*Available online: http://journal.ipb.ac.id/index.php/jgizipangan* ***J. Gizi Pangan, January 2024, 19(Supp.1):63-68***
*Accredited based on DGHE, Republic of Indonesia No. 28/E/KPT/2019*
*ISSN 1978-1059 EISSN 2407-0920*

# The Relationship between Folic Acid Intake and Depression among College Students

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## ABSTRACT

The aim of this study was to investigate the relationship between folic acid intake and the incidence of depression among students of Universitas Muhammadiyah Surakarta, department of Nutrition. This cross-sectional study recruited 40 participants following the inclusion criteria. Sample collection was done by random sampling. Data collection on the adequacy of folic acid intake was carried out using the non-consecutive three days 24 four Food recall. The prevalence of depression was obtained by measuring the level of depression in the last two weeks using the Beck Depression Inventory-II (BDI-II) questionnaire. The results showed that 2.5% of the subjects had sufficient folic acid intake and 97.5% had insufficient folic acid intake with mean 78,5 mcg. About 47.5% of subjects experienced minimal depression, 20% experienced mild depression, 25% experienced moderate depression, and 7.5% experienced major depression with mean score 13.4. Futher analysis, the p-value (p=0.145) indicated that there was no significant relationship between folic acid and depression status. Recommended for using the Semi-Quantitative Food Frequency Questionnaire (SQ-FFQ) to see acid intake folate and pay attention to other factors that cause depression.

**Keywords**: depression, folic acid

## INTRODUCTION

The college period is a challenging time for students because of the amount of responsibility and busyness such as the demands of completing various kinds of assignments, and programs, and preparing a thesis to end their studies as a condition for obtaining a bachelor's degree (Monk FJ *et al.* 2002). These demands and responsibilities often become a pressure for students and cause psychological problems that often occur such as stress, anxiety, and depression (Sutjiato 2015). In Indonesia, more than 19 million people aged over 15 years experience emotional mental disorders, and more than 12 million people experience depression (MoH RI 2018).

Depression can occur due to a neurochemical imbalance in the part of the brain that is responsible for regulating mood, anxiety, and fear. Folic acid is a nutrient that plays an important role in various methylation reactions in the body such as the synthesis and methylation of brain neurotransmitters (Bjelland *et al.* 2003). Folic acid also plays a role in reducing the risk of neurological disorders such as dementia, decreased cognitive function, and depression by suppressing homocysteine levels in the blood which, if increased, can cause hyperhomocysteinemia (Zhao *et al.* 2013).

Folate is consumed in the form of Dihydrofolate (DHF) which will then be converted to Tetrahydrofolate (THF). THF is then converted to 5,10 methylteterahydrofolate (5, 10-MTHF) which is a substrate for the formation of 5-methyltetrahydrofolate (5-mthf) which functions as a methyl group donor in various methylation reactions including in the brain (Sharp & Little 2004; Tan *et al.* 1977). The 5-MTHF compound provides a methyl group for the homocysteine remethylation process to become a methionine compound which acts as a substrate in the formation of S-adenosylmethionine (SAM). Sam acts as a methyl donor in the methylation reactions of DNA, RNA, various neurotransmitters, and phospholipids in the central nervous system and histones. Therefore, folic acid deficiency will cause depression because it will inhibit the synthesis of neurotransmitters and inhibit

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*(Received 24-07-2023; Revised 22-09-2023; Accepted 01-12-2023; Published 31-01-2024)*

methylation processes in the brain such as dopamine, serotonin, and norepinephrine (Kevere *et al.* 2012).

Several studies investigating the relationship between nutrition and depression have been conducted, such as Rethorst (2014) in a study in the Journal of Clinical Psychiatry which found that for the brain to work properly, it is necessary to have an adequate amount of folic acid needed by the brain (Rethorst *et al.* 2014). However, limited studies were conducted in Indonesia regarding the relationship between intake of nutrients and folic acid with depression has not been widely carried out.

Based on a preliminary survey conducted on 20 Nutrition students at the Universitas Muhammadiyah Surakarta, it was shown that out of 20 students, 75% experienced depression, with details of 40% experiencing mild depression, 25% experiencing moderate depression, and 10% experiencing severe depression. In addition, all students have less folic acid intake. Therefore, this paper is aimed to investigate the relationship between folic acid levels and depression among nutritional science students at Universitas Muhammadiyah Surakarta.

## METHODS

### Design, location, and time

This study is an analytical observational study explaining the relationship between folic acid intake and the level of depression among nutrition students of the Universitas Muhammadiyah Surakarta. The design of this study uses a cross-sectional design that observes variables at the same time. The research was conducted in July 2023 and data collection was carried out at Muhammadiyah Surakarta Nutrition Study Program. The research code of ethics was obtained from the Health Research Ethics Commission, Faculty of Medicine, Universitas Muhammadiyah Surakarta with the ethical eligibility letter number 4929/B.1/KEPK-FKUMS/VII/2023.

### Sampling

The population in this study were all 136 students of the Nutrition Study Program, Muhammadiyah University of Surakarta. The minimum sample size is determined using the Lemeshow formula and a sample size of 40 students was obtained. Sampling was done using a random sampling technique where everyone in the population has the same opportunity to be selected as a research subject. Sample selection was carried out randomly based on students who did not have a class schedule at the time of data collection.

### Data collection

Folic acid intake was obtained using the Food Recall-24 hours form for 3 days nonconsecutive days to describe the eating habits of representative individuals (Gibson 2005). Individual food consumption amounts were obtained using a household measurement tool with a food photo book. The total intake of folic acid in three days was then averaged and compared with the Estimated Average Requirement (EAR) which was converted from the Nutritional Adequacy Figures 2019. EAR value is 320 mcg/day and then categorized into two categories, namely the adequate and inadequate category. Adequate category if the intake is more than or equal with 320 mcg/day and inadequate category if intake is less than 320 mcg/day.

Depression levels were obtained using the Beck Depression Inventory-II (BDI-II) questionnaire within the last two weeks of the Indonesian version which was tested for validity and reliability by Ginting *et al.* (2013) in the Indonesian population. The results of the validity test showed that the Indonesian version of BDI-II showed a significant positive correlation with two parallel measures, namely DS14 ($r=0.52$, $p<0.01$) and with BAI ($r=0.52$, $p<0.01$ ) and significantly negatively correlated with two opposite measures, namely MSPSS ($r=-0.39$, $p<0.01$) and LOT-R ($r=-0.46$, $p<0.01$). The results of the reliability test showed that the Indonesian version of the 21 BDI-II question items had a Cronbach Alpha of 0.90 so they had sufficient to high consistency.

The BDI-II questionnaire is scored from 0–3 on a Likert scale for each question answer. The answer that best fits the indicators or criteria for depression will have the highest score (score 0 for answer choice A, score 1 for answer choice B, score 2 for answer choice C, and score 3 for answer choice D). The score of each respondent is then summed up and ranked based on the total BDI-II score (Beck *et al.* 1967). The scores from each question are then added up and categorized with a score of 0–16 for minimal depression,

score 17–19 for mild depression, score 20–28 for moderate depression, and score 29–63 for severe depression.

**Data analysis**

***Univariate analysis.*** Univariate analysis was performed to analyze each variable. The analysis is descriptive and presented in the form of percentages and frequencies. The data was analyzed and the distribution displayed was data on gender, age, place of residence, folic acid intake and level of depression. Data were analyzed using several software such as Nutrisurvey to analyze recall data and SPSS to analyze all data.

***Bivariate analysis.*** Bivariate analysis was carried out to examine the relationship between the independent variable and the dependent variable, namely between folic acid intake and the level of student depression. Before carrying out bivariate analysis, the data normality was tested using the Kolmogrov-Smirnov test. Since the data are normally distributed the correlation test is used to study the relationship between the independent and dependent variables**.**

## RESULTS AND DISCUSSION

The research results consist of the results of bivariate and univariate analysis. Univariate analysis includes data on participants characteristics such as gender, age, place of residence, intake of folic acid, and level of depression. Bivariate analysis included the relationship between folic acid intake and the respondent's level of depression.

The general characteristics of participants in this study are presented in Table 1. Based on Table 1, it can be seen that of the 40 participants 95% of them were female and the rest were male. Majority of participants in this study were female 95%, n=38. There are several studies that state that gender also affects mental health in general, where depressed women are more likely to experience social isolation and withdraw (Otten *et al.* 2021).

Meanwhile, the age of most students was 21 years old with a total of 29 students (72.5%) and most participants resided in boarding houses with a total of 29 participants (72.5%). Data on the characteristics of the participants shows that the age range of the participants was 20–22 years old with the majority of participants aged 21 years (72.5%). This age is classified as young adulthood and a transitional period from adolescence (Terlizzi & Villarroel 2020). This is in line with other research which states that this age is the ideal age range for studying as a student so that they are very vulnerable to experiencing depression (Matsari & Ediati 2020).

Table 1. Characteristics of participants (n=40)

| Variable | n | % |
|---|---|---|
| Gender | | |
| Male | 2 | 5 |
| Female | 38 | 95 |
| Age | | |
| 20 | 5 | 12.5 |
| 21 | 29 | 72.5 |
| 22 | 6 | 15 |
| Place of residence | | |
| Boarding house | 29 | 72.5 |
| Home | 11 | 27.5 |
| Total | 40 | 100 |

The distribution of participants based on the level of depression is presented in Figure 1. Based on Figure 1, was shown that 47.5% of the participants were in the category of minimal or no depression, 25% experienced moderate depression, 20% experienced mild depression, and 7.5% experienced severe depression.

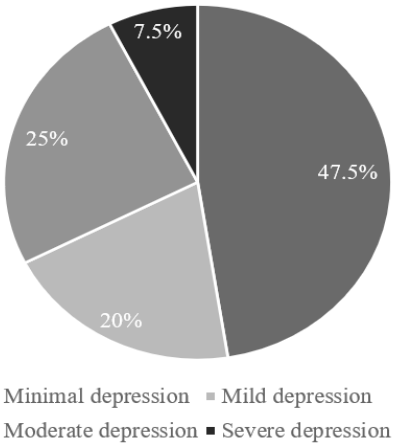


Figure 1. Distribution of participants based on level of depression

Meanwhile, the distribution of participants based on folic acid intake is presented in Figure 2. Based on Figure 2, it can be seen that out of 40 participants only 2.5% had adequate folic acid intake, and the remaining 97.5% had inadequate folic acid intake.

Depression is a impaired mental condition characterized by bad moods, feelings of guilt, loss of interest in everything, decreased concentration, loss of energy, hunger strikes, and sleep problems (WHO 2017). Based on the Pearson correlation test results in Table 2, it was concluded that there was no significant relationship between folic acid intake and depression in nutrition students of the Universitas Muhammadiyah Surakarta (p=0.145). These results indicate that folic acid intake is not a direct factor that influences the depression level of Nutrition Science students at the Universitas Muhammadiyah Surakarta.

Participants' folic acid intake tended to be inadequate (<320 mcg/day based on EAR). Lack of folic acid intake can be caused by a lack of awareness of the importance of meeting folic acid intake for health. In addition, most of the participants live in boarding houses and are far from their parents, so their eating patterns become less regular because the participants are focused on other things, such as obligations to do college assignments and demands to live independently.

Depression can be caused by other factors such as psychosocial conditions (Lidya *et al.* 2021), social support (Nurfatimah & Entoh 2017), and workload (Setiawati & Ismahmudi 2020). Therefore, when investigating the relationship between folic acid intake and depression levels, it is necessary to pay attention to other factors such as cognitive function and other psychosocial conditions. Based on the BDI-II questionnaire, it was found that the majority of participants experienced depression because of the many tasks and obligations that had to be completed simultaneously. Apart from that, some of the participants felt they had failed and were disappointed in their lives, which caused them to feel guilty and continue to grieve within themselves.

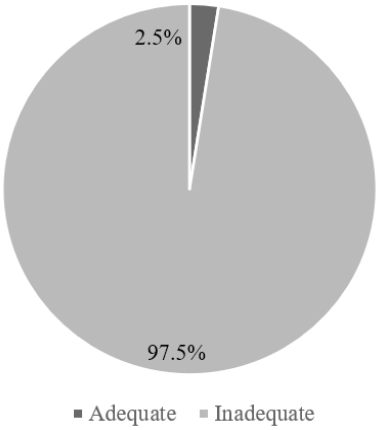


Figure 2. Distribution of participants based on folic acid intake

Another factor that can cause depression in students is physical condition. The tight lecture schedule and the large amount of subject matter that needs to be understood often reduces the time and quality of student rest. The quality of student sleep can influence levels of stress, anxiety and depression (Aryadi *et al.* 2018).

Symptoms of depression experienced by students consist of physical symptoms in the form of irregular sleeping, irregular eating, headaches,

Table 2. Distribution of participants' levels of ldepression based on folic acid intake

| Level of depression | Folic acid intake | | | | | | *p* |
|---|---|---|---|---|---|---|---|
| | Adequate | | Inadequate | | | | |
| | n | % | n | % | n | % | |
| Minimal depression | 1 | 2.5 | 18 | 45 | 19 | 47.5 | 0.145 |
| Mild depression | 0 | 0.0 | 8 | 20 | 8 | 20 | |
| Moderate depression | 0 | 0.0 | 10 | 25 | 10 | 25 | |
| Severe depression | 0 | 0.0 | 3 | 7.5 | 3 | 7.5 | |
| Total | 1 | 2.5 | 39 | 97.5 | 40 | 100 | |

swollen eyes, aches, and fatigue, emotional symptoms, namely anxiety that gradually lasts a long time, is depressed, and irritability, symptoms of cognitive consists of loss of concentration, daydreaming, mind jumping and unable to focus, interpersonal symptoms arise in the form of not contributing to the surrounding environment, friends and family (Giyarto & Uyun 2018).

## CONCLUSION

It can be concluded that there is no significant relationship between folic acid intake and level of depression as indicated by p=0.145>0.05. Therefore, it is hoped that future studies will be able to look further at the relationship between folic acid intake and student depression levels by taking into account other factors such as cognitive factors, psychosocial conditions, place of residence, and workload.

## ACKNOWLEDGEMENT

This research can be successfully pursued with support from various sources. Therefore, the researcher would like to thank to Nutrition Science Study Program Universitas Muhammadiyah Surakarta for providing support and research grants in this research.

## DECLARATION OF CONFLICT OF INTERESTS

The authors have no conflict of interest.

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