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ORIGINAL ARTICLE

Nutritional status indicator and its correlation with mental health score among adolescents in Islamic boarding schools

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Abstract

Background: It has been estimated that about 10–20% of adolescents worldwide had experiences of mental health problems. Malnutrition, including overweight and obese, is one of the risk factors for mental health in adolescents. There is a knowledge gap regarding the nutritional status and its correlation with mental health among adolescents who live in boarding schools. This study aimed to determine nutritional status and its correlation with mental health among adolescents in Islamic boarding schools.

Methods: A cross-sectional approach was used in this study in which two schools in South Tangerang City of Banten Province were purposively selected and 302 of students aged 15–18 years were completed this study. BMI-for-age Z-scores (BAZ) was used as the nutritional status indicator, and the Strengths and Difficulties Questionnaire (SDQ) was used to determine mental health of the subjects. Spearman correlation was used to determine the correlation between nutritional status indicator and mental health score.

Results: Nearly 30% of the subjects were overweight and obese, and almost 20% had result of mental health score in categories "borderline" and "abnormal". There was a significant correlation between nutritional status indicator and mental health score among adolescents in Islamic boarding schools (r=0.157, P=0.006).

Conclusion: Adolescents who had higher BAZ, had higher total difficulties scores. The schools and policy makers should give attention to nutritional status of the students since it is correlated with mental health.

Keywords adolescents, nutritional status, mental health, boarding school

Introduction

Mental health is a fundamental and important component of health. World Health Organization defined mental health as a state of well-being in which the individual realizes his or her own abilities, can cope with the everyday stresses of life, can work productively and successfully, and can contribute to his or her community. Mental health is more than the absence of illness and is strongly connected with physical health and behavior. Mental health is the foundation for well-being and effective functioning for an individual and a community.[1]

Adolescence is an essential time for enhancing mental health behaviors and well-being. During adolescence, poor mental health can compromise adolescents' development and future potential, and

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can lead to both physical and mental health impairments in adulthood if they remain untreated.[2] Poor mental health in adolescents is strongly associated with lower educational achievements, substance abuse, violence, and poor reproductive and sexual health.[3] It has been estimated that about 10–20% of adolescents worldwide had experiences of mental health problems.[2] A high prevalence of depression and anxiety problems has been reported worldwide over recent years, and there is increasing concern regarding adolescents' mental health. Previous studies have found that adolescents are more vulnerable to traumatic and stressful events and are prone to developing mental health problems.[4]

Five of the ten leading causes of disability-adjusted life years (DALY) in people aged 15-44 years are mental disorders (unipolar depressive disorders, alcohol use disorders, self-inflicted injuries, schizophrenia, and bipolar affective disorder). A study in Australia has shown that mental disorders contributed to 60–70% of the total DALY in young people age 15–24 years, reinforcing the idea that mental disorders are the major contributor to disease burden in this age group. Aside from disability, mental disorders might also contribute a substantial burden on mortality in young people. In many communities, a period of the heightened risk of suicide is increased in youth, where suicide is a leading cause of death in young people in China and India.[5]

Data from Basic Health Research 2018 in Indonesia showed that the prevalence of households whose member(s) were diagnosed with schizophrenia was 6.7‰, while the prevalence of population aged 15 years and above with depression and emotional disorders was 6.1% and 9.8%, consecutively. The prevalence of households whose member(s) were diagnosed with schizophrenia was increased nearly 4 times from 2013, while the prevalence of emotional disorders among population aged 15 years and above was almost doubled. The prevalence of depression is not available in 2013. Female showed higher prevalence in both depression and emotional disorders in Indonesia.[6,7]

Malnutrition, including overweight and obesity, is one of the risk factors for mental health in adolescents.[8] Previous studies have found the association between body weight status and mental health in adolescents. A study amongst children and adolescents found that depression and separation anxiety was mostly seen among underweight group.[9] Another study found that compared with normal weight adolescents, overweight/obese adolescents had lower self-esteem, higher overall depression scores, and severe anhedonia.[10] Several studies also mentioned the association between overweight or obesity with suicide ideation and attempts, anxiety, behavioral problems, and poor self-image.[11] Indonesia's National Basic Health Research in 2018 reported that 13.5% of adolescents age 16-18 years were overweight and obese, and the trend was increasing where the prevalence has risen tenfold between 2010 and 2018.[6,7] An observational study of overweight in Indonesia suggested the urgent program and policy action to reduce and prevent overweight among all ages, including adolescents.[12]

Islamic boarding school or known as *pesantren,* is the oldest Islamic educational institution in Indonesia.[13] It is an intensive form of education, in which students reside at school and visit their families only for weekends and vacations.[14] Boarding school can cause a sense of alienation since students are physically and emotionally isolated from their families and communities that may affect their mental health.[15] There is a knowledge gap regarding the nutritional status and its correlation with mental health among adolescents in Islamic boarding schools. It is crucial to measure nutritional status and mental health to identify the problems, and then develop and implement effective interventions. This study aimed to determine the correlation between nutritional status and mental health among adolescents living in Islamic boarding schools.

Methods

Study design

A cross-sectional approach was used in this study, where both independent and dependent variables are collected at the same time. Data collection was done in July–August 2020 at two Islamic boarding schools, located in South Tangerang City, Banten Province. South Tangerang was purposively selected since it is located in Banten Province, which was the 2nd province with largest number of Islamic

boarding school, and it had more Islamic boarding schools compared to other cities nearby, such as Jakarta, Depok, or Bekasi. The selection of the schools was based on the presence of the students in boarding school since the data collection was conducted during Covid-19 pandemic in which only small number of boarding schools had resumed their activities starting on July 2020. Both of schools selected were private Islamic boarding schools, which had formal education curriculum equal to senior secondary school.

Subjects

The subjects in this study were the students grade 11th and 12th aged 15–18 years in Islamic boarding schools. Students grade 10th were not included since the data collection was done during the process of new student recruitment in the new academic year 2020/2021. Therefore, the students grade 10th were not staying in the boarding school yet. Students who were not present during data collection, or refuse to participate in the study were excluded. The sample size was calculated using correlation coefficient formula, resulted in 264 minimum samples. There were 306 students voluntarily participated in this study.

Anthropometry and measurement

Body weight and height was measured using calibrated tools by well-trained school's staff due to the restriction on direct encounter with the students in regard to Covid-19 prevention. Previous study found that the results of school staff measured weight/height using similar protocol to the study should validly reflect weight/height status for almost all students.[16] Body weight was measured using SECA weighing scale. This measurement was following the standard method of body weight measurement: (1) placing the scale on the flat surface, (2) positioning the subjects in straight position, (3) bare feet, light clothes and taking off anything that can alter the result. Height was taken using Shorr Board according to the standard method: (1) doing the measurement on the stable surface, (2) the subjects should take off any accessories that can interfere the measurement, (3) head, shoulders, buttocks and heels should touch the board.

Nutritional status indicator

BMI-for-age Z-score (BAZ) was used as nutritional status indicator in this study. After body weight and height was measured, the body mass index (BMI) of the subjects was calculated by dividing body weight (kg) to height (m^2). The BAZ was calculated using software WHO AnthroPlus which is the global application of the WHO Reference 2007 to monitor the growth of children and adolescents aged 5–19 years.[17]

Mental health score

The Strengths and Difficulties Questionnaire (SDQ) was used to determine mental health of the subjects. The self-report questionnaire was used in this study. The SDQ has been adapted and translated into Indonesian language, and also been tested for validity and reliability.[18] It is made up of a total 25 statements distributed across five subscales: (1) emotional problems, (2) conduct problems, (3) hyperactivity, (4) peer problems, and (5) prosocial behavior. There were three option of response in each statement, "not true", "somewhat true", and "certainly true". "Somewhat true" is always scored as 1 but the scoring of "not true" and "certainly true" varies with the item. The score on each subscale ranges from 0-10 points. The first four subscales (emotional problems, conduct problems, hyperactivity, and peer problems) yield a total difficulties score.[19] The total difficulties scores were categorized into three categories which are normal, borderline and abnormal, which is shown in **Table 1**.

Statistical analysis

Before running the analysis, we excluded cases with incomplete data. Data was analyzed using software IBM SPSS Statistics for Windows version 25. Univariate analysis was used to describe the characteristics of the subjects, nutritional status, and mental health. The data was interpreted in both numerical and categorical data. Numerical data was analyzed using mean and standard deviation if the data was normally distributed, or median (25th – 75th percentile) if the data was not normally distributed. Categorical data was analyzed using

frequency (n) and percentage (%) distribution. Bivariate analysis was used to see the relationship between two variables. The Spearman correlation test was used to see the significant association between nutritional status indicator and mental health score. The results were considered significant if the p-value is less than 0.05.

Ethical consideration

This study was conducted after receiving an approval from Ethical Committee of Faculty of Medicine, Universitas Indonesia No. KET-246/UN2.F1/ETIK/PPM.00.02/ 2020, signed on March 2nd 2020, with the amendment of the protocol due to the adjustment of data collection method during Covid-19 pandemic situation (ND-709/UN2.F1/ETIK/PPM.0002/2020 signed on June 29th 2020). Permission before data collection was also obtained from the institutions where the study conducted. Before the data collection, all of the subjects received detail information regarding the study purpose and all of measurements. All of the subjects selected were voluntarily participated in this study. All of the information collected during the study was treated as confidential.

Results

In total, there were 302 students of Islamic boarding school aged 15–18 years completed the study and included in data analysis. The subjects' mean age was 16.8 ± 0.7 years, and the majority of them were girls. The subjects' parental education level was mostly moderate, which indicated the completion of junior or senior secondary school education. The details on subjects' characteristics was shown in **Table 2**.

The prevalence of thin, overweight, and obese in subjects were 3.3%, 14.9%, and 7.3%, respectively, as shown in **Figure 1**. This indicated that overweight and obese were more serious problem among the subjects in this study. The categories of nutritional status were reduced into two categories, which were overweight and non-overweight, for further analysis.

The mean value of the subjects' BAZ was 0.19, and it was not showing any significant difference between boys and girls (P>0.05). After being categorized, the proportion of overweight among the subjects was 22.2% (**Table 3**). The proportion of overweight was higher in boys than girls, but the difference was not statistically significant based on the chi-square test.

Table 4 showed that the total difficulties score presented a median value of 11, with the first and third quartiles of 8 and 14 respectively. When distributed in categories, most of the subjects had a "normal" results. The majority of them were also categorized as "normal" in all dimensions of emotional problem, conduct problem, hyperactivity, peer problem, and prosocial.

The proportion of subjects categorized as "abnormal" was mostly found in the dimension of emotional problem (9.6%). The scores of emotional problem was significantly different between boys and girls. The proportion of girls with "abnormal" results in emotional problem dimension (13.5%) was much higher than boys (4%). The conduct problem scores were not showing any significant difference between boys and girls, but the significant difference was found when it was categorized. The proportion of boys categorized as "abnormal" in conduct problems (12.1%) was much higher than girls (0.6%).

The Spearman's rho correlation test resulted in significant correlation between total difficulties, emotional problem, and hyperactivity scores with BAZ (**Table 5**). This suggested that the higher BAZ would result in the higher problem in terms of total difficulties, emotional problem and hyperactivity. However, the correlations were considered as weak since the correlation coefficients were all below 0.3.

Table 6 showed the comparison of mental health score by nutritional status. The result suggested that total difficulties and hyperactivity scores were significantly higher in overweight subjects. However, there were no significant difference between emotional problems, conduct problem, peer problem and prosocial scores among overweight and non-overweight subjects.

Discussion

Our results indicated that overweight and obesity were more serious health concerns than thinness in this study population. The findings also confirmed previous study that found a high prevalence of

overweight and obesity among the students who lived in Islamic boarding schools.[20] This finding was in line with the results of Basic Health Research Indonesia in which 13.5% of adolescents aged 16–18 years were overweight and obese in 2018, and the trend was increasing where prevalence of overweight and obesity had risen almost tenfold between 2010 and 2018. Meanwhile, the prevalence of thin adolescents was decreased in 2018. The high and increasing prevalence of overweight and obesity in adolescents is a major global public health problem since it will affect adolescents' health in later life, not only physical, but also psychological health. Studies found that overweight was associated with comorbidity conditions, such as hypertension, hyperlipidemia, diabetes, sleep apnea, poor self-esteem, and even depression. In addition, if the condition followed-up to adulthood, adolescents with overweight or obesity much more likely to suffer from cardiovascular and digestive diseases.[21]

There are overwhelming studies regarding factors associated with overweight and obesity among adolescents. Genetic factors, socioeconomic status, dietary intake, physical activity, sedentary behavior, screen time, sleep duration, food store environment, and school food environment are the factors found to be associated with overweight or obesity among adolescents.[22] Adolescents in this study were living in boarding school which have same environment, including food environment and physical activity environment. The schools provided meals three times a day, a mandatory physical education class once a week, and recess twice a day that can be used for students to do physical activity (e.g., sports, games, or cleaning activities). However, the students still had control regarding their food intake and physical activity. They were allowed to buy and consume snacks available in school canteen. Their parents were also allowed to send foods and snacks for the students. Snacking is a great contributor to energy intake among adolescents where a study among adolescents aged 12-19 years found that daily snacks consumption, which resulted in higher intake of added sugar, saturated fat, and sodium, were associated with overweight and obesity among adolescents. The finding suggested that approaches targeting snacking behavior are relevant to prevent overweight and obesity among adolescents.[23]

The result of this study revealed that the prevalence of overweight among boys was higher than girls. However, there was no statistically significant difference between them. This finding was different from the previous study, which found that the prevalence of overweight and obesity among girls in Islamic boarding school was higher than boys.[24] Data of Basic Health Research Indonesia 2018 also showed same pattern where the prevalence of overweight among girls (11.4%) were higher than boys (7.7%).[6] Decreasing participation in physical activity and sports, particularly for girls, may explain the differences.[25] On the contrary, a cohort study of United States adolescents revealed that gender norms were positively associated with weight loss attempts and behaviors for girls, while in boys, gender norms were positively associated with weight gain or muscle building behaviors. Gender norms are defined as societies' rules and standards that guide and constrain social behaviors for boys and girls regarding how they are supposed to act, think, and feel.[26] All these findings may suggest that the prevalence of overweight in adolescents is a concern, regardless the gender.

This study found that most subjects were not having problems in all subscales of the SDQ (emotional problem, conduct problem, hyperactivity, peer problem, and prosocial). However, there were almost 20% of the subjects that need further investigation and diagnosis by professionals. The lower score was found in peer problems and conduct problems, which indicated the lower problems in those subscales. A previous study mentioned that the students in Islamic boarding school were usually having close relationships with their peers since they lived and spent most of their time with them. Thus, it may explain the lower peer problems among them. The students in Islamic boarding school must follow the rules of the school, including daily activities, such as studying, praying, reciting Al-Qur'an, and participating in extracurricular activities. This condition may be associated with lower conduct problems among them.[27]

The differences between gender were found in emotional and conduct problems. Girls were more likely to have emotional problems, while boys were more likely to have conduct problems. This pattern was similar to previous study among Norwegian

adolescents that found higher emotional problems in girls and higher conduct problems in boys.[28] Girls were more likely to have emotional problems, especially related to internalizing problems, such as depression and anxiety, while boys were more likely to have externalizing problems, including conduct problems.[27] Literature mentioned that hormonal changes during menstruation may be associated with emotional problems among girls.[29]

This study found that nutritional status, which is defined as BAZ, was correlated with mental health. The higher BAZ would result in higher total difficulties, emotional problems, and hyperactivity scores. This result was in line with previous studies that found higher BMI (body mass index) was predictive of higher total difficulties and emotional scores.[30,31] Adolescents with overweight will attract attention to their surroundings and often develop a poor self-image, which can lead to being bullied by their peers.[11] Thus, it may result in emotional problems among them. Moreover, overweight subjects were more likely to have higher total difficulties scores that indicated poorer mental health, compared to non-overweight subjects. Overweight adolescents have been shown to be at higher risk of poor psychological health in general. Likewise, this study also found that overweight subjects were having higher scores in the hyperactivity subscale. This was aligned with previous study that found a significantly higher prevalence of Attention-Deficit/Hyperactivity Disorder (ADHD) for overweight children and adolescents aged 11-17 years. Children and adolescents with ADHD more frequently reported eating problems and were less likely to engage in physical activity. Hence, it may lead to overweight.[32,33]

There were some limitations to the current study. First, there is a possibility of random errors due to self-reported questionnaire. However, the SDQ is a brief, widely used, valid, and reliable instrument to determine mental health of adolescents. Second, the direction of nutritional status and mental health relationship may be bidirectional, but it cannot be determined in this study due to the cross-sectional design. Third, the Islamic boarding schools in this study were purposively selected. Thus, precautious should be taken in generalizing the results.

Conclusion

Nutritional status, determined by BMI-for-age Z-scores, was significantly correlated with mental health in terms total difficulties score, emotional problem, and hyperactivity. Adolescents with overweight showed higher total difficulties score and hyperactivity. Gender differences was found in mental health where girls were more likely to have emotional problems, while boys were more likely to have conduct problems. We suggest that the schools should give more attentions regarding the nutritional status and mental health of the students. Nearly 30% of the students were overweight and obese, which should be taken seriously since it will affect their health in later life. Investigating the health behavior associated with nutritional status in the schools is recommended since boarding schools play an important role in promoting healthy behavior. Developing and implementing school-based mental health promotion and interventions are recommended since almost 20% of the students were indicated a need to further diagnose of mental health problems by professionals. Further study is needed to investigate other potential factors associated with mental health among adolescents.

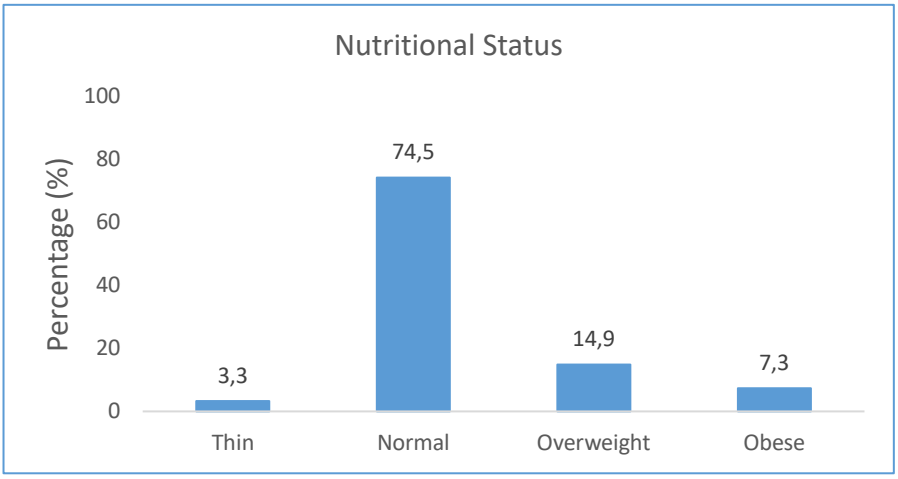

Figure 1. Nutritional status of the subjects

Table 1. The SDQ scores categories

Subscales	Normal	Borderline	Abnormal
Total difficulties score	0–15	16–19	20–40
Emotional problems	0–5	6	7–10
Conduct problems	0–3	4	5–10
Hyperactivity	0–5	6	7–10
Peer problems	0–3	4–5	6–10
Prosocial behavior	6–10	5	0–4

Table 2. Characteristics of the subjects (n=302)

Characteristics	Results
Age, years, mean±SD	16.8±0.7
Gender, n (%)	
Boys	124 (41.1)
Girls	178 (58.9)
Father's education level, n (%)	
Low (illiteracy-primary school)	18 (5.9)
Moderate (junior-senior secondary school)	176 (58.3)
High (diploma-doctorate)	108 (35.8)
Mother's education level, n (%)	
Low (illiteracy-primary school)	24 (7.9)
Moderate (junior-senior secondary school)	181 (60.0)
High (diploma-doctorate)	97 (32.1)

Table 3. Nutritional status of the subjects

Nutritional Status	Total (n=302)	Boys (n=124)	Girls (n=178)	p-value
BMI-for-age Z-scores[a]	0.19±1.1	0.12±1.3	0.25±0.9	0.322[b]
Non-overweight, n (%)	235 (77.8)	90 (72.6)	145 (81.5)	0.091[c]
Overweight, n (%)	67 (22.2)	34 (27.4)	33 (18.5)	

[a]Result presented in mean±SD since the data was normally distributed (tested by Kolmogorov-Smirnov with P value>0.05), [b]Continuous variable significance was tested by the Student's t-test, [c]Categorical variable significance was tested by chi-Square test

Table 4. The subjects' scores of total difficulties, emotional problem, conduct problem, hyperactivity, peer problem and prosocial

Mental health measured by SDQ	Total (n=302)	Boys (n=124)	Girls (n=178)	p-value
Total difficulties score[a]	11 (8-14)	10 (8-13.75)	12 (9-14)	0.022[be]
Normal, n (%)	255 (84.4)	107 (86.3)	148 (83.1)	0.750[c]
Borderline, n (%)	32 (10.6)	12 (9.7)	20 (11.2)	
Abnormal, n (%)	15 (5.0)	5 (4.0)	10 (5.6)	
Emotional problems score[a]	4 (2-5)	2.5 (1-4)	5 (3-6)	<0.001[be]
Normal, n (%)	244 (80.8)	116 (93.5)	128 (71.9)	<0.001[de]
Borderline, n (%)	29 (9.6)	3 (2.4)	26 (14.6)	
Abnormal, n (%)	29 (9.6)	5 (4.0)	24 (13.5)	
Conduct problems score[a]	2 (1-3)	2 (1-3)	2 (1-3)	0.105[b]
Normal, n (%)	258 (85.4)	100 (80.6)	158 (88.8)	<0.001[de]
Borderline, n (%)	28 (9.3)	9 (7.3)	19 (10.7)	
Abnormal, n (%)	16 (5.3)	15 (12.1)	1 (0.6)	
Hyperactivity score[a]	3 (2-4)	3 (2-4)	3 (2-5)	0.668[b]
Normal, n (%)	272 (90.1)	113 (91.1)	159 (89.3)	0.404[d]
Borderline, n (%)	23 (7.6)	10 (8.1)	13 (7.3)	
Abnormal, n (%)	7 (2.3)	1 (0.8)	6 (3.4)	
Peer problems score[a]	2 (1-3)	2 (1-3)	2 (1-3)	0.047[be]
Normal, n (%)	245 (81.1)	94 (75.8)	151 (84.8)	0.117[d]
Borderline, n (%)	51 (16.9)	26 (21.0)	25 (14.0)	
Abnormal, n (%)	6 (2.0)	4 (3.2)	2 (1.2)	
Prosocial score[a]	9 (7-10)	9 (7-10)	9 (8-10)	0.151[b]
Normal, n (%)	285 (94.4)	113 (91.1)	172 (96.6)	0.108[d]
Borderline, n (%)	14 (4.6)	9 (7.3)	5 (2.8)	
Abnormal, n (%)	3 (1.0)	2 (1.6)	1 (0.6)	

Table 5. Correlation between nutritional status indicator and mental health score (n=302)

Variable	Mental health score (correlation coefficient)					
	Total difficulties	**Emotional problem**	**Conduct problem**	**Hyperactivity**	**Peer problem**	**Prosocial**
Nutritional status indicator (BAZ)	0.157**	0.166**	0.018	0.170**	-0.033	0.015

**Statistical analysis used Spearman correlation test with significance level of p-value<0.01

Table 6. Comparison of mental health score by nutritional status indicator

Nutritional status indicator	Mental health score (median, Q1–Q3)					
	TD	**EP**	**CP**	**H**	**PP**	**PS**
Non-overweight (n=235)	11 (8–14)	3 (2–5)	2 (1–3)	3 (2–4)	2 (1–3)	9 (7–10)
Overweight (n=67)	12 (10–15)	4 (3–5)	2 (2–3)	4 (3–5)	2 (1–3)	9 (8–10)
p-value	0.005**	0.079	0.281	<0.001**	0.511	0.841

**Statistical analysis used Spearman correlation test with significance level of p-value<0.01
TD: Total difficulties, EP: Emotional problem, CP: Conduct problem, H: Hyperactivity, PP: Peer problem, PS:Prosocial

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