

Relationship between the Risk of Eating Disorders and the Concentration Capacity of High School Students

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Abstract

Background: Eating disorder is a change in eating behaviour that affects daily activities, resulting in a vulnerability towards diseases that have several effects on the organ systems, including the neurological system. In teenagers, these disturbances, including a decline in memory, cognitive function, and concentration, will significantly affect daily activities, especially in their studies. The objective of this study was to determine the relationship between the risk of eating disorders and the concentration capacity of high school students aged 12–19 years old.

Methods: This study was an observational analytic study conducted cross-sectionally among high school students. Data were collected from September to October 2019. Data were taken using Eating Disorder Examination (EDE) Questionnaire filled out by the respondents, followed by a Stroop test. Data analysis was performed by the chi-square test.

Results: Of 294 students, 56.5% had a risk of eating disorder, of whom 66.7% did eating restrain. Of all respondents, 54.8% had poor concentration capacity. There was a relationship between the risk of eating disorder and concentration capacity ($p=0.002$).

Conclusion: The risk of eating disorders has a significant relationship with concentration capacity. An urgent measurement is needed to promote an eating behaviour among adolescents to increase good and productive daily activity.

Keywords: Concentration capacity, eating disorders, EDE-Q, Stroop test

Introduction

Changes in eating behaviors and dietary habits are very common in the general global population. Unhealthy eating behavior may affect daily activities and cause vulnerability to various diseases, known as eating disorders.¹ Eating disorders are a group of serious mental disorders, generally leading to fatal consequences that cause people to become obsessed with weight and body shape.² The disorder is a comprehensive spectrum disorder, which is further classified into anorexia nervosa (AN), bulimia nervosa (BN), binge-eating disorder (BED), avoidant/restrictive food intake disorder (ARFID), and pica. Those with an eating disorder who do not meet the full criteria for any of the disorders

above falls into 'other specified feeding and eating disorder' (OSFED) or 'unspecified eating disorder' (UFED).^{3,4} Changes in individual eating behavior are designated as unhealthy if the effects of these changes result in an excessive or inadequate energy intake. Three of the most common eating disorders are anorexia nervosa (AN), bulimia nervosa (BN), and BED.¹

Eating disorders are most commonly found in women between the ages of 12–35 years, although they can also be found in all types of individuals.⁵ Another study has shown that this disorder is found primarily in adolescents, mainly at 16–24 years old.⁶ Unhealthy eating behavior can be experienced by everyone, although it is more commonly found in women from adolescence to young adulthood.^{1,7} In

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Indonesia, 12–22% of women aged 15–29 years suffer from chronic energy deficiency with a body mass index of <18.5, however, it has not been confirmed yet due to a lack of prevalence studies conducted.⁸ Moreover, eating disorders prevalence is relatively high in adolescents under 18 years old, and the prevalence is high in Asia and other developing countries.⁹ This high prevalence of eating disorders among adolescents might be correlated with the effect of negative body image distortion.¹⁰

Next to serious mental illness, eating disorders affect various organ systems in the body, among others cardiovascular, gastrointestinal, endocrine, and neurology system.¹¹ Food restriction, nutritional deficiency, and in other ends also, excessive energy intake can cause an individual to experience several disruptions in the activities of daily living. In adolescents, neurological disruption will significantly affect daily activities, especially in the study.¹¹ These neurological disruptions include dull memory, decreased cognitive function that is associated with cognitive inflexibility, which is considered one factor that worsens prognosis, which will be more likely to present resistance to therapy,¹² and problems with concentration or inattention due to alterations of the neurotransmission of the brain.¹¹

An individual is described as inattentive if he/she has poor concentration capacity, a short attention span, and is easily distracted.¹³ Several studies have found evidence showing a relationship between eating disorders and neurological disruption.¹³ This relationship is associated with neurological disruption due to either inadequate nutrition intake for the body or excessive food intake, which are both caused by disordered eating.¹¹

This study focuses on concentration problems as one of the consequences of an eating disorder due to the high demands for good concentration in high school students and the high prevalence of eating disorders in adolescents in the high school age range. Therefore, this study aimed to determine the relationship between eating disorders in adolescents aged 12–19 years in West Jakarta and their impacts on concentration capacity.

Methods

This study was a cross-sectional analytic observational study conducted from September to October 2019. The sample was collected by total sampling. The respondents

were all junior and senior high school students at an international school in West Jakarta, Indonesia who met the inclusion criteria. Inclusion criteria were students aged 12–19 years had never done the Stroop test and were willing to become respondents by signing informed consent. Since they were underage, informed consent was signed by their parents/guardian and they were asked for possible exclusion criteria. Exclusion criteria were respondents who were color blind, had dyslexia, and had attention-deficit/hyperactivity disorder (ADHD). Furthermore, respondents who experienced non-optimal physical conditions that could interfere with concentration, such as headache, body aches, fatigue due to physical activity, chills, fever, cough, and runny nose, were excluded. Respondents who were taking drugs that stimulated drowsiness were also excluded as well as those who were not present on the day of data collection. Ethical clearance was obtained from the Research Ethics Committee School of Medicine and Health Sciences Atma Jaya Catholic University of Indonesia with a number 02/09/KEP-FKUAJ/2019.

Data were collected using the EDE-Q questionnaire to obtain data on the risk of eating disorder and the Stroop test to determine the concentration capacity. The EDE-Q questionnaire was used to screen respondents for eating disorders. The results of the questionnaire were divided into 4 subscales, including restrain, eating concern, shape concern, and weight concern. The 4 subscales were then subdivided to obtain the average value or the global score of each respondent's EDE-Q.

The Stroop test used was the Stroop Color and Word Test (SCWT). In the Stroop test, respondents were asked to read a board containing the name of the color (W) printed in different ink from the writing (C). For example, the word "BLUE" in red ink. This condition will cause the participant's attention to be more divided, where tasks that can usually be done more automatically, such as reading the color of the writing, become obstructed due to the respondents being required to name the color of the ink instead of reading the word.¹⁴

The concentration capacity tested by the Stroop test was divided into two parts. Initially, the respondents will be asked to read aloud the words written on the card while ignoring the color of the ink printed on the word. Then in the next section, the respondent will be asked to name the color of ink used for the word, regardless of the word printed on

Table 1 Demographic Characteristics, Eating Disorders, and Concentration Capacity of Junior and High School Students (n=294)

Variable	Distribution	
	n	%
Class level		
Grade 7	53	18.0
Grade 8*	63	21.4
Grade 9	62	21.1
Grade 10	58	19.7
Grade 11	37	12.6
Grade 12	21	7.1
Gender		
Female*	179	60.9
Male	115	39.1
Eating disorder		
Risk of eating disorder*	166	56.5
No risk	128	43.5
Concentration capacity		
Impaired*	161	54.8
Normal	133	45.2

Note: *Highest percentage

the card. The respondent's reading time (in seconds) was recorded in both steps. Then the researcher calculated the interference score between these two steps by reducing the time recorded in the first step with the time recorded in the second step. If the interference score was less than 13, the concentration of the respondent was categorized as good. If the interference score was more than or equal to 13, the concentration of the respondent was considered poor.¹⁵

The data were analyzed by univariate analysis for the demographic characteristics, risk of eating disorders, and concentration capacity of the junior and high school students. Bivariate analysis was then performed with the chi-square test for the relationship between the effects of risk of eating disorder and concentration capacity.

Results

This study included 294 junior and high school students. The distribution of respondents by gender was 179 female (60.9%), and 115 male (39.1%). Distribution of respondents who had a risk of eating disorders was 56.5%, while 43.5% did not. The results also showed that there were 54.8% with impaired concentration capacity, while 45.2% did not (Table 1).

Hence, the risk of eating disorders and impaired concentration capacity dominates all respondents. Females (60.9%) had more risk of eating disorders compared to males (49.6%) (Table 2). However, there was no significant relationship between gender and risk of eating disorder ($p=0.056$). Interestingly, there was a significant relationship between gender and concentration disruption ($p=0.000$).

Table 2 Normality Test

Gender	Eating Disorders		Concentration Capacity	
	Risk n (%)	No risk n (%)	Impaired n (%)	Normal n (%)
Female	109 (60.9)	70 (39.1)	59 (33.0)	120 (67.0)
Male	57 (49.6)	58 (50.4)	102 (88.7)	13 (11.3)

Table 3 Eating Disorder Examination Questionnaire (EDE-Q) Interpretation

Subscale	Mean	Impaired n (%)	Normal n (%)
Restrain	1.625	196 (66.7)	98 (33.3)
Eating concern	1.256	203 (69.1)	91 (30.9)
Shape concern	2.258	177 (60.2)	117 (39.8)
Weight concern	1.780	161 (54.8)	133 (45.2)
Global score	1.730	166 (56.5)	128 (43.5)

Table 4 Relationship between Eating Disorders Risk and Concentration Capacity of High School Students

Eating Disorders Risk	Concentration Capacity		Total n (%)	P-value*
	Impaired n (%)	Normal n (%)		
Risk	104 (35.4)	57 (19.4)	166 (56.5)	0.002
No risk	62 (21.1)	71 (24.1)	128 (43.5)	
Total	161 (54.8)	133 (45.2)	294 (100.0)	

In the interpretation results on the EDE-Q questionnaire, which were divided into 4 subscales, it was found that 66.7% had the restrain subscale, 69.1% had the eating concern subscale, 60.2% had the shape concern subscale, and 56.5% had the weight concern subscale (Table 3).

There was a significant relationship between the risk of eating disorders and impaired concentration ($p=0.002$), and there was a significant relationship between eating restrictions and the risk of eating disorders ($p=0.000$) (Table 4).

Discussion

The results showed that females had a higher risk of eating disorders compared to male, as depicted in Table 2. However, the relationship between gender and risk of eating disorders is not significant ($p=0.056$). This result is in accordance with a study on the risk of eating disorders in more respondents, including 6,140 adolescents. There is a higher number of body dissatisfaction in girls compared to boys in their adolescence period. However, gender as a risk factor for the eating disorders could not be determined.¹⁶ The results of this study are also supported by a meta-regression analytical study that refutes gender role as a risk of developing an eating disorder.

Although gender may play a role, it needs to be in correlation with other risk factors in determining a person's risk for eating disorders.¹⁷

Our study also showed that male students had more experienced concentration problems compared to female students. Gender seems to have a role in impaired concentration. Similar to another study, the Stroop test is different between genders. The response speed in women is faster than in men. Therefore, the performance of the Stroop test in men has worse results.¹⁸

There is a significant relationship between the risk of eating disorders and the concentration capacity of these junior and high school students ($p=0.002$). This result is consistent with a study about the physiological consequences of eating disorders. Nutritional deficits in eating disorders can cause sufferers to become weak and tired easily.¹¹ Eating disorder risks in this study were determined by disordered eating and dissatisfaction with self-perception at least in the last 28 days. It shows that respondents who have been determined to have an eating disorder risk changed to abnormal eating patterns. This nutritional deficit behavior can cause cognitive development disorders, and one of the components of cognitive function is concentration.¹⁰ Furthermore, other studies

also state the existence of neurological susceptibility in nutritionally restricted individuals.¹⁹ There is a close relationship between impaired concentration/attention and restrictive eating patterns.²⁰ Individuals with eating disorders have worse performance in completing cognitive tasks, inhibitory function, planning performances, and worse working memory tasks.²¹

A significant relationship between restrictive eating behavior and the risk of eating disorders. In our study also shows that there is a relationship between restrictive eating behavior on concentration capacity. This finding supports the theory that restrictive eating behavior may cause nutritional deficiencies and thus can interfere with concentration capacity.¹¹ These results are consistent with a study that assessed the relationship of cognitive function with restrictive eating behavior such as skipping meals. Skipping meals and cognitive function has a significant interaction, in which dietary restriction impairs the ability to learn and encode new information.²²

This study has several limitations and shortcomings. One of the limitations encountered in this study was the location where respondents were collected, which was only from one school. Therefore, the data obtained only describes the results of the risk of eating disorders in high school students where the majority are from the middle and upper socioeconomic status with a Tiong Hoa ethnic background. Data collection for concentration power also does not exclude confounding factors, such as preoccupation with gaming addictions, which also have a high prevalence in adolescents.

In conclusion, the risk of eating disorders has dominated junior and senior high school students with the concentration capacity mostly disrupted. Counseling about the effects of eating disorders and the ease of individuals to have the risk of eating disorders is highly needed, to reduce the number of students who have the risk of eating disorders and to reduce individuals who receive the effects of unhealthy eating habits.

References

1. Neale J, Hudson LD. Anorexia nervosa in adolescents. *Br J Hosp Med (Lond)*. 2020;81(6):1-8.
2. National Institute of Mental Health. Eating disorders [Internet]. Bethesda, Maryland: National Institute of Mental Health; 2016. [cited 2021 November 28]. Available from: <https://www.nimh.nih.gov/health/topics/eating-disorders/index.shtml>.
3. Qian J, Wu Y, Liu F, Zhu Y, Jin H, Zhang H, et al. An update on the prevalence of eating disorders in the general population: a systematic review and meta-analysis. *Eat Weight Disord*. 2022;27(2):415-28.
4. Hay P. Current approach to eating disorders: a clinical update. *Intern Med J*. 2020;50(1):24-9.
5. Zipfel S, Giel KE, Bulik CM, Hay P, Schmidt U. Anorexia nervosa: aetiology, assessment, and treatment. *Lancet Psychiatry*. 2015;2(12):1099-111.
6. Solmi F, Hatch SL, Hotopf M, Treasure J, Micali N. Prevalence and correlates of disordered eating in a general population sample: the South East London Community Health (SELCoH) study. *Soc Psychiatry Psychiatr Epidemiol*. 2014;49(8):1335-46.
7. McBride O, McManus S, Thompson J, Palmer RL, Brugha T. Profiling disordered eating patterns and body mass index (BMI) in the English general population. *Soc Psychiatry Psychiatr Epidemiol*. 2013;48(5):783-93.
8. Krisnani H, Santoso MB, Putri D. Gangguan makan anorexia nervosa dan bulimia nervosa pada remaja. *Prosiding Penelitian dan Pengabdian Kepada Masyarakat*. 2017;4(3):399-447.
9. Galmiche M, Déchelotte P, Lambert G, Tavolacci M-P. Prevalence of eating disorders over the 2000-2018 period: a systematic literature review. *Am J Clin Nutr*. 2019;109:1402-13.
10. Azrimaidaliza A, Helmizar H, Yollanda F. Meta analysis study of factors relates eating disorders on adolescents. *J Aisyah*. 2021;6(1):17-22.
11. Sidiropoulos M. Anorexia nervosa: the physiological consequences of starvation and the need for primary prevention efforts. *McGill J Med*. 2007;10(1):20-5.
12. Grau A, Magallón-Neri E, Faus G, Feixas G. Cognitive impairment in eating disorder patients of short and long-term duration: a case-control study. *Neuropsychiatr Dis Treat*. 2019;15:1329-41.
13. Ptacek R, Stefano GB, Weissenberger S, Akotia D, Raboch J, Papezova H, et al. Attention deficit hyperactivity disorder and disordered eating behaviors: links, risks, and challenges faced. *Neuropsychiatr Dis Treat*. 2016;12:571-9.
14. Donnelly B, Touyz S, Hay P, Burton A, Russell J, Caterson I. Neuroimaging in bulimia nervosa and binge eating disorder:

- a systematic review. *J Eat Disord.* 2018;6:3.
15. Sardiman AM. *Interaksi & motivasi belajar mengajar.* Jakarta: PT Raja Grafindo Persada; 2020.
 16. Micali N, De Stavola B, Plouhidis G, Simonoff E, Treasure J, Field AE. Adolescent eating disorder behaviours and cognitions: gender-specific effects of child, maternal and family risk factors. *Br J Psychiatry.* 2015;207(4):320–7.
 17. Jahrami H, Saif Z, Faris ME, Levine MP. The relationship between risk of eating disorders, age, gender and body mass index in medical students: a meta-regression. *Eat Weight Disord.* 2019;24(2):169–77.
 18. Baroun K, Alansari B. Gender differences in performance on the Stroop test.. *Soc Behav Personal.* 2006;34(3):309–18.
 19. Weir K. New insights on eating disorder. *Am Psychol Assoc.* 2016;47(4):36.
 20. Kaisari P, Dourish CT, Rotshtein P, Higgs S. Associations between core symptoms of attention deficit hyperactivity disorder and both binge and restrictive eating. *Front Psychiatry.* 2018;9:103.
 21. Iceta S, Rodrigue C, Legendre M, Daoust J, Flaudias V, Michaud A, et al. Cognitive function in binge eating disorder and food addiction: a systematic review and three-level meta-analysis. *Prog Neuropsychopharmacol Biol Psychiatry.* 2021;111:110400.
 22. Datta N, Bidopia T, Datta S, Mittal G, Alphin F, Marsh EJ, et al. Meal skipping and cognition along a spectrum of restrictive eating. *Eat Behav.* 2020;39:101431.