# ASSOCIATION BETWEEN PSYCHOLOGICAL STRESS AND BODY MASS INDEX OF NUTRITION DEPARTMENT STUDENTS IN SURABAYA

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**Abstract.** Stress is a human response to straining environment. Humans respond to stress through parasympathetic and sympathetic networks. Chronic stress can be a risk factor that can trigger, worsen, or lead to weight gain. This study identified the association between psychological stress and the body mass index of fifty-five students in Surabaya. It was an observational analytic study with a cross-sectional design. Data were collected from measurements of body weight and body height to calculate the body mass index and through online questionnaires on levels of psychological stress. The data were analyzed using Kendall's Tau-b on SPSS software. The results showed that 18 respondents classified as normal psychological stress levels had normal body mass index, and one respondent with severe psychological stress had underweight status. The Kendall's Tau-b test results showed a *p*-value of 0.186 indicating that psychological stress was not significantly associated with body mass index of this population.

**Keywords:** psychological stress, body mass index, students, health well-being

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## INTRODUCTION

Stress is a pressure experienced in everyday life. An expert and the founder of the Stress Theory, Hans Selye, defined stress as a non-specific response of the body to a stressor (Selye, 1946). Stress is a state of the mind, involving both the brain and body as well as their interactions; it reflects not only the major life events but also the conflicts and pressures of daily life that alter physiological systems. A chronic stress burden is a factor for developing a disease (McEwen, 2012). Individual resistance to stressors is different from one person to another. Individuals with low-stress tolerance tend not to be able to control stressors, so they will easily experience stress (Prahestyningrum, 2017).

Furthermore, stress is a condition caused by uncontrolled physical demands, the environment, and social situations. The prevalence of stressful events is quite high, and almost more than 350 million people in the world have experienced stress. Stress is ranked the 4th highest illness in the world according to the World Health Organization (WHO, 2017).

Chronic stress can be a risk factor that can trigger, worsen, or lead to weight gain. If stress occurs continuously for a long time, then it will affect body weight, whether it results in underweight or overweight (Andriana and Nunu Prihantini, 2021). Stress could occur to anyone including students.

Students are vulnerable to stress because they are surrounded by monotonous situations, noise, tasks, far-fetched expectations, ambiguity, dangerous and critical situations, and strict rules (Pratama, 2014). In addition, they are sometimes facing under pressure, not appreciated, ignored, and competitions. Psychological factors such as depression, anxiety, and stress have a major contribution to determining food intake and nutritional status. Stress is known to cause eating disorders, either in the form of decreased or increased appetite (Kusuma *et al*, 2010).

Research on stress levels in students from a specific faculty has been carried out at several universities in the world. The global prevalence of

students experiencing stress was 38-71%, while it was 39.6-61.3% in Asia (Habeeb, 2010) and 36.7-71.6% in Indonesia (Fitasari, 2011).

Body mass index (BMI) is a measure of weight adjusted for height, calculated as weight in kilograms divided by the square meters of height ($kg/m^2$) (CDC, 2011). After calculating the BMI, the BMI value will be categorized according to the WHO's standards for Asia such as <18.5 $kg/m^2$ for underweight, 18.5-22.9 $kg/m^2$ for normal, 23.0-24.9 for overweight, 25-29.9 $kg/m^2$ for obesity I, and ≥30 $kg/m^2$ for obesity II (Lim *et al*, 2017).

When a person experiences stress, stress can disrupt the balance of the sufferer's body. Therefore, the body will respond to stress and restore balance by producing a physiological response. One of the body's balance that is disrupted due to stress is the body's physiology related to food intake (Miliandani and Meilita, 2021). When the body is under stress, it gives orders from the hypothalamus to the adrenal glands to release the hormones adrenaline and cortisol. This cortisol hormone increases appetite. Meanwhile, a decrease in appetite is caused by the adrenal glands secreting more of the hormone epinephrine which triggers the body's response to delay eating (Rahmawati, 2020). Poor nutritional status could be a factor for the emergence of infectious diseases, while excessive nutritional status could be a factor for the emergence of degenerative diseases.

This study was conducted on Nutrition Department students at Faculty of Public Health, Universitas Airlangga in 2016-2019 with the aim to determine the level of stress that occurs in college students and its relationship with body mass index.

## MATERIALS AND METHODS

This study used quantitative and observational analytic method with a cross-sectional research design. This study was granted an ethical approval by the Health Research Ethics Committee, Universitas Airlangga, Faculty of Public Health with the approval number: 54/EA/KEPK/2020.

The population in this study was 239 undergraduate students at Nutrition Department, Faculty of Public Health, Universitas Airlangga. The inclusion criteria of the samples were 1) female and male students aged 18-24 years, 2) not fasting, 3) not currently on a certain type of diet, 4) not pregnant, 5) willing to participate by signing a consent form.

The following simple formula would be used for calculating the minimum sample size in this study:

$$n = \frac{Z^2 p(1\text{-}p)N}{d^2(N\text{-}1) + Z^2 p(1\text{-}p)}$$

where $n$ = sample size; $Z$ = z-score; $p$ = standard of deviation; $N$ = population size; and $d$ = precision.

As a result, sample size needed in conducting this study was:

$$n = \frac{1.96^2 \times 0.24 \times (1\text{-}0.24) \times 239}{0.1^2(239\text{-}1) + 1.96^2 \times 0.24 \times (1\text{-}0.24)} = 54.36$$

Based on the sample calculation formula, the minimum sample size in this study was 55 students.

The instrument used to measure stress levels was the Depression Anxiety Stress Scale 42 (DASS-42) which was developed by Lovibond in 1995 (Lovibond and Lovibond, 1995). The DASS-42 instrument consists of 42 questions that identify a depression, anxiety, and stress scale. The results of completing the questionnaire will be summed based on the answer score which consists of never (score 0), rarely (score 1), often (score 2), always (score 3). Then the total score is categorized into five levels, namely normal (score 0-14), mild (score 15-18), moderate (19-25), severe (26-33), and very severe (>34).

In addition, anthropometric measurements were also carried out to obtain data on weight and height. The data is then used to calculate the respondent's body mass index.

The data were analyzed using Kendall's Tau-b on Statistical Package for the Social Sciences (SPSS) version 20 (IMB Corp, Armonk, NY). The data were analyzed using Kendall's Tau-b test to determine the relationship between variables. Kendall's tau test was used because the data were ordinal and not normal.

## RESULTS

A total of 55 college students participated in this study. The age of the respondents ranged from 18 to 22 years. The average age (±standard deviation (SD)) of the respondents was 19.56 (±1.19) years and the majority of respondents (96.4%) were female (Table 1).

Table 1
Character distribution of Nutrition Department students, Faculty of Public Health, Universitas Airlangga in 2020

| Characteristic | Frequency *n* (%) |
|---|---|
| Age | |
| 18 years | 12 (21.8) |
| 19 years | 17 (30.9) |
| 20 years | 12 (21.8) |
| 21 years | 11 (20.0) |
| 22 years | 3 (5.5) |
| Gender | 2 (3.6) |
| Male | 53 (96.4) |
| Female | 17 (30.9) |

According to the Depression Anxiety Stress Scale-42 questionnaire, which has been modified and only focuses on stress indicators, the average score (±SD) of respondents' psychological stress was 15.4 (± 7.2). After categorizing the psychological stress, almost half of the respondents (40%) had normal psychological stress while the prevalence of students with mild, moderate, severe, and very severe psychological stress was 29.1%, 21.8%, 7.3%, and 1.8%, respectively. The distribution of respondents' psychological stress levels is presented in Table 2.

BMI value was obtained from the measurement of weight and height independently. The average BMI of the respondents was 22.1±3.7 $kg/m^2$. Most of the respondents (60%) had normal nutritional status, and

Table 2
Psychological stress distribution of Nutrition Department students, Faculty of Public Health, Universitas Airlangga in 2020

| Psychological stress level | Frequency *n* (%) |
|---|---|
| Normal | 22 (40.0) |
| Mild | 16 (29.1) |
| Moderate | 12 (21.8) |
| Severe | 4 (7.3) |
| Very severe | 1 (1.8) |

Note: The DASS-42 instrument used to determine the psychological streaa level consists of 42 questions that identify a depression, anxiety, and stress scale. The results of completing the questionnaire will be summed based on the answer score which consists of never (score 0), rarely (score 1), often (score 2), always (score 3). Then the total score is categorized into five levels, namely normal (score 0-14), mild (score 15-18), moderate (19-25), severe (26-33), and very severe (>34).

only a small proportion (10.9%) had underweight status. In addition, the prevalence of overweight, obesity I, and obesity II were 10.9%, 16.4%, and 1.8%, respectively. The total prevalence of obesity in this group was 18.2%. The distribution of respondents' nutritional status is presented in Table 3.

The distribution of respondents based on the relationship between psychological stress levels and BMI can be seen in Table 4. Based on Table 4, 32.7% of respondents in the normal stress category had normal nutritional status, and 1.8% in the very severe stress category had obese status. From the Kendall's Tau-b results, this study showed psychological stress level had no significant relationship with BMI ($p$=0.186).

Table 3
Nutritional status of Nutrition Department students, Faculty of Public Health, Universitas Airlangga in 2020

| Nutritional status | Frequency<br>*n* (%) |
|---|---|
| Underweight | 6 (10.9) |
| Normal | 33 (60.0) |
| Overweight | 6 (10.9) |
| Obesity I | 9 (16.4) |
| Obesity II | 1 (1.8) |

Note: Body mass index (BMI) is a measure of weight adjusted for height, calculated as weight in kilograms divided by the square meters of height ($kg/m^2$) (CDC, 2011). After calculating the BMI, the BMI value will be categorized according to the WHO's standards for Asia (WHO Expert Consultation, 2004) such as <18.5 $kg/m^2$ for underweight, 18.5-22.9 $kg/m^2$ for normal, 23.0-24.9 $kg/m^2$ for overweight, 25-29.9 $kg/m^2$ for obesity I, and ≥30 $kg/m^2$ for obesity II.

$kg/m^2$: kilograms per square meter

Table 4

Relationship between psychological stress levels and BMI of Nutrition Department students, Faculty of Public Health, Universitas Airlangga in 2020

| Psychological stress level | Nutritional status, *n* (%) | | | | | *p*-value |
|---|---|---|---|---|---|---|
| | Underweight | Normal | Overweight | Obesity | Total | |
| Normal | 1 (1.8) | 18 (32.7) | 2 (3.6) | 1 (1.8) | 22 (40.0) | 0.186 |
| Mild | 2 (3.6) | 9 (16.4) | 1 (1.8) | 4 (7.3) | 16 (29.1) | |
| Moderate | 2 (3.6) | 5 (9.1) | 3 (5.5) | 2 (3.6) | 12 (21.8) | |
| Severe | 1 (1.8) | 1 (1.8) | 0 (0.0) | 2 (3.6) | 4 (7.3) | |
| Very severe | 0 (0.0) | 0 (0.0) | 0 (0.0) | 1 (1.8) | 1 (1.8) | |
| Total | 6 (10.9) | 33 (60.0) | 6 (10.9) | 10 (5.5) | 55 (100.0) | |

The DASS-42 instrument used to determine the psychological streaa level consists of 42 questions that identify a depression, anxiety, and stress scale. The results of completing the questionnaire will be summed based on the answer score which consists of never (score 0), rarely (score 1), often (score 2), always (score 3). Then the total score is categorized into five levels, namely normal (score 0-14), mild (score 15-18), moderate (19-25), severe (26-33), and very severe (>34).

Body mass index (BMI) is a measure of weight adjusted for height, calculated as weight in kilograms divided by the square meters of height ($kg/m^2$) (CDC, 2011). After calculating the BMI, the BMI value will be categorized according to the WHO's standards for Asia (WHO Expert Consultation, 2004) such as <18.5 $kg/m^2$ for underweight, 18.5-22.9 $kg/m^2$ for normal, 23.0-24.9 $kg/m^2$ for overweight, 25-29.9 $kg/m^2$ for obesity I, and ≥30 $kg/m^2$ for obesity II.

$kg/m^2$: kilograms per square meter

## DISCUSSION

The results showed that most of the respondents in the normal stress category had normal nutritional status, and a small number of respondents in the severe stress category had obesity II status.

During acute stress, corticotrophin-releasing hormone (CRH) released by the hypothalamus will inhibit neuropeptide Y (NPY) and Agouti-related protein (AgRP) resulting in suppression of appetite (Sominsky and Spencer, 2014). In addition, urocortin, which belongs to the CRH family, can also suppress food intake by reducing ghrelin secretion (Sominsky and Spencer, 2014). On the other hand, glucocorticoids in peripheral tissues increase lipoprotein lipase activity, leading to fat surging (Sominsky and Spencer, 2014). Glucocorticoids acts on the hypothalamus to stimulate appetite by increasing the secretion of NPY and AgRP and yielding leptin resistance in the brain (Sominsky and Spencer, 2014).

The results showed no significant relationship between psychological stress and BMI. This is in line with previous research which showed no significant relationship between stress levels and BMI of nursing students (Urbanetto *et al*, 2019). However, another previous research found a contrast finding (Purwanti *et al*, 2017).

To our knowledge, this is the first study to assess nutritional status and its relationship whit psychological level in students of Nutrition Department in Surabaya. There were some limitations, such as bias. Selection bias may arise from the recruitment of respondents. Respondent bias can be caused by the recall process during the interview session. To minimize memory and measurement bias, we used trained enumerators to guide respondents through questionnaires and used detailed questions where appropriate. A further study should look at the relationship between psychological stress categories such as acute and chronic stress and BMI.

In summary, most of the respondents in this study were 19 years old and female. Less than half of the respondents had a normal level of psychological stress. Meanwhile, the prevalence of mild, moderate, severe, and very severe psychological stress was 29.1%, 21.8%, 7.3%, and 1.8%, respectively. Most of the respondents had normal nutritional status based on their BMIs. The prevalence of underweight, overweight, obesity I, and obesity II status was 10.9%, 10.9%, 16.4%, and 1.8 %, respectively. Respondents who had severe psychological stress did not always have poorer nutritional status compared to those with normal or mild levels of psychological stress.

## CONFLICT OF INTEREST DISCLOSURE

The authors declare no conflict of interest.

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