Exploring the Correlation between Nutritional Status, Macronutrient Intake, and Depression Symptoms among Medical Students: A Study at Halu Oleo University

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Abstract. Nutritional status represents the balance between nutrient intake and physiological and psychological needs. The central nervous system and brain require adequate nutrient supply. This study aimed to investigate the correlation between nutritional status, macronutrient intake, and depression symptoms among medical students at Halu Oleo University, Class of 2022. This study used an analytical observational method with a cross-sectional approach conducted at the Faculty of Medicine, Halu Oleo University. A total of 126 participants were included using the total sampling technique. The dependent variable was depression symptoms, measured using the Beck Depression Inventory-II (BDI-II), while the independent variables were nutritional status and macronutrient intake. The SQ-FFQ questionnaire was used to assess macronutrient intake, and anthropometric data were collected to evaluate nutritional status. Data were analyzed using The Rank Spearman correlation test. Among the 126 participants, the findings revealed that 68.3% had minimal depression symptoms, 11.1% had mild symptoms, 15.9% had moderate symptoms, and 4.8% had severe symptoms. The statistical analysis showed a significant correlation ($p < 0.05$) between carbohydrate intake ($p= 0.027$, $r = 0.197$) and depression symptoms, showing a weak positive relationship. However, no significant correlations were found between nutritional status, protein intake, and fat intake with depression symptoms. The study revealed a correlation between carbohydrate intake and depression symptoms among medical students. These findings suggest the importance of considering the role of macronutrient intake, specifically carbohydrates, in relation to depression symptoms among medical students. Further research is recommended to explore other potential factors influencing the relationship between nutrition and mental health.

Keywords: Depression Symptoms, Nutritional Status, Macronutrient Intake, Medical Students.

1   Introduction

Students are individuals who are enrolled in higher education and actively participating in the study. Nutritional status will be affected by every physical change, which includes an increase in height and weight [1]. The nutritional status of an individual is determined by the extent of their physical need for energy and nutrients from food. [4] define nutritional status as the balance between the intake and requirements of nutrients by the body for biological processes. According to the findings of the 2018 Basic Health Research (Riskesdas), the percentage of individuals aged 18 years and above in Indonesia with varying nutritional statuses, as determined by Body Mass Index (BMI), is: 9.3% are classified as undernourished or underweight, 13.6% are classified as overweight, and 21.8% are classified as obese [3]. A preliminary investigation was carried out at the Faculty of Medicine, Halu Oleo University, focusing on students enrolled in the medical study program for Batch 2022. The study revealed that 29 individuals (23%) showed signs of undernutrition, while 66 individuals (52.4%) demonstrated appropriate nutritional status. Additionally, 31 individuals (24.6%) had indicators of overnutrition. The prevailing proportion of students enrolled in the medical study program for the Batch of 2022 have a normal nutritional status. Nevertheless, there are individuals who continue to experience challenges related to their nutritional status, regardless of whether it is characterized by an excess or deficiency of nutrients.

One method for assessing nutritional status involves the utilization of the Body Mass Index (BMI), which entails the computation of body weight in kilograms (kg) divided by the square of height in meters (m2). [4] identified many classifications of body mass index (BMI), including underweight, normal weight, overweight, and obesity. During the early stages of adulthood, individuals may encounter a range of potential challenges that might adversely affect their mental well-being, such as heightened levels of stress and increased vulnerability to food insecurity [5]. Macronutrients (carbohydrates, proteins, and lipids) are essential nutrients that are required in significant amounts to facilitate cellular growth and facilitate the conversion of metabolic byproducts into energy, so enabling the execution of many physiological functions. Carbohydrates have the potential to stimulate the synthesis of serotonin and tryptophan, hence potentially enhancing the experience of positive emotions. Proteins consist of amino acids that contribute to the synthesis of mood-regulating neurotransmitters such as dopamine and serotonin. A deficiency in omega-3 fatty acids, often known as fat, has been found to potentially disrupt the normal functioning of nerves [6].

Depression has distinct characteristics that distinguish it from typical fluctuations in mood and emotional reactions experienced in daily life. During a depressive episode, individuals experience a depressed mood that is marked by feelings of sadness, irritability, and a diminished capacity for experiencing pleasure or interest in activities, lasting for a minimum duration of two weeks. According to the World Health Organization [7]. First-year students constitute a demographic that is susceptible to experiencing stress as a result of the various life adjustments associated with transitioning into a university setting. [8] Depression has been observed to induce a reduction in appetite, so potentially impeding the assimilation of essential nutrients

inside the body, particularly in terms of energy consumption [9]. The researchers aimed to investigate the potential relationship between nutritional status, macronutrient intake, and depression symptoms among students enrolled in the Faculty of Medicine at Halu Oleo University, specifically those in the class of 2022.

2   Materials and Methods

The present study incorporates observational analytic research with a cross-sectional design. The study was conducted throughout the months of April and May in the year 2023 at the Faculty of Medicine, Halu Oleo University. The sampling methodology employed in this study was the use of a complete sampling strategy, whereby all individuals who met the predetermined inclusion and exclusion criteria were included in the sample. The total sample size consisted of 126 participants.

Depressive symptoms were assessed by the utilization of the BDI-II instrument, while data pertaining to macronutrient consumption was obtained through the SQ-FFQ questionnaire. Additionally, anthropometric data were gathered in order to evaluate the nutritional status of the participants. The data underwent analysis utilizing the Rank Spearman test. The present study has obtained ethical clearance from the Health Research Ethics Commission, Faculty of Medicine, Halu Oleo University, with the reference number 012/UN29.17.1.3/ETIK/2023.

3   Results

The characteristics of the respondents, including age, gender, and place of residence, can be seen through from Table 1. In terms of age distribution, the survey results indicate that the largest proportion of respondents, comprising 45.2%, fell within the 18-year-old category. This was closely followed by respondents aged 19, accounting for 43.7% of the total sample size. A smaller percentage of respondents, specifically 7.1%, were aged 20, while those aged 17 constituted the smallest proportion, with 4% of the respondents falling within this age group.

Table 1. Characteristics of subjects (n=126).

Characteristics	n	%
Age (yrs)		
17	5	4.0
18	57	45.2
19	55	43.7
20	9	7.1
Gender		
Men	39	31
Women	87	69
Residential Location		
With Parents	72	57.1

Boarding House	54	42.9

(Source: Primary Data, 2023)

In terms of gender, the survey yielded a higher number of female respondents compared to male respondents. Specifically, there were 87 female respondents, accounting for 69% of the total, whereas male respondents constituted 39 individuals, or 31% of the sample. Furthermore, considering the attributes of the residential location, it is seen that the biggest proportion of respondents, including 72 individuals (57.1%), remain in their parents' household. Subsequently, the second highest percentage is represented by respondents residing in rented or boarding houses, with a total of 54 individuals (57.1%).

Based on Table 2, the results show that the nutritional status of the most respondents was in normal nutritional status as many as 66 respondents (52.4%) and the least was in underweight status as many as 29 respondents (23%).

Table 2. Subject's Characteristics Based on Nutritional Status.

Characteristics	Jumlah (n)	Persentase (%)
Nutritional Status		
Underweight	29	23
Normal	66	52.4
Overweight	31	24.6

(Source: Secondary Data, 2023)

According to the data presented in Table 3, a total of 126 participants were examined. The analysis revealed that a significant proportion of these individuals had sufficient carbohydrate intake, falling within the range of 80-110% of the recommended daily allowance (RDA). Specifically, 77 respondents, constituting 20.6% of the sample, exhibited this level of carbohydrate consumption. In terms of protein consumption, a significant proportion of participants demonstrated adequate protein intake, specifically 76 individuals (60.3%). Regarding fat consumption, a significant proportion of participants demonstrated adequate fat intake, specifically 66 individuals (52.4%).

Table 3. Distribution of Subjects Based on Macronutrients Intake According to RDA.

Categories	n	%
Carbohydrate, gr/day		
Inadequate	26	20.6
Adequate	77	61.1
Excess	23	18.3
Protein, gr/day		
Inadequate	5	4
Adequate	76	60.3
Excess	45	35.7
Fat, gr/day		
Inadequate	25	19.8

Adequate	66	52.4
Excess	35	27.8

(Source: Primary Data, 2023)

According to Table 4, the distribution of respondents' characteristics is presented based on their depressive symptoms. The findings indicate that 86 respondents (68.3%) exhibited depressive symptoms, 14 respondents (11.1%) reported mild depressive symptoms, 20 respondents (15.9%) experienced moderate depressive symptoms, and 6 respondents (4.8%) displayed symptoms of major depression. The evaluation of depressed symptoms in research participants was conducted by the utilization of the Beck Depression Inventory II (BDI-II) questionnaire.

Table 4. Distribution of Subjects Based on Depressive Symptoms.

Classification	n	%
Mild	86	68.3
Moderate	14	11.1
Moderately Severe	20	15.9
Major (Severe)	6	4.8

(Source: Primary Data, 2023)

According to the findings presented in Table 5, the Spearman Rank correlation test was conducted to assess the relationship between nutritional status and the derived p value was determined to be 0.257. If the calculated p-value is greater than 0.05, the null hypothesis (H0) is accepted. Based on the findings, it can be inferred that there is no significant positive correlation between nutritional status and depression symptoms among students enrolled in the Faculty of Medicine at Halu Oleo University, namely those belonging to the class of 2022.

Table 5. Correlation of Nutritional Status to Depressive Symptoms in Medical Faculty Students Class of 2022.

Nutritional Status	Depressive Symptoms										Sig. (p)	Correlation (r)
	Mild		Moderate		Moderately Severe		Major (Severe)		Total			
	n	%	n	%	n	%	n	%	n	%		
Underweight	21	16.7	4	3.2	4	3.2	0	0	29	23		
Normal	45	35.7	9	7.1	10	15.2	2	1.6	66	52.4	0.257*	0.102
Overweight	20	15.9	1	0.8	6	4.8	4	3.2	31	24.6		
Total	86	68.3	14	11.1	20	15.9	6	4.8	126	100		

*Rank Spearman Test

Based on the data from Table 6, the Spearman Rank correlation test was conducted to assess the relationship between carbohydrate intake and the acquired results yielded a p-value of 0.027, indicating statistical significance. The correlation coefficient, r, was calculated to be 0.197, suggesting a weak positive association between carbohydrate intake and the variable under consideration. If the calculated p-value is less than 0.05, the alternative hypothesis (Ha) is deemed to be accepted. Based on the findings, it can be inferred that there exists a positive association between the consumption of carbohydrates as a macronutrient and the manifestation of depressive symptoms among students enrolled in the Faculty of Medicine at Halu Oleo University, namely those belonging to the class of 2022. The correlation coefficient, denoted as r = 0.197, suggests that the strength of the association is characterized as very weak.

Table 6. Correlation of Macronutrients Intake to Depressive Symptoms in Medical Faculty Students Class of 2022.

Macronutrients Intake	Depressive Symptoms								Sig. (p)	Correlation (r)
	Mild		Moderate		Moderately Severe		Major (Severe)			
	n	%	n	%	n	%	n	%		
Carbohydrate, gr/day									0.027*	0.197
Inadequate	21	16.7	2	1.6	3	2.4	0	0		
Adequate	52	41.3	11	8.7	12	9.5	2	1.6		
Excess	13	10.3	1	0.8	5	4	4	3.2		
Protein									0.772*	-0.026
Inadequate	3	2.4	0	0	2	1.6	0	0		
Adequate	51	40.5	11	8.7	12	9.5	2	1.6		
Excess	32	25.4	3	2.4	6	4.8	4	3.2		
Fat									0.377*	0.079
Inadequate	18	14.3	3	2.4	4	3.2	0	0		
Adequate	45	35.7	9	7.1	10	7.9	2	1.6		
Excess	23	18.3	2	1.6	6	4.8	4	3.2		

According to the data shown in Table 6, the Rank Spearman correlation test was conducted to examine the relationship between protein intake and the resulting p value

was 0.772. If the calculated p-value is greater than 0.05, the null hypothesis (H0) is accepted. Based on the findings, it can be inferred that there is no significant negative association between protein consumption, a macronutrient, and the manifestation of depression symptoms among students enrolled in the Faculty of Medicine at the University of Halu Oleo, specifically those belonging to the class of 2022.

According to the data presented in Table 6, the Spearman Rank correlation test was conducted to examine the relationship between fat intake and the derived p-value was found to be 0.377. If the calculated p-value is greater than 0.05, the null hypothesis (H0) is accepted. Based on the findings, it can be inferred that there is no significant negative association between the consumption of macronutrient fat and the manifestation of depressive symptoms among students enrolled in the Faculty of Medicine at the University of Halu Oleo, specifically those belonging to the class of 2022.

4   Discussion

4.1   Nutritional Status and Depressive Symptoms

This study did not show significant positive correlation between nutritional status and depressive symptoms. This is due to the fact that the majority of respondents with mild, moderate, or severe depressive symptoms have a healthy nutritional status. The symptoms of depression are influenced by a number of variables, including exposure to stress. If it persists untreated, it can play a significant role in the development of depressive symptoms [10]. The results of this study are consistent with other research conducted by [11], which indicates that psychological/social factors rather than biological factors such as cortisol explain the relationship between body mass index and depression. Depression symptoms cannot be determined solely by an individual's nutritional status. Among the many factors that influence depressive symptoms is nutritional intake. Nutritional status is also affected by nutritional intake, but it cannot be said that nutritional status influences depressive symptoms. A higher prevalence of depressive symptoms was observed among obese individuals. Due to the excessive production of proinflammatory substances by adipose tissue, obesity can cause changes in the HPA axis (hypothalamus-pituitary gland-adrenal cortex), which can increase glucocorticoid levels and alter the serotonin reuptake system [12].

4.2   Macronutrients Intake and Symptoms of Depression

The findings of this study demonstrated a significant positive association between the consumption of macronutrient carbs and depressed symptoms. The correlation coefficient suggested a minimal strength between these variables. There exists a positive correlation between the level of carbohydrate consumption and the probability of encountering symptoms associated with depression. Carbohydrates can be classified into two main categories: complex and simple carbohydrates. Complex carbohydrates are derived from sources such as dietary fiber, starch, whole grains, vegetables, and fruits. Complex carbohydrates, such as fiber, possess beneficial properties for the

human body due to their ability to function as prebiotics, nourishing the microbiota residing in the gastrointestinal tract. Prior research has demonstrated that prebiotics has the ability to influence the composition of the gut microbiota, hence playing a role in the maintenance of human health. Prior studies have demonstrated a correlation between disharmony and disturbance within the gut microbiota and several diseases, including depression, Alzheimer's disease (AD), autism, and other cognitive problems [13]. Based on the findings derived from the SQ-FFQ interviews, a significant proportion of the participants reported obtaining their intake of complex carbs through the consumption of various food items such as white rice, quick noodles, yellow rice, carrots, apples, and avocados. Simple carbohydrate intake is obtained from the consumption of sugar, sweet foods and drinks such as boxed tea, soda, milk, coffee, better, beng-beng and oreo.

There exists a positive correlation between increased sugar consumption and an elevated incidence of depression. Multiple biological reasons exist for the association between chronic sugar consumption and the heightened susceptibility to depression over an extended period. Initially, a reduction in brain-derived neurotrophic factor (BDNF) is observed, which is linked to both neurogenesis and the development of depression. Additionally, the consumption of carbohydrates has been linked to elevated levels of circulating inflammatory indicators, which have the potential to negatively impact mood. Furthermore, it should be noted that the consumption of a diet high in sugar has the potential to elicit hypoglycemia by triggering an excessive release of insulin, thereby impacting hormone levels and mood states. Furthermore, the addictive properties of sugar imply that there may be a connection between regular sugar consumption and depression through the involvement of dopaminergic neuronal transmission mechanisms, according to the study conducted by [14]. Based on a study conducted by [15], there exists a correlation between carbohydrate consumption and the manifestation of depression symptoms. Previous research has indicated that the modulation of simple carbs and sugars consumption has a beneficial impact on psychological well-being and mood.

The study conducted by [16] provided evidence of the detrimental impact of sugar consumption derived from sugary foods and beverages on individuals' long-term psychological well-being. Furthermore, the study proposed that reducing sugar intake could potentially be linked to improved psychological health. On the other hand, a higher consumption of carbohydrates has been found to have a mitigating effect on symptoms associated with depression. According to [16], the consumption of complex carbohydrates, including whole grains, vegetables, and fruits, has been found to elevate serotonin levels, hence inducing a state of calmness in individuals. Additional studies have indicated that an inadequate consumption of dietary fiber may contribute to an increased susceptibility to symptoms associated with depression. The impact of dietary fiber on the composition of the gastrointestinal microbiota has been well-documented. The potential benefits of this phenomenon include the promotion of a healthy gut microbiome through the consumption of fiber-rich foods, as well as the modulation of neurotransmitter levels to alleviate symptoms of depression [17].

The present investigation did not find a statistically significant inverse relationship between protein consumption and symptoms of depression. This phenomenon can be

attributed to the fact that a significant proportion of the research participants exhibit only mild depressive symptoms, along with a protein intake rate that above that of AKG. This observation implies that students have successfully fulfilled their daily protein needs as per the AKG guidelines. According to the source cited [18], it may be inferred that the information provided is from a scholarly publication. While it is true that consuming a diet high in protein can elevate the levels of tryptophan in the bloodstream, it is important to note that other amino acids present in the nervous system may engage in a competitive process with tryptophan for absorption into the brain. In the year 2020, there were several noteworthy events. According to the findings derived from the SQ-FFQ interview, it was observed that the protein sources commonly ingested by students included chicken, beef, fish, and chicken. Consuming a diverse range of foods helps mitigate the likelihood of an individual experiencing deficiencies in specific essential nutrients. According to the Ministry of Health in Indonesia [19].

4.3   Fat intake and symptoms with depression

This study did not find a statistically significant negative connection between fat intake and symptoms of depression. This phenomenon can be attributed to the fact that a significant proportion of research participants exhibit only mild depressive symptoms, along with a sufficiently high rate of fat consumption that surpasses that of the recommended Adequate consumption (AI) for alpha-ketoglutarate (AKG). Consequently, it can be inferred that students are fulfilling their daily fat requirements in accordance with the AI established for AKG. The fat sources that were most frequently ingested by the participants included coconut oil, chicken, and high-fat items such as bacon and fried bananas. One example of a type of food that has the potential to increase adipose tissue accumulation is bacon. According to the results obtained from the SQ-FFQ survey, a majority of the participants reported consuming turmeric on a weekly basis. The findings of this investigation align with the research conducted by [20], which demonstrates a notable reversal in the association between low or moderate polyunsaturated fatty acid (PUFA) consumption and depressive symptoms. Both depression and anxiety have been found to have a positive correlation with the production of pro-inflammatory cytokines. The potential antidepressant effects of omega-3 polyunsaturated fatty acids (PUFAs) may be associated with their capacity to inhibit inflammatory reactions [21].

5   Conclusion

The findings suggested no significant association between the nutritional status of college students and the presence of depressive symptoms. There was no observed correlation between protein and fat intake and depressed symptoms among college students, however a correlation was found between carbohydrate intake and depressive symptoms in this population. The present study aims to enhance the existing research by employing an alternative research strategy and gathering more precise data pertaining to the investigation. This will enable a more comprehensive evaluation of

the association between nutritional status, macronutrient intake, and depressive symptoms.

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