drinks. The high intake of fructose and glucose can increase calorie intake which has an impact on being overweight (Fatmawati, 2019). Coffee also becomes a beverage that contains high sugar which can also increase the risk of obesity (Ashour, 2019). Along with the development of the era, technology is increasingly sophisticated and makes it easier for humans to do various things. In addition to being effective, it turns out that there are negative impacts that are produced, one of which is a decrease in the physical activity carried out by humans because it has been replaced by technology. A sedentary lifestyle, and

screen-based activity (SBA), could increase the occurrence of obesity (Utami et al., 2018). It was found that very light physical activity increases the risk of obesity, especially in the pandemic era (Robinson et al., 2021).

Beside of the excessive calorie intake and low physical activity, there are other factors cause obesity. The habit of skipping breakfast contributes to the occurrence of more nutritional status because people will consume snacks that have more calories (Ma et al., 2020). Low sleep duration can lead to overnutrition because it causes an increase in the hormones ghrelin and leptin, increasing appetite (Papatriantafyllou et al., 2022; Satterfield & Killgore, 2020; Utami et al., 2018). In contrast to skipping breakfast and low sleep duration that lead to overnutrition, a study suggests that coffee consumption has a reduced risk of obesity (Nordestgaard et al., 2015).

Because of the tight schedule and high demanding activity as University students, they tend to do bad habits such as low physical activity level, skipping breakfast, and high consumption of coffee (Pop et al., 2021). They also had high level of stress and sleep quality that make them vulnerable to becoming obesity (Najem et al., 2020). Ahmad Dahlan University students also has the similar condition which also has a great risk in having obesity. Prevention of obesity must be dealt with immediately to increase their quality of life. Thus, this wants to examine the relationship between breakfast habits, coffee consumption, and sleep duration with the incidence of obesity in students at Ahmad Dahlan University. The results of this study could be used as a basis for obesity prevention strategies in the future.

## METHOD

This type of research was an observational study with a cross sectional design. The research was carried out in November-December 2020 at Ahmad Dahlan University. The data collection of this research was carried out directly (primary data). Data collection was carried out directly by the researcher to the research subject.

The population of this research was all students of Ahmad Dahlan University (UAD). The inclusion criteria for subjects of this study were to be registered as UAD students and aged 18 years and over. The exclusion criteria in this study were if they had a history of chronic disease. Population size of Ahmad Dahlan University are 17,000 students. The minimum sample size of this study was determined from the Lemeshow formula so that the minimum number of samples was 384 and added 10% to anticipate the loss of research subjects so that the minimum required subjects were 423 people (Levy & Lemeshow, 2013). The sampling technique in this research was the purposive sampling method. In this study, the final number of subjects who met the inclusion criteria and not excluded criteria were 459 people.

The research instrument used was an online questionnaire using google forms. The questionnaire contains self-identity data, health data, and breakfast habits data. The category of breakfast habit was "complete" when the breakfast menu consists of staple food, protein source, and vegetable/fruit; "less complete" when consist of staple food and protein source; "incomplete" when only contain of only staple food or protein source or vegetable/fruit or drink only in their breakfast menu. Breakfast data consists of breakfast habits, breakfast frequency, breakfast time, breakfast source, and breakfast. Other health data such as exercise habits, sleep duration, and coffee drinking habits also recorded. Nutritional

status data were obtained from self-reported research subjects with the question, "What was your last weight and height measured in the last 1 month?". The category of nutritional status based on BMI was categorized according to the Indonesia classification: <18.5 "underweight" categories; 18.5-25.0 "normal"; 25.1-27.0 "overweight"; and >27.0 "severe fat/obesity". (Kementrian Kesehatan RI, 2014). The subjects who did not have recent anthropometric measurement data were excluded from this research.

Before filling out the questionnaire, they were asked to given consent as research subjects and provided honest and truthful data. This research has been approved by the Ahmad Dahlan University research ethics commission with ethical approval letter number 012010068 dated 27 November 2020.

The research data was processed using the STATA version 12 statistical application. Statistical analysis carried out was univariate and bivariate analysis. Univariate analysis was frequency (percentage) of the characteristics research subjects and breakfast patterns data. Bivariate analysis was conducted to determine the relationship between health data and breakfast habits with nutritional status. The statistical test used was the chi-square test with a significance level of  $p < 0.05$ .

## RESULTS AND DISCUSSION

Table 1 shows the characteristics of the research subjects. Most of the research subjects were women (68.41%) and aged 18-20 years (77.12%).

**Tabel 1.**  
**Characteristics of Research Respondents**

Variable	n	%
<b>Gender</b>		
Male	145	31.59
Female	314	68.41
<b>Age</b>		
18 – 20 years	354	77.12
21 – 23 years	102	22.22
24 – 26 years	3	0.65

Table 2 contains the results of the analysis of the variables studied with the nutritional status of students. Obese, overweight, normal, and underweight students had similar habits of breakfast, sport habit, and sleep duration. From the statistical analysis, it shows that breakfast habits, breakfast frequency, breakfast source, breakfast time, and breakfast menu did not have a significant relationship with nutritional status ( $p > 0.05$ ). Also, exercise habits and sleep duration did not have a statistically significant relationship with nutritional status ( $p > 0.05$ ). On the other hand, 11.89% obese students was consume coffee routinely, but only 8.76% non-coffee drinkers was obese. Non-coffee drinkers had more proportion in normal weight (63.44%), while 57.81% of coffee drinkers was in normal weight. Based on the statistical analysis, the coffee consumption habits was related to nutritional status ( $p = 0.001$ ).

The relationship between coffee intake and obesity in this study was also affected by gender. In Table 3 it can be seen that there is a significant relationship between coffee consumption and nutritional status in female subjects ( $p = 0.014$ ).

**Table 2.**  
The relationship between breakfast habits, coffee drinking habits, and sleep intake with nutritional status

Variable	Nutritional Status				p
	Underweight n (%)	Normal n (%)	Overweight n (%)	Obesity n (%)	
<b>Breakfast Habits</b>					
Yes	65 (20.97)	194 (62.58)	19 (6.13)	32 (10.32)	0.904
No	34 (22.82)	90 (60.40)	11 (7.38)	14 (9.40)	
<b>Breakfast Frequency</b>					
1-3x/week	39 (27.46)	84 (59.15)	8 (5.63)	11 (7.75)	0.181
4-7x/week	60 (18.93)	200 (63.09)	22 (6.94)	35 (11.04)	
<b>Breakfast Time</b>					
≤ 9 o' clock	57 (19.79)	187 (64.93)	15 (5.21)	29 (10.07)	0.223
> 9 o' clock	42 (24.56)	97 (56.73)	15 (8.77)	17 (9.94)	
<b>Source of Breakfast</b>					
Provided	56 (21.96)	147 (57.65)	17 (6.67)	35 (13.73)	0.079
Cook	20 (21.05)	60 (63.16)	10 (10.53)	5 (5.26)	
Buy	21 (22.11)	66 (69.47)	3 (3.16)	5 (5.26)	
Uncertain	2 (14.29)	11 (78.57)	0 (0.00)	1 (7.14)	
<b>Breakfast Menu</b>					
Complete	46 (19.66)	144 (61.54)	17 (7.36)	27 (11.54)	0.840
Less complete	21 (25.61)	50 (60.98)	4 (4.88)	7 (8.54)	
Incomplete	32 (22.38)	90 (62.94)	9 (6.29)	12 (8.39)	
<b>Sports Habits</b>					
Yes	38 (20.54)	116 (62.70)	9 (4.86)	22 (11.89)	0.459
No	61 (22.26)	168 (61.31)	21 (7.66)	24 (8.76)	
<b>Coffee Consumption Habits</b>					
Yes	24 (18.75)	74 (57.81)	6 (4.69)	24 (18.75)	0.001*
No	75 (22.66)	210 (63.44)	24 (7.25)	22 (6.65)	
<b>Sleep Duration</b>					
< 7 hours	65 (22.11)	185 (62.93)	18 (6.12)	26 (8.84)	0.659
≥ 7 hours	34 (20.61)	99 (60.00)	12 (7.27)	20 (12.12)	

\* statistically significant,  $p < 0,05$

**Table 3.**  
Relationship between Coffee Drinking Habits and Nutritional Status by Gender

Coffee Consumption habits	Nutritional Status				p
	Underweight n (%)	Normal n (%)	Overweight n (%)	Obesity n (%)	
<b>Male</b>					
Yes	11 (18.97)	33 (56.90)	2 (3.45)	12 (20.69)	0.376
No	20 (22.99)	54 (62.07)	4 (4.60)	9 (10.34)	
<b>Female</b>					
Yes	13 (18.57)	41 (58.57)	4 (5.71)	12 (17.14)	0.014*
No	55 (22.54)	156 (63.93)	20 (8.20)	13 (5.33)	

\* statistically significant,  $p < 0,05$

## DISCUSSION

In this study, we are not found significant relationship between breakfast habits and nutritional status of students. This finding was different from previous studies which stated that the habit of skipping breakfast was at risk of developing nutritional problems (Anandaraj et al., 2019; Ma et al., 2020). Different findings could be caused by several things, such as there may be changes in breakfast habits during university which was carried out online in this pandemic era or the regularity of breakfast patterns was indeed influenced by family conditions, such as the number of siblings, family perceptions, and family activities, especially working mothers (Levin & Kirby, 2012). In addition, the frequency of breakfast factor is not an independent factor in the emergence of excess nutrition. Based on the results of other study, the punctuality of overall food consumption, not only breakfast, was the risk of overnutrition (Lopez-Minguez et al., 2019). There was also

stated that skipping breakfast was not the main predictor of overweight and obesity, especially in female subjects, and was more influenced by the frequency of eating (Mota et al., 2008). Breakfast habits could be different between country that caused different effect of nutritional status. Breakfast dishes depend on the culture of ethnic group or etno-cultural (Poulain et al., 2023). Thus, we need explore more about the culture in overall food intake including breakfast to determine the effect of eating on nutritional status.

We also found that exercise habits were not related significantly to obesity because this variable was not a dominant risk factor for obesity in university students or indirect causes of obesity. Increasing body weight is directly caused by high total daily calorie intake and low energy expenditure through exercise and physical activity based on the theory of energy balance (Nurkhopipah et al., 2017). In this study, we were not collect some data related to total daily intake and the amount of physical activity could not be taken

in detail because only exercise habits were obtained and no significant relationship was found with nutritional status. Another study also found a similar thing that the level of physical activity was not fully related to nutritional status because a significant relationship was not found in women (Mota et al., 2008). In current technological developments era, humans more likely to have sedentary activity patterns, so that the most research subjects do not have exercise habits. Therefore, compared with exercise habits, high sedentary activity (high screen time) was more associated with the onset of obesity (Utami et al., 2018).

Other finding from this research was the habit of sleeping time or sleep duration in this study was not significantly related to the nutritional status of university students. Low sleep duration was one of the causes of overnutrition because it causes hormonal changes, which was increased the ghrelin hormone and a decreased leptin hormone, resulting in an increase in appetite and a decrease in satiety which causes excessive food intake (Papatriantafyllou et al., 2022; Satterfield & Killgore, 2020). The different findings could be caused by several things. In previous studies, it was also found that obesity was not strongly influenced by sleep duration factors and more influenced by other factors such as sedentary activity in the (high screen time) which reduces the amount of energy expenditure (Utami et al., 2017, 2018).

The limitation of this research was this study only a cross-sectional study so that the causal effect of the two variables cannot be ascertained. The effects of skipping breakfast on nutritional status will be more visible if it lasts in the long term. In a 5 year longitudinal study in Japan with 18 years old subjects, it was found that the anthropometric index for BMI and abdominal circumference was increased by 0.2 kg/m<sup>2</sup> and 1.1 cm in men and 0.046 kg/m<sup>2</sup> and 1.0 cm in women who skip breakfast 4-6x/week. In male subjects who skip breakfast every day, the increase in abdominal circumference is 0.248 cm per year compared to those who eat breakfast every day (Sakurai et al., 2017).

This study was also found that the coffee consumption was related to nutrition status and the relationship consistently found only in female group. This finding was similar to the results of research Lee et al. (2019) who found that the effect of coffee intake and nutritional status had different results according to gender. More coffee consumption was associated with a decrease in central obesity in men but in women, the opposite effect was found which it increased central obesity. Other cross-sectional study was also found that high coffee intake was associated with a high prevalence of obesity in Korean female subjects, which whom consumed 3 cups of coffee per day compared to those who did not drink coffee had 2.52 higher risk to becoming obese (J. Lee et al., 2017).

Even though coffee was found increasing the risk of obesity, some studies shows that coffee consumption affected reducing the risk of obesity, metabolic syndrome, and type 2 diabetes (Nordestgaard et al., 2015). Coffee is a beverage that contains caffeine and large amounts of caffeine can support weight loss, BMI, and body fat mass (Tabrizi et al., 2019). However, the effect of coffee consumption will differ based on the time of consumption. Caffeinated coffee consumed 3-4.5 hours before meals had a low impact on food intake and macronutrients, while caffeine consumed 0.5-4 hours before meals had more effect on suppressing food intake (Schubert et al., 2017). Coffee is consumed in moderation it can have a protective effect on the incidence of stroke (Lopez-Garcia et al., 2009). Intake of caffeinated drinks should not be excessive and limit coffee intake for women of reproductive age as much as 300 mg of caffeine per day. (equivalent to 4.6 mg/kg

body weight for a person weighing 65 kg) while children should consume 2.5 mg per kg body weight per day (Nawrot et al., 2003). Based on the results of the meta-analysis, this protective effect only applies when consumption was not more than 4 glasses per day (Nordestgaard et al., 2015).

## CONCLUSIONS AND RECOMMENDATION

Our study has several limitation because it only uses self-reported data on the last measurement of height and weight within 1 month to measure nutrition status. Further research is needed to explore the relationship between variables using better measurement technique and reseach methods such as cohort studies.

In conclusion of this research, health habits such as breakfast habits, exercise habits, and sleep duration are not related to the nutritional status of students. In this research, only coffee consumption habits was related to nutritional status of university students and consistently found in female students, but not in male students. This findings shows that university students should be more aware in coffee consumption in order to preventing obesity. Coffee consumption in moderate has protective effect for some disease, but over consumption has opposite effect, especially when the sugar content of coffee is high.

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## DECLARATIONS

### Ethics approval and consent to participate

This research has received approval from the Universitas Ahmad Dahlan research ethics (Komisi Etik Penelitian Universitas Ahmad Dahlan) commission with the ethical approval letter number 012010068 dated 27 November 2020.

### Consent for publication

Not applicable

### Availability of Data and Material (ADM)

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

### Competing interests

The authors declare that they have no competing interests.

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## Authors' contributions

Nurul Putrie Utami: Principal researcher, Analyze the data, Write the manuscript

Cita Eri Ayuningtyas: Arrange and check the research instruments, Check the manuscript

Putri Cahya Pertiwi: Data collection

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