



Body Mass Index and Emotional Symptoms Among Alpha Generation Adolescents: A Cross-Sectional Study

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Abstract

Background: Adolescents generally experience greater emotional intensity and interpersonal conflicts than children or adults. Adolescents' responses to the emotional stress of their body weight differ between boys and girls. This study aimed to examine the association between body mass index and emotional symptoms among adolescents of the alpha generation and to assess whether this association differed by gender.

Methods : A Cross-Sectional study was conducted from Periodic Health Screening and Examination in School Data by Public Health Center of all adolescent born 2010-2014 in Junior High School on August 2025. Emotional symptoms were assessed using the Strengths and Difficulties Questionnaire (SDQ) for 11-18 years old. The Body Mass Index was measured using the body weight and height of each participant. The cleaned data for analysis included 2.786 cases. Associations were analyzed using Pearson's Chi-Square Test and Multinomial Logistic Regression, stratified by gender.

Results: The results was significantly associated with emotional symptoms in both boys ($p = 0.037$) and girls ($p = 0.024$). The association between BMI and emotional symptoms differed significantly by sex ($p < 0.001$). Among boys, a significant positive association emerged for the Overweight category compared to those with Borderline and Normal symptoms ($OR = 2.12$; $95\% CI = 1.19-3.76$; $p = 0.011$). In girls, a significant association emerged for the thinness category compared to individuals with abnormal and normal symptoms ($OR = 0.68$; $95\% CI = 0.53-0.88$; $p = 0.003$). These findings suggest an association but do not imply a causality.

Conclusion: For Boys, the risk appears to concentrate at the higher end of the BMI spectrum. Overweight boys had significantly increased odds of borderline symptoms. For Girls, the risk appears to concentrate at the higher end of the BMI spectrum, as a lower BMI was associated with reduced odds. Thin girls had significantly lower odds of abnormal symptoms. Interventions targeting emotional well-being should consider overweight and obesity as potential risk factors in boys. Public health programs must consider this into account in order to adapt their messages to adolescents.

Keywords: Adolescent, Body Mass Index, Emotional Symptom, Gender Differences

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Introduction

Adolescence is frequently characterized as a period of "storm and stress," marked by heightened conflict, mood disturbances, and risk-taking

behavior. Although this conceptualization is not universally applicable, empirical evidence indicates that adolescents generally experience greater emotional intensity and interpersonal conflict than either children or adults.¹ The World

Health Organization (WHO) estimates that 1 in 7 adolescents aged 10-19 years' experience mental disorders, including depression and anxiety, which contribute to approximately 15% of the disease burden in this age group.¹ In Indonesia, the Basic Health Research (Riset Kesehatan Dasar)² showed a prevalence of mental and emotional disorders among adolescents aged 15 years and older of 6.1%. Furthermore, the Indonesian Health Survey⁴ reported that the prevalence of depression among adolescents aged 15-24 years reached approximately 2%.

Nutritional status plays a crucial role in the psychological balance and emotional health of adolescents.⁴ Adequate and balanced nutritional intake is important for maintaining brain function, producing neurotransmitters (such as serotonin and dopamine), and regulating mood. Conversely, deficiencies in macronutrients and micronutrients, such as protein, iron, zinc, B-complex vitamins, omega-3s, and magnesium, can trigger emotional disorders, such as anxiety, irritability, difficulty concentrating, and even mild depression.^{5,6} In some studies, the association between obesity and psychological health among adolescents has also been extensively researched. In several study reported among children and adolescents supported an association between obesity and mental health problems, including depression, anxiety, low self-esteem, and extension-deficit hyperactivity disorders.⁷⁻⁹

Adolescents' responses to the emotional stress of their body weight differ between boys and girls.¹⁰ A meta-analysis of 20 studies examining the association between obesity and mental health problems found that the association was seen only among girls.¹² A study among girls, mental health was higher for thin girls and decreased with increasing Body Mass Index (BMI). In contrast, mental health was lower for thin, overweight, and obese boys than for normal-weight boys. However, in Keating's study¹¹, girls who were obese had significantly emotional functioning scores than normal-weight girls, but the same was not true for boys.

Adolescents in a special age, especially those belonging to Generation Alpha, experience significant physical changes, making this period crucial for body image and self-concept development.¹² As a generation born into the internet and social media, they are increasingly exposed to unrealistic and idealized body shapes. Studies have shown that girls are more likely than boys to be dissatisfied with their body weight.¹³⁻¹⁶ Girls are more concerned about their body weight and are more likely to be influenced by peers, mass media, parents, and other sociocultural factors. Despite extensive research on the association between Body Mass Index (BMI) and emotional symptoms in adolescents, significant gaps remain. First, the Alpha Generation, those born from 2010 onward, remains largely unexplored, despite their unique exposure to digital media from early childhood, which may shape body image and emotional well-being differently than in previous cohorts.

Second, evidence regarding gender differences is inconclusive and contradictory, with some studies reporting associations only among girls, while others find effects in both sexes but in opposite directions. To date, no study has specifically examined whether this association differs by gender among adolescents of the Alpha Generation. Therefore, this study aimed to address this gap by examining the association between body mass index and emotional symptoms among adolescents of the Alpha generation and assessing whether this association differs by gender.

Methods

Study design

A cross-sectional study was conducted using secondary data from Periodic Health Screening and Examination in School Data by Public Health Center in Tarakan City of all adolescent born 2010-2014 in Junior High School in August 2025. Emotional Symptoms were assessed using the Strength and Difficulties Questionnaire (SDQ) for 11-18 years old. It is classified

as Normal (0-5 scores), borderline (6 scores), or Abnormal (7-10 scores). The Body Mass Index was measured using the body weight and height of each participant. Data were collected by health workers from the Public Health Center Tarakan City. BMI was calculated as weight (kg) / height (m)² and classified into Thinness (BMI <18.5), Normal (BMI 18.5-22.9), Overweight (BMI 23.0-29.9), and Obesity (BMI ≥30.0) and Severe Obesity (BMI ≥40.0). An overview of the research stages can be seen in the flowchart shown in Figure 1.

Sampling method

Data were collected from 4,251 adolescents. Data cleaning was employed for gender, BMI, and Dimensions Mental Health data. The completeness of variables such as BMI and Dimensions of Mental Health because of input errors were considered in data cleaning. All cleaned data for analysis were 2,786 (Figure 1).

Data analysis method

Descriptive and comparative analyses were performed using Jamovi

software version 2.3.28. BMI and Dimensions of Mental Health were described using means and frequencies. The analysis of the association between BMI and emotional symptoms differed by sex using Pearson's Chi-Square Test, and to analyze a stratified by gender to examine whether the association of binary category differed between boys and girls using Multinomial Logistic Regression. "Normal" BMI serves as the reference category for the predictor and "Normal" emotional symptoms served as the reference categories for the predictor and outcome, respectively. The measures of association were also presented with Odds Ratios (OR) with 95% Confidence Intervals (95% CI).

Ethics Statement

All procedures were in accordance with ethical standards to protect respondents' information and privacy. Ethical approval was obtained from the Health Research Ethics Commission, Science of Health Faculty, University of Borneo Tarakan (No. 227/KEPK-FIKES UBT/XII/2025).

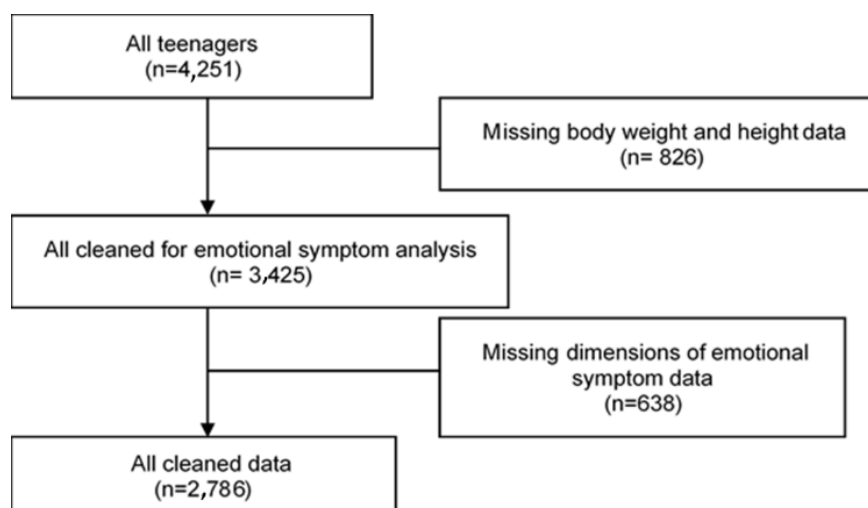


Figure 1. Overview of study population and results of data cleaning

Results

Table 1 presents the distribution of Body Mass Index (BMI) and Emotional Symptoms stratified by gender. Boys and Girls have similar Mean Body Mass Index

(respectively 19.7 ± 4.91 and 20.3 ± 4.54). The proportion of thinness was higher among boys (56.5%) than among girls (43.3%). Conversely, in the Normal weight category, the proportion of girls was higher (60.0%) than that of boys. In the

overweight and obesity categories, girls again demonstrated slightly higher proportion rates (54.5% and 54.0%, respectively). Severe obesity, although relatively rare ($n=29$), was more prevalent

among boys (53.3%). Emotional symptoms in girls showed a higher proportion in the “Abnormal” category (76.8% of cases). In contrast, boys dominated the “Normal” category (56.8%).

Table 1. Gender Differences of Body Image and Emotional Symptoms

Variables	Boys (N= 1315)		Girls (N = 1471)		Total (N= 2786)	
	Mean (SD)	n (%)	Mean (SD)	n (%)	Mean (SD)	n (%)
BMI	19.7 (4.91)		20.3 (4.54)		20 (4.73)	
Thinness		576 (56.6)		441 (43.4)		1017 (100)
Normal		505 (40)		758 (60.0)		1263 (100)
Overweight		153 (45.5)		183 (54.5)		336 (100)
Obesity		65 (46.0)		76 (54.0)		141 (100)
Severe Obesity		16 (53.3)		13 (46.7)		29 (100)
Emotional Symptoms						
Abnormal		169 (23.2)		560 (76.8)		729 (100)
Borderline		131 (43.2)		172 (56.8)		303 (100)
Normal		1015 (57.8)		739 (42.2)		1754 (100)

BMI = Body Mass Index

Table 2 presents the association between Body Mass Index (BMI) and Emotional Symptoms among boys and girls. The results revealed a statistically significant association between BMI and emotional symptoms in both boys ($p = 0.037$) and girls ($p = 0.024$). The association between BMI and emotional symptoms differed significantly by sex ($p < 0.001$). Thinness Boys reported the lowest proportion of abnormal symptoms (10.7%) and the highest prevalence of normal symptoms (78.5%). The

prevalence of abnormal symptoms in boys rose from 12.9% among those with Normal BMI to 17.6% among Overweight Boys, 18.5% among those with obesity, and further to the highest proportion among those with Severe Obesity (20.0%). Among Girls, the proportion of Abnormal symptom was higher from thinness (32.0%) to Normal BMI (39.8%) and remained elevated among those with Overweight (43.2%), Obesity (40.8%) and Severe Obesity (53.8%), although the sample size was limited ($n=13$).

Table 2. The Association between Body Mass Index and Emotional Symptom, Stratified by Sex

Gender	Body Mass Index	Emotional Symptom			Total n (%)	P value
		Abnormal n (%)	Borderline n (%)	Normal n (%)		
Boys	Thinness	62 (10.7)	62 (10.7)	453 (78.5)	577 (100.0)	0.037 ^a
	Normal	65 (12.9)	38 (7.5)	402 (79.5)	505 (100.0)	
	Overweight	27 (17.6)	21 (13.7)	105 (68.6)	153 (100.0)	
	Obesity	12 (18.5)	9 (13.8)	44 (67.7)	65 (100.0)	
	Severe Obesity	3 (20.0)	1 (6.7)	11 (73.3)	15 (100.0)	
Girls	Thinness	141 (32.0)	49 (11.1)	251 (56.9)	441 (100.0)	0.024 ^b
	Normal	302 (39.8)	91 (12.0)	365 (48.2)	758 (100.0)	
	Overweight	79 (43.2)	23 (12.6)	81 (44.3)	183 (100.0)	
	Obesity	31 (40.8)	6 (7.9)	39 (51.3)	76 (100.0)	
	Severe Obesity	7 (53.8)	3 (23.1)	3 (23.1)	13(100.0)	
P value						<0.001 ^c

^a = p value interaction of body mass index and emotional symptom among boy

^b = p value interaction of body mass index and emotional symptom among girl

^c = p value interaction gender differences of body mass index and emotional symptom

^{abc} was used Pearson chi square's test to analyse

Table 3 confirms that the association between BMI and emotional symptoms differs by sex. Among boys, overweight was significantly associated with borderline emotional symptoms compared to Normal BMI (OR = 2.12; 95%

CI: 1.19–3.76; $p = 0.011$), with 2.12 times higher odds. Among girls, thinness was associated with lower abnormal emotional symptoms (OR = 0.68; 95% CI: 0.53–0.88; $p = 0.003$), with 32% lower odds compared to Normal BMI.

Table 3. Multinomial Logistic Regression Examining the Association between Body Mass Index and Emotional Symptom, Stratified by Sex

Outcome	Predictor	Overall		Boys		Girls	
Emotional Symptoms	Body Mass Index	OR	95% CI	OR	95% CI	OR	95% CI
Normal - Borderline	Thinness - Normal	0.93	0.71 – 1.23	1.45	0.95 – 2.22	0.78	0.53 – 1.15
	Overweight - Normal	1.41	0.96 – 2.05	2.12 ²	1.19 – 3.76	1.14	0.68 – 1.91
	Obesity - Normal	1.07	0.60 – 1.92	2.16	0.98 – 4.77	0.62	0.25 – 1.50
	Severe Obesity - Normal	1.49	0.49 – 4.51	0.96	0.12 – 7.65	3.01	0.66 – 13.68
Normal - Abnormal	Thinness - Normal	0.60 ¹	0.49 – 0.74	0.85	0.58 – 1.23	0.68 ³	0.53 – 0.88
	Overweight - Normal	1.19	0.91 – 1.56	1.59	0.96 – 2.62	1.18	0.84 – 1.67
	Obesity - Normal	1.08	0.73 – 1.60	1.69	0.85 – 3.36	0.96	0.59 – 1.58
	Severe Obesity - Normal	1.49	0.59 – 2.90	1.69	0.46 – 6.21	2.12	0.61 – 7.29

¹ = p value: <0.001; ² = p value: 0.011; ³ = p value: 0.003

Discussion

This study investigated the association between body mass index and emotional symptoms among adolescents in the coastal areas of Kerala, India, with particular attention to gender differences. Our findings of a significant overall association between BMI and emotional symptoms among boys and girls contribute to the mixed literature. Sutaria et. Al.¹⁷ in their meta-analysis found that obesity was associated with depression only among girls, whereas this study identified significant associations in both sexes, albeit in different directions and at different BMI thresholds. Our results partially align with those of Halfon et al.¹⁰ and Topcu et al.⁸, who documented associations between obesity and various mental health problems, including anxiety and low self-esteem.^{7,9} However, this study expands upon existing research by showing that the connection varies by gender and that distinct BMI categories present different emotional difficulties for boys and girls.

The relationship between body weight and emotional well-being varies by sex, supporting the hypothesis that sex

modifies this association. Notably, among boys, overweight status was significantly associated with an increased likelihood of borderline emotional symptoms. In contrast, among girls, thinness was

associated with a 32% reduction in the odds of abnormal emotional symptoms. These contrasting patterns indicate that the psychological significance of body weight may differ between boys and girls.

Our finding that overweight boys had more than twice the odds of experiencing borderline emotional symptoms compared to their normal-weight counterparts aligns with some previous research but contradicts others. Keating et al found that obesity affected emotional functioning in girls but not boys¹¹, whereas this study identified significant effects specifically for overweight (not necessarily obese) boys. This discrepancy may reflect the contextual factors specific to the generational differences among Alpha Generation adolescents. Overweight boys may experience teasing or social exclusion that affects their emotional well-being. Other explanation, the alpha generations constant exposure to social media may amplify body image concerns even

among boys, who have traditionally been less affected by weight-related psychological distress.¹³ Thinness among boys in this study have the lowest proportion of abnormal emotional symptoms and the highest proportion of normal emotional symptoms. This contrast with Bonsergent, et al who found that thin boys had lower mental health than normal weight boys.¹⁸

Among girls, thinness emerged as a protective factor against abnormal emotional symptoms, with 32% lower odds than those with normal BMI. However, girls in all other BMI categories-normal, overweight, obesity, and severe obesity-showed progressively higher proportions of abnormal emotional symptoms. This pattern suggests that, for girls, any deviation from thinness may carry emotional risks. These findings are consistent with the extensive literature documenting greater body weight dissatisfaction among girls.^{14,15} The alpha generation girls in this study have grown up with social media platforms that disproportionately emphasize thin ideals for females. In coastal Tarakan City, where access to mental health services is limited, girls may have fewer opportunities to develop critical perspectives on these idealized images or to receive support for body image concerns. The protective effect of thinness for girls aligns with¹⁸ who found that mental health was higher for thin girls. However, this study extends these findings by quantifying the reduced odds of abnormal symptoms.

Biologically, nutritional status affects neurotransmitter production and mood regulation differently across genders.^{5,6,19} The protective effect of thinness in girls might reflect complex interactions between body composition, hormonal factors, and mood regulation during adolescence. Psychosocially, girls face greater sociocultural pressure to be thin, which may mean that thin girls experience less weight-related teasing and greater social acceptance, translating into better emotional health. For boys, who traditionally face less pressure for

thinness, being overweight may be more psychologically salient because it deviates from the expected norm. In coastal communities where physical labor is valued, overweight boys may be perceived as less capable, affecting their social standing and self-concept.

The developmental tasks of adolescence—including identity formation and increasing peer orientation—may make Alpha Generation adolescents particularly susceptible to weight-related emotional difficulties. Shin and Nam noted that adolescence is crucial for body image and self-concept development¹², and our findings suggest that this process is gendered in ways that have implications for mental health.

This study has several strengths, including the large sample size (2,786 adolescents), use of validated instruments (SDQ), and focus on an understudied population (Alpha Generation adolescents in coastal Indonesia). The stratified analysis by gender and the use of multinomial logistic regression allowed a nuanced examination of how different BMI categories relate to different levels of emotional symptoms.

This study has several limitations. First, the cross-sectional design precludes causal inference, making it impossible to determine whether BMI influences emotional symptoms, whether emotional symptoms influence BMI through effects on eating behavior, or whether both are affected by unmeasured confounders. Second, the data were collected from a single coastal city, limiting the generalizability of the results to other coastal or inland populations. Third, we lacked data on potential confounders, such as socioeconomic status, family dynamics, peer relationships, and social media use, which might influence both BMI and emotional symptoms. Fourth, the small sample size in the severe obesity category ($n=29$) limits confidence in the findings for this group. Fifth, the SDQ emotional symptoms subscale, although validated, does not provide clinical diagnoses of mental disorders.

Conclusion

The study showed that the association between body mass index and emotional symptoms among adolescents in the coastal areas of the alpha generation was significantly modified by gender. For boys, overweight status was associated with a higher likelihood of borderline emotional symptoms. For girls, thinness had significantly lower odds of abnormal symptoms, whereas all other BMI categories had elevated emotional difficulties. These findings underscore the importance of gender-sensitive approaches in public health programs targeting adolescent emotional well-being and suggest that coastal communities with limited mental health services may need to integrate nutritional and emotional support in accessible and culturally appropriate ways.

Ethics approval

This study was approved by the Health Research Ethics Committee of the Faculty of Health Science, University of Borneo Tarakan (approval number: 227/KEPK-FIKES UBT/XII/2025) Because of using secondary data from Public Health Centre in Tarakan City, the informed consent was obtained from all participants to participate collected by Public Health Centre.

Availability of data and materials

The datasets that were generated and analyzed are not available for publication because of the need to protect the privacy of the participants.

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Author Contribution

AYH contributed to the idea of the study, interpreted the data, and wrote the manuscript. MSZ and LS contribute to collected and analyzed data.

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