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Association of antidepressant food scores, anemia, and physical activity with adolescent depression

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ABSTRAK

Latar Belakang: *Satu dari tiga remaja di Indonesia memiliki masalah kesehatan mental, sementara di sisi lain permasalahan anemia pada remaja putri belum teratasi. Beberapa literatur menyatakan bahwa pola makan dan aktivitas fisik dapat menjadi strategi untuk mencegah depresi.*
Tujuan: *Untuk menganalisis hubungan antidepressant food scores, status anemia, dan aktivitas fisik dengan kejadian depresi pada remaja.*
Metode: *Penelitian kuantitatif ini menggunakan desain analitik cross-sectional yang melibatkan 173 siswa perempuan. Pemilihan subyek penelitian menggunakan teknik purposive random sampling yang dipilih dengan kriteria inklusi siswi berusia 15 - 18 tahun, berdomisili di Kabupaten Bekasi, bersedia diambil darahnya. Kriteria eksklusi siswi yang sedang melakukan diet dan tidak mengonsumsi obat antidepresan. Konsumsi makanan antidepresan diukur menggunakan Semi Quantitative-Food Frequency Questionnaire (SQ-FFQ), anemia diukur dengan alat Quick Check HB, aktivitas fisik diukur dengan kuesioner International Physical Activity (IPAQ-SF) dan tingkat depresi diukur dengan kuesioner Depression Anxiety Stress Scale (DASS 42). Analisis data menggunakan uji chi-square dan regresi logistik.*
Hasil: *Remaja dengan pola konsumsi antidepresan food rendah sebesar 70.05%. Remaja dengan anemia ditemukan 32.2%. Remaja dengan aktivitas fisik rendah ditemukan 66.5%. Remaja depresi ditemukan 45.3%. Hasil uji bivariat menunjukkan ada hubungan antara pola makan antidepresan dan status anemia pada remaja putri ($p<0.05$). Remaja putri anemia memiliki resiko mengalami depresi 0,939 kali lebih besar dari pada remaja putri yang tidak mengalami anemia (OR = 0.939; CI = 0.794-1.107). Remaja putri yang memiliki pola konsumsi makanan antidepresan rendah beresiko mengalami depresi 1,862 kali lebih besar dari pada remaja putri yang memiliki pola konsumsi makanan antidepresan tinggi (OR = 1.862; CI=0.700 – 4.952.). Tidak ada hubungan antara tingkat aktivitas fisik dengan kejadian depresi pada remaja putri ($p>0.05$).*
Kesimpulan: *Antidepressant Food Score dan status anemia dapat dikaitkan dengan kejadian depresi pada remaja. Aktivitas fisik dalam penelitian ini tidak menunjukkan adanya hubungan yang signifikan dengan kejadian depresi pada remaja.*

KATA KUNCI*: aktivitas fisik; anemia; antidepressant food scores; depresi, pola makan*

ABSTRACT

Background: *One in three adolescents in Indonesia faces mental health issues, meanwhile, the problem of anemia among adolescent girls remains unresolved. Several literatures suggest that dietary patterns and physical activity may serve as strategies to prevent depression.*

Objectives: *To examine the relationship between antidepressant food scores, anemia status, and physical activity with the incidence of depression among adolescents.*

Methods: *This quantitative study employed a cross-sectional analytical design involving 173 female students. The research subjects were selected using a purposive random sampling technique, with inclusion criteria of female students aged 15-17 years, residing in Bekasi Regency, and willing to provide blood samples. The exclusion criteria included students who were on a diet and those not consuming antidepressant medications. Antidepressant food consumption was measured using the Semi Quantitative-Food Frequency Questionnaire (SQ-FFQ), anemia was assessed with the Quick Check HB device, physical activity was measured using the Physical Activity Questionnaire (IPAQ-SF), and depression levels were measured using the Depression Anxiety Stress Scale (DASS 42) questionnaire. Data analysis was conducted using chi-square and logistic regression tests.*

Results: *Adolescents with low antidepressant food consumption were 70,05%. Adolescents with anemia were found to be 31.2%. Adolescents with low physical activity were found to be 66.5%. Depressed adolescents were found to be 45.3%. The results of the bivariate test showed there is a relationship between antidepressant dietary patterns and anemia status with the incidence of depression among adolescents ($p<0.05$). Anemic adolescent girls have a 0.939 times higher risk of experiencing depression compared to non-anemic adolescent girls (OR =0.939; CI = 0.794 - 1.107). Adolescent girls with low antidepressant food consumption patterns are 1.862 times more likely to experience depression than those with high antidepressant food consumption patterns (OR = 1.862; CI = 0.700 - 4.952). No significant relationship was found between physical activity and the incidence of depression among adolescents ($p>0.05$).*

Conclusions: *Antidepressant Food Score and anemia status can be associated with the incidence of depression among adolescents. Physical activity in this study did not show a significant relationship with the incidence of depression among adolescents.*

KEYWORD*: anemia; antidepressant food scores; depression; dietary patterns physical activity*

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INTRODUCTION

Depression is a significant health issue within society. It is a mental disorder that affects an individual's feelings, thoughts, and behaviors. The World Health Organization (WHO) states that over 300 million people suffer from severe depressive disorders (1). Major depressive disorder is characterized by loss of interest or pleasure in almost all activities, depressed mood, and/or irritability. All of these feelings are also associated with physical symptoms such as fatigue, sleep disorder, and concentration disorder (2). Depression, if left untreated, can become chronic and cause substantial impairment in an individual's ability to perform daily activities (3).

One of the age groups vulnerable to depression is adolescents. Adolescence is a phase during which emotional, cognitive, physical, and psychological maturity, representing a transition from childhood to adulthood. During this phase, numerous pressures, demands, and issues emerge, leading to feelings of depression (4). According to the Indonesia-National Adolescent Mental Health Survey (I-NAMHS) conducted in 2022, one in three adolescents (34.9%) or approximately 15.5 million adolescents in Indonesia experience mental health issues (2). Depression can negatively impact the growth and development of adolescents, academic

performance, relationships with family and peers, and, in more severe cases, may lead to suicidal actions (5). Depression is the leading cause of illness and disability in adolescents, while suicide is the third leading cause of death in adolescents (6).

The impact of depression is the basis for many studies in examining various things that can reduce the risk of depression, including diet and physical activity. Several studies have shown that mental health is influenced by food quality (7,8). It is known that certain foods and eating habits influence mental health. There are twelve antidepressant foods associated with the prevention and treatment of depressive disorders, namely folate, iron, fatty acids, long-chain omega-3 (EPA and DHA), magnesium, potassium, selenium, thiamine, vitamin A, vitamin B6, vitamin B12, vitamin C, and zinc (9). Previous studies reported that consumption of anti-depressant foods is related to the level of depression in adolescents, but after conducting a logistic regression test, it did not show a significant effect (10).

Nutrients play a role in the balance of dopamine, serotonin, and norepinephrine which are the most influential neurotransmitters in controlling a person's mood and behavior (11,12). Research conducted on mice showed an increase in serum serotonin and dopamine levels after being given physical exercise intervention compared to the control group, so that physical activity is known as a protective factor for depression (13,14). The synthesis of dopamine and serotonin in the brain is influenced by the enzymes tyrosine hydroxylase and tryptophan hydroxylase which are influenced by the availability of iron as a cofactor (15). This statement raises the suspicion that iron deficiency is related to the level of depression.

Lack of iron in the blood or better known as iron deficiency anemia. Anemia is a condition characterized by lower hemoglobin (Hb) levels in the blood. Anemia is classified according to the WHO definition for anemia, as follows: Hb < 12 g/dL in females and Hb < 13 g/dL in males (16). Research conducted by Hidase et al. indicates a positive relationship between iron deficiency anemia and depression (17). Individuals with anemia are 2.6 times more likely to experience depression compared to those without anemia (18). The study raises the hypothesis that the condition of anemia may increase the incidence of depression. Another study involving anemic women who received iron supplements demonstrated improvements in depression and stress scores compared to anemic women who received a placebo (19).

The studies linking diet, anemia, and depression have so far been mostly conducted on people who follow a Mediterranean diet, people with certain diseases that physiologically cause anemia and depression, while in adolescents, anemia still needs confirmation of the possible relationship between the two. Based on the above background, the researcher is interested in investigating the relationship between antidepressant food scores, the incidence of anemia, and levels of depression among adolescents. The urgency of this research lies in the high prevalence of depression among adolescents and the limited studies in Indonesia regarding food and diet as preventive measures to reduce depression levels.

MATERIALS AND METHODS

This quantitative study employed a cross-sectional analytical design. The research settings were SMA Negeri 1 Tambun Selatan, SMA Negeri 1 Cikarang Pusat, and SMA Negeri 1 Cikarang Utara. The three schools were selected purposively because they are distinguished public schools in Bekasi Regency, based on the 2022 National Computer-based Test (Ujian Tulis Berbasis Komputer/UTBK) scores according to the Higher Education Entrance Test Institute (Lembaga Tes Masuk Perguruan Tinggi/ LTMPT) and hold an A accreditation rating. UTBK is one of the tests used for university entrance selection. Distinguished schools are characterized by a high level of academic competition. The high level of academic competition between top or favorite schools can cause students to easily experience stress which leads to depression (20). According to Zhong et al. (2018), as the level of competition increases, the stress response also intensifies (21).

This study was conducted from August to November 2024. Research subjects were selected using a stratified random sampling

technique. The minimum sample size for this study is 162. The number of samples for each school was determined proportionally from the total number of female students at that school. The inclusion criteria for this research are students aged 15 to 18 years, residing in Bekasi Regency, and willing to provide blood samples. The exclusion criteria for this study include female students who are on a diet and those who are consuming antidepressant medications.

Data collection for this study was conducted by trained enumerators. Data on the consumption patterns of antidepressant foods were obtained using the Semi Quantitative Food Frequency Questionnaire (SQ-FFQ), which is based on the Antidepressant Food Score (AFS) database. The scoring of the AFS was calculated using the following formula: ((total % daily value per Antidepressant Nutrient / 12) / calories per 100 g serving) x 100 (9).

$$AFS = \frac{(\frac{\sum daily\ value\ per\ nutrient\ antidepressant}{12})}{Calories\ per\ 100\ grams\ serving} x\ 100\% [1]$$

Antidepressant food consumption patterns are categorized as low if the score is <75.43 and high if the score is ≥ 75.43. Hemoglobin levels were measured using the Easy Touch GCHB device, Ministry of Health of the Republic of Indonesia, AKL No20101710009. According to research conducted by Laila et al. in 2021, the digital strip device Easy Touch GCHB can be used for blood hemoglobin testing, as the results do not show a significant difference compared to hemoglobin level measurements using the Cyanmethemoglobin method, as recommended by the WHO (22). Data are categorized as anemia if the hemoglobin level is < 12 g/dL. Activity levels were measured using the International Physical Activity Questionnaire (IPAQ-SF), expressed in MET-minutes per week. Light activity is defined as a score of 0-3000, while heavy activity is defined as a score of ≥ 3000. The Depression Anxiety and Stress Scales (DASS-42) were utilized to assess the level of depression among adolescents. The DASS-42 questionnaire consists of 14 questions about stress, 14 questions about anxiety, and 14 questions about depression. Questions about depression are at numbers 3, 5, 10, 13, 16, 17, 21, 24, 26, 31, 34, 37, 38, and 42. Depression is categorized as a score of ≥ 10, while scores of 0-9 indicate no depression.

Data analysis was performed using SPSS. Data normality was tasted using the Saphiro Wilk. The Mann Whitney test was performed to see the difference in consumption at the level of depression. The Chi-square test was performed to see the relationships between independent variables (variables consumption of antidepressant foods, anemia, and physical activity) and dependent variables (incidence of depression). Logistic regression tests were performed for multivariate analysis. This study has received ethical approval from the Health Research Ethics Committee of Universitas Harapan Bangsa, with the approval number B.LPPM-UHB/937/09/2024. Each subject was explained in the research. Research subjects who were willing to be involved in the research were asked to sign an informed consent form.

RESULTS AND DISCUSSIONS

The subjects of this study comprised 173 individuals aged between 15 and 18 years. Based on the assessment of food consumption, it was found that more than half of the respondents (65.3%) had a low level of antidepressant food consumption. The hemoglobin level examination indicated that 31.2% of respondents were in the anemia category. More than half of the respondents exhibited low levels of physical activity. A significant number of respondents were classified as depressed, accounting for 35.3%.

Table 2 shows that 41% of depressed respondents had a low antidepressant diet. Most of the depressed respondents were not anemic (70,49%) and 67,92% had light physical activity. The results of the bivariate analysis above indicate a relationship between antidepressant food consumption patterns and depression levels, with a p-value of 0.000. The variable of anemia status also demonstrated a significant relationship with the depression status variable, with a p-value of 0.000. In contrast, the variable of physical activity level showed no significant relationship with depression status. Most respondents had light physical activity levels in both the depressed and non-depressed groups.

Table 1. Distribution of characteristics respondents

Variabel	n	%
Age (Years)		
15	4	2.30
16	102	59.0
17	61	35.3
18	6	3.50
Antidepressant food consumption		
Low	122	70.5
High	51	29.5
Anemia status		
Anemia	54	31.2
Non Anemia	119	68.8
Physical activity level		
Light	115	66.5
Heavy	58	33.5
Depression level		
Depressed	61	35.3
Not Depressed	112	64.7

The hemoglobin level examination indicated that 31.2% of respondents were in the anemia category. More than half of the respondents exhibited low levels of physical activity. A significant number of respondents were classified as depressed, accounting for 35.3%. **Table 2** shows that 41% of depressed respondents had a low antidepressant diet. Most of the depressed respondents were not anemic (70,49%) and 67,92% had light pshysical activity.

Association between antidepressant food consumption and anemia status with depression

The variables included in the multivariate analysis are independent variables with a p-value ≤ 0.05. Based on the results of the statistical tests, it is evident that antidepressant food consumption patterns and anemia status have a significant effect on depression status, as indicated by a significance value of <0.05 with a negative direction. The odds ratio (OR) for antidepressant food consumption patterns is 1.862, while the OR for anemia status is 0.938. Depression is a public health issue characterized by increased emotional distress, diminished interest, and reduced energy and concentration.

In this study, it was found that 35.3% of adolescent girls experienced depression. This figure is significantly higher compared to the Basic Health Research report from 2018 in West Java, which indicated a prevalence of 7.8% for the age group ≥ 15 years (23). The difference in prevalence may be attributed to the variations in the instruments used. The Basic Health Research of 2018 employed the Self-Reporting Questionnaire (SRQ), which consists of 20 questions, whereas this study utilized the Depression Anxiety and Stress Scales (DASS-42), which comprises 14 questions related to depression. The high prevalence of depression in this study represents a public health phenomenon that poses a threat to adolescents. The adolescents in this research belong to Generation Z, defined as individuals born between 1997 and 2012. The American Psychological Association (APA) reports that Generation Z is more likely to experience mental health issues compared to previous generations (24).

It was found that 31.2% of adolescent girls in this study had anemia. This figure is not significantly different from the research conducted by Widaningsih in 2023 at the Karangraharja Health Center in Bekasi Regency, which reported a high prevalence of anemia among adolescents at 32.60% (25). The bivariate test between anemia status and depression indicates a significant relationship. In this study, adolescent girls with anemia have a 0.939 times greater risk of experiencing depression compared to those without anemia. These findings are consistent with research conducted by Yuliawati et al, which reported that anemia significantly influences the occurrence of depression among Generation Z adolescents (26). These findings support the results of Robinson et al, who stated that iron

deficiency and anemia in adolescent boys are associated with higher depression scores compared to those with normal levels (27). Vitamins and minerals present in food function as cofactors in the body's biochemical reactions, including those in the brain that regulate mood (28). In the brain, iron plays a role in the transmission and modulation of neurons by influencing several enzymes involved in oxidative metabolism and amino acid metabolism. Iron is responsible for the formation of the myelin sheath and the function of neurotransmitters, including serotonin, dopamine, and norepinephrine, during brain development (29).

Table 2. Relationship of antidepressant food score, anemia status, and physical activity level with depression

Variabel	Depressed		Not Depressed		P-*value*
	n	%	n	%	
Antidepressant Food Consumption					
Low	41	67.21	81	72.32	0.00*
High	20	32.79	31	27.68	
Anemia Status					
Anemia	18	29.51	36	32.14	0.00*
Normal	43	70.49	76	67.86	
Physical Activity Level					
Light	36	67.92	79	65.83	0.86
Heavy	17	32.08	41	34.17	

Note*: significant ($p<0.05$)

Economically, improving depression care could yield a potential benefit of $230 billion by the year 2030 (30). Depression care can be done through Lifestyle Medicine. Lifestyle Medicine is an evolving medical specialty that utilizes lifestyle change interventions as the primary therapy for treating chronic non-communicable diseases. Several studies report the potential protective effects of physical activity and diet quality on depression symptoms. Based on the results of the bivariate analysis, there is a significant relationship between antidepressant food consumption patterns and depression status. This study indicates that adolescent girls with low antidepressant food consumption patterns are 1.862 times more likely to experience depression compared to those with high antidepressant food consumption patterns.

Individuals with healthy eating patterns have a lower risk of depression symptoms compared to those with unhealthy diets. Healthy eating habits represent a potential preventive measure against depression. Researchers have found that individuals following specific diets, such as the Dietary Approaches to Stop Hypertension (DASH), Mediterranean diet, or Mediterranean-DASH Intervention for Neurodegenerative Delay, which emphasize the consumption of plant-based foods and avoidance of animal products, tend to have a lower risk of depression (31). Research indicates that interventions involving the Mediterranean diet are effective in reducing depression symptoms among young and middle-aged adults with severe depression or mild to moderate depressive symptoms (32). Dietary recommendations to reduce the risk of depression include the consumption of fruits, vegetables, legumes, and whole grains, while minimizing the intake of unhealthy foods such as fast food, pastries, and sugary beverages (33). Dietary patterns play a role in determining mental health because some evidence shows the effectiveness of nutrients in treating depression, including iron (Fe), Omega 3, Magnesium, Potassium, Selenium, Vitamin B Complex, Vitamin A and Vitamin C, and Zinc (Zn) (29,34–37).

Dietary patterns and physical activity are primary determinants of mental health (38). Physical activity is one of the healthy lifestyle behaviors that offers benefits for health. A meta-analysis of prospective studies reported that, compared to individuals with low levels of physical activity, those with higher activity levels have a 17% (95% CI, 12%-21%) lower likelihood of experiencing depression (39), while, another meta-analysis reported a 21% (95% CI, 18%-25%) lower likelihood of experiencing depression (40). Although physical activity is associated with

the incidence of depression in several studies, the relationship between physical activity levels and depression status among adolescent girls was not found to be significant in this study. This is maybe because there are many other factors that influence the incidence of depression that were not controlled in this study, such as biological factors, psychology, coping mechanisms, sleep time, and socioeconomic status (41). Many factors can influence a person's mood that were not collected in this study. Axelta and Abidin stated that factors related to depression in adolescents include hormonal and physiological changes in adolescent girls, conflict and poor parenting by parents, and academic pressure (42).

CONCLUSIONS AND RECOMMENDATIONS

Antidepressant dietary patterns and anemia status can be associated with the incidence of depression among adolescent girls in Bekasi Regency. The majority of adolescent girls in this study exhibited low levels of physical activity. Physical activity in this research did not demonstrate a significant relationship with the incidence of depression in adolescents. Policy recommendation for the future is to develop a nutrition education program into the education curriculum in Indonesia to promote the importance of healthy eating patterns in maintaining mental and physical health.

There is a need for cross-sector collaboration between schools and health authorities to promote the importance of dietary management and regular iron tablet consumption programs for maintaining mental health. Future research should include the assessment of ferritin levels as an indicator of iron stores in the body and develop a database of antidepressant foods based on local Indonesian cuisine Indonesia.

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