Metabolic and Nutritional Profiles: Supporting School Well-being for Students

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Abstract. Health status is one aspect related to student welfare with the lowest achievement compared to other aspects such as having, being, and loving in achieving school well-being. A cross-sectional study conducted on 18 students with overweight and obese status aims to examine the correlation between the metabolic profile (blood glucose and blood pressure) and the nutritional status profile with food intake in supporting the achievement of school well-being for students. This research was conducted in May-June 2024 at Universitas Respati Yogyakarta. Blood glucose (BG) and blood pressure (BP) data were obtained using a glucometer and digital blood pressure monitor. Nutritional status data was obtained through measuring body weight and height which is then translated into body mass index (BMI). Food intake data was obtained through 1x24 hour food recall which was carried out five times. There is a correlation between energy intake and body weight, systolic BP, and diastolic BP. There is a correlation between fat intake and body weight and BMI. A positive correlation was also seen between carbohydrate intake and diastolic BP. Food intake is correlated with BP and nutritional status. Blood pressure and nutritional status are descriptions of physical health conditions supporting students in the process of learning. Of course, this is an aspect that must be considered so that school well-being for students can be achieved.

Keywords: food intake, metabolic profile, nutritional status, school well-being

1 Introduction

Well-being at school is a subjective description of the condition or environment of the campus, which consists of four main aspects, including the physical condition of the campus (having), the need for self-fulfillment (being), social relationships (loving), and health status (health) [1]–[5]. With all the challenges faced, both interactions between lecturers and students as well as the burden of assignments and organization, students need a conducive learning environment so that all learning processes can run well [1].

Well-being at school is one of the supporting factors for achieving learning goals for students. Students with high well-being tend to have good academic achievement, and vice versa [1], [2], [6]. Previous studies conducted on students at the Faculty of Social Sciences at Makasar State

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University showed that the majority (44%) of students' school well-being levels were still in the medium category with 14% of students feeling that they had school well-being in the low category. The highest aspect of school well-being among students is the loving aspect, while the lowest aspect is the student's health aspect. The health aspect includes physical and mental aspects such as psychosomatic symptoms, chronic diseases, and minor illnesses experienced by students [1], [4]. A similar study conducted on students at the Faculty of Psychology, Riau Islamic University also showed that the subject's school well-being was in the medium category. The highest aspect is the having aspect with a value of 52.33 and the lowest aspect is the health aspect with a value of 6.80 [7].

In the health aspect, it is hoped that no source of disease or sick students will be found in the school environment [2], [3]. A case study conducted on elementary school children showed that the students did not have chronic congenital diseases. However, students have experienced various infectious diseases such as fever, flu, coughs, and colds [3].

As far as researchers know, there have not been many studies related to health aspects in achieving school well-being among students. This study is important to carry out considering that students are independent individuals who can make choices regarding the lifestyle they adopt every day, especially regarding eating choices and the use of gadgets or screen time [8]. Lifestyle is one thing that also influences students' academic achievement because this is related to the health of body organs. One of the lifestyles of students today is that they tend to like various instant things, one of which is fast food. Unbalanced food consumption contributes to the incidence of obesity [9], [10]. The increasing popularity of contemporary foods and drinks circulating among students is a risk factor for the development of chronic diseases, one of which is hypertension and diabetes mellitus considering that many of the contemporary foods are high in calories, fat, simple sugars, and sodium accompanied by low fiber content [10].

This study aims to examine the magnitude of health problems in terms of metabolic profiles (blood glucose and blood pressure) and nutritional status profiles and their correlation to students' food intake. This study is useful as an initial picture of the magnitude of health problems that students have so that it can be used as a basis for determining steps or policies to support the achievement of school well-being in the campus environment.

2 Method

The study conducted from May to June 2024 at Universitas Respati Yogyakarta was a cross-sectional study involving 18 students with overweight and obesity conditions. Research sampling was carried out purposively by considering the subject inclusion and exclusion criteria. Subject inclusion criteria included: a) aged 19-30 years, b) had a BMI >25 kg/m^2, c) did not experience or had no history of metabolic disease related to nutrition, d) was not on a weight loss program for the last six months, e) not currently on a program of taking drugs that affect appetite, f) not smoking, g) not currently pregnant or breast-feeding which can affect increased nutritional needs, h) willing to be a research subject as proven by signing the informed consent. Subject exclusion criteria were subjects in an unhealthy condition during the data collection process.

The metabolic profile examined in this study includes random blood glucose (RBG) levels and blood pressure (BP). Meanwhile, the nutritional status profile is described by calculating body mass index based on the results of measurements of body weight and height. Random

blood glucose levels are obtained by taking a blood sample from the fingertip and measuring using a glucometer. Blood pressure is measured using a digital blood pressure monitor. Body weight was measured using a digital scale with an accuracy of 0.1 kg, and height was measured using a microtoise with an accuracy of 0.1 cm. Food intake data was obtained by interviews using the 1x24-hour food recall method which was conducted five times non-consecutively, with three days representing weekdays and two days representing weekends so that it could describe the subject's eating patterns. Next, the results of the food intake interview were processed using the Nutrisurvey program to determine the amount of energy, protein, fat, and carbohydrate intake. To ensure the accuracy of the food intake data, a survey was first carried out regarding the types of food and drinks consumed by the subjects, and then the information on the nutritional value of various types of food and drinks was entered into the Nutrisurvey program.

Metabolic profile data, nutritional status profile, and food intake were then analyzed at the data distribution level using the Shapiro-Wilk Test. The correlation between variables for normally distributed data was tested using Pearson correlation, while the correlation between variables for data that was not normally distributed was tested using Spearman rho. The level of significance used in this research is 95%.

This research has met ethical standards. This is proven by obtaining a certificate of ethical suitability with number 044.3/FIKES/PL/IV/2024 issued by Universitas Respati Yogyakarta through the Health Research Ethics Commission, Faculty of Health Sciences.

3 Results and Discussion

All subjects involved in this research were female with the age range of the subjects being 20 years to 23 years with an average age of 21 years. Table 1 presents data on the nutritional status profile and metabolic profile of the subjects. More than 90% of the subjects involved in this study were subjects with obese nutritional status with the average BMI of obese subjects being 31.97 kg/m^2, while the BMI of overweight subjects was 26.87 kg/m^2. The categorization of nutritional status refers to the Ministry of Health of the Republic of Indonesia, namely the obesity category if BMI is >27 kg/m^2 and the overweight category if BMI is >25 kg/m^2 to 27 kg/m^2 [11]. All subjects had random blood glucose levels below 200 mg/dL. Most subjects had normal blood pressure. The lowest to highest systolic blood pressure is 100 to 143, while the lowest to highest diastolic blood pressure is 69 to 111. Blood pressure classification refers to the European Society of Hypertension (ESH) 2023, with the optimal blood pressure category <120/80 mmHg, normal blood pressure category 120-129/80-84 mmHg, prehypertension 130-139/85-89 mmHg, grade 1 hypertension 140-159/90-99 mmHg, grade 2 hypertension 160-179/100-109 mmHg, and grade 3 hypertension ≥ 180/110 mmHg [12].

The condition of being overweight and/or obese can be one of the gateways to the emergence of mental health problems in students. Students who are overweight will receive ridicule from other students which will cause students to become more discouraged due to stigma and discrimination. Obesity can increase the risk of depression by 55% [13]. A study showed that overweight and obese subjects had higher depression, anxiety, and stress scores than subjects with normal weight [14].

Students with mental problems tend to have a low quality of life, experience difficulties in education, and experience difficulties in socialization [15]. Of course, this is a factor in not achieving school well-being. Not achieving school well-being is the cause of increasing student academic anxiety which leads to not achieving learning goals. Previous studies showed that 42.6% of the causes of academic anxiety came from low school well-being [16].

The continued discovery of students with prehypertension and grade 1 to grade 3 hypertension is a factor that must be taken into account considering that hypertension is a risk factor for other non-communicable diseases, one of which is cardiovascular diseases [17]. Health conditions that are not optimal are one of the factors in not achieving school well-being.

Table 1. Nutritional Status Profile and Metabolic Profile of Subjects

Variable		n (%)	Mean±SD
Body weight		18 (100)	72.65 (59.00–124.60) *
Height		18 (100)	153.80±5.48
Body Mass Index	Overweight Obesity	1 (5.56) 17 (94.44)	30.86 (26.87–47.48) *
Random blood glucose		18 (100)	109.33±24.98
Systolic/ diastolic blood pressure	Normal Prehypertension Grade 1 hypertension Grade 2 hypertension Grade 3 hypertension	11 (61.11) 4 (22.22) 1 (5.56) 1 (5.56) 1 (5.56)	122.33±11.23/ 82.00 (69.00–111.00) *

*Median (Minimum-Maximum)

Table 2 presents data on the subjects' food intake. Energy, protein, and fat intake from lowest to highest, namely 1116.54 kcal – 1893.32 kcal; 35.38 grams – 71.78 grams; and 40.28 grams – 90.34 grams. Meanwhile, the percentage of food intake fulfillment compared to the need for energy, protein, and fat from lowest to highest is 62.47% – 100.20%; 52.79% – 99.78%; and 81.13% – 172.12%. The majority of subjects had energy, protein, and carbohydrate intake in the poor category (<80% of needs), while fat intake was in the over category (≥ 110% of needs). The categorization of food intake refers to the National Widyakarya for Food and Nutrition (WNPG) with intake stated as poor if <80% of needs, good if 80%-109% of needs, and over if ≥ 110% of needs. The subject's nutritional needs are calculated individually by calculating basal energy first and then calculating the total energy requirements based on corrections for the subject's age, height, weight, and activity factors. Body weight correction refers to previous studies, namely for overweight subjects: the ideal body weight is used, and for obese subjects: the adjusted body weight is used [18].

The majority of subjects still consume food without paying attention to the principles of balanced nutrition. At every meal, it may not necessarily find vegetables and fruit in the food consumed by the subjects. The majority of subjects consumed rice as a source of carbohydrates in small amounts, but subjects still consumed other foods in the form of fried foods in larger quantities. Some subjects still often consume fast food such as modern noodles at fast food restaurant outlets with accompanying foods such as fried dumplings in quite large quantities (3 to 5 large pieces per meal). Some also still eat snacks in the form of *cireng* and *cilok* (food made from *tapioca* flour dough, either fried or steamed), tofu walik, and bakwan (food made from wheat flour dough and prepared by frying).

Table 2. Subjects' Food Intake

Food Intake	Category	n (%)	Total Intake	% Fulfillment
			Mean±SD	Mean±SD
Energy (kcal)	Poor Good	10 (55.56) 8 (44.44)	1530.54±195.12	80.08±9.45
Protein (gram)	Poor Good	12 (66.67) 6 (33.33)	53.89±9.23	75.22±12.67
Fat (gram)	Good Over	5 (27.78) 13 (72.22)	65.33±12.12	122.88±21.29
Carbohydrate (gram)	Poor Good	16 (88.89) 2 (11.11)	182.39 (144.50–279.36) *	62.14 (52.69–98.75) *

*Median (Minimum-Maximum)

There is a correlation between energy intake and body weight (p=0.040); systolic BP (p=0.019), and diastolic BP (p=0.014) with r=0.488; r=0.546; r=0.568, respectively. There is a correlation between fat intake and body weight (p=0.010; r=0.589) and BMI (p=0.009; r=0.60). A positive correlation was also seen between carbohydrate intake and diastolic BP (p=0.019; r=0.546) (Table 3). The subject's unbalanced and instant diet is the cause of overweight and/or obesity as well as increased blood pressure. Obesity is caused by consuming an unbalanced diet [9], [10]. Overweight and obese events were found in subjects with excessive energy and fat intake [19]. Previous studies have also proven that there is a relationship between energy and carbohydrate intake and blood pressure [20]. The increasing consumption of modern foods and drinks among students contributes to an increased risk of developing chronic diseases, one of which is hypertension, in that many modern foods contain lots of calories, fat, simple sugars, sodium, and low fiber [10]. Unfortunately, this study did not examine sodium and fiber intake. Future studies could explore the role of other nutrients on metabolic profiles and nutritional status profiles.

Table 3. Correlation of Food Intake with Nutritional Status Profile and Metabolic Profile

Variable	Energy		Protein		Fat		Carbohydrate	
	p	r	p	r	p	r	p	r
Body weight	0.040*#	0.488	0.261*	0.280	0.010*#	0.589	0.216*	0.307
BMI	0.067*	0.441	0.131*	0.370	0.009*#	0.600	0.468*	0.183
RBG	0.415^	0.205	0.300^	0.259	0.179^	0.332	0.945*	-0.018
Systole BP	0.019^#	0.546	0.558^	0.148	0.073^	0.433	0.071*	0.435
Diastole BP	0.014*#	0.568	0.725*	-0.089	0.310*	0.254	0.019*#	0.546

*Spearman's rho; ^Pearson correlation; #signifikan p<0.05

The existence of various health problems found in students can be the basis for campuses or universities to further improve or make campus health unit programs more effective, so it can improve students' health status. Campuses can carry out or improve education for students regarding the latest health issues, and can even provide health counseling through campus health clinics [4].

3 Conclusions

Health problems that are still visible in this study are over-nutrition status and hypertension with unbalanced nutritional intake. Nutritional status and blood pressure have a positive correlation with nutritional intake, especially energy, fat, and carbohydrate intake. The description of health problems in this study can be a basis for the university in determining steps to solve problems so that school well-being for students can be achieved optimally.

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