Iran J Psychiatry Behav Sci. 2018 June; 12(2):e11258. doi: 10.5812/ijpbs.11258.

Published online 2018 March 11. **Original Article**

Association Between Body Weight and Weight Misperception and Depressive Symptoms in Southeast Asian Nations (ASEAN) University Students: A Cross-National and Cross-Sectional Survey, 2014 - 2015

Karl Peltzer,[1,2,*] and Supa Pengpid[2,3]

[1]HIV/AIDS/STIs/and TB (HAST), Human Sciences Research Council, Pretoria, South Africa
[2]Department of Research and Innovation, University of Limpopo, Turfloop, South Africa
[3]ASEAN Institute for Health Development, Mahidol University, Salaya, Phutthamonthon, Nakhonpathom, Thailand

[*]*Corresponding author*: Address: Karl Peltzer, Human Sciences Research Council, Private Bag X 41, Pretoria 001, South Africa. Tel: +27-0123022000, Fax: +27-0123022001, E-mail: kpeltzer@hsrc.ac.za

Received 2017 March 11; **Revised** 2017 May 11; **Accepted** 2017 October 04.

Abstract

Background: Little is known on the correlation between categories of the misperception of body weight and depression.
Objectives: The study aimed to investigate the association between body weight, weight misperception categories, and depressive symptoms in ASEAN University students.
Methods: In a cross-sectional survey, 5,337 undergraduate university students from 8 ASEAN countries responded to a self-administered questionnaire and anthropometric measurements were taken in 2014 to 2015.
Results: In logistic regression analyses adjusted for confounding variables, overweight female university students tended to report more depressive symptoms than female students with normal body mass index (OR = 1.52, CI = 1.11, 2.05), and male university students with self-perceived overweight tended to report more depressive symptoms (OR = 1.63, CI = 1.12, 2.35) than male students with normal body weight perception. Overweight male university students with normal body weight perception tended to experience less depressive symptomatology (OR = 0.33, CI = 0.15, 0.72) than male students who had accurate perceptions of their body weight, and underweight male university students who self-perceived their body weight as overweight tended to display more depressive symptoms (OR = 5.63, CI = 1.91, 16.62).
Conclusions: Female university students who were overweight and male students with perceived overweight were having a higher prevalence of depression than students that had normal (perceived) weight. Male university students who underestimated their normal or overweight tended to have less depressive symptoms and male students that overestimated their underweight tended to report more depressive symptoms than male students who perceived their weight accurately.

Keywords: Asia, Body Mass Index, Body Weight, Depressive Symptom, Perception, Student, Young Adult

1. Background

Globally, the prevalence of overweight and obesity was 39% and 13%, respectively, in adults ($\geq$ 18 years) in 2014 (1). In the "Association of Southeast Asian Nations" (ASEAN) region, the proportion of overweight (Body Mass Index = BMI $\geq$ 25 - 29.99 kg^2) and obesity (BMI $\geq$ 30 kg^2) in adults ($\geq$ 20 years) ranged from 14.6% in Vietnam to 60.3% in Malaysia (2). Among adolescents, the overall prevalence of overweight or obesity across 7 ASEAN countries was 9.9%, ranging from 3.4% in Myanmar to 36.1% in Brunei Darussalam (3). Obesity constitutes a key risk for the development of a number of non-communicable diseases, such as cardiovascular disorders, type 2 diabetes, and specific types of cancer, which may lead to increased morbidity and premature death (4).

Emerging adulthood is an important period in preventive behavior development mitigated by changing influences of parents, peers, social contexts, and identity development (5). Obesity in emerging adulthood is not only associated with the development of non-communicable diseases, but also with mental disorders such as major depressive disorder (6, 7). Mannan et al. (6) found in a review that the relationship between depression and obesity is bi-directional. The body image is of great concern of emerging adults, such that having obesity can lower one's self-esteem and increase depressive symptoms (8). In a longitudinal study from adolescence to young adulthood in Australia, Al Mamun et al. (9) found that body weight perception, not the actual overweight, were related with men-

tal distress. In a cross-sectional study among adults in the USA, it was found that the perceived underweight among both women and men and perceived over weight among women was associated with depressive symptoms (10). In a small study of Korean university students, it was found that body weight overestimation was associated with depression symptoms (11). In an investigation among adolescents in South Korea, female students who overestimated and male students who underestimated their body weight had greater depressive symptoms than those students who perceived their weight accurately (8). These studies were predominantly conducted in high-income countries, and there is a lack of studies in low- and middle-countries such as in ASEAN.

It is essential to recognize the relationship between self-perceived body weight categories and depression symptoms among university students in ASEAN, so as to better design health interventions (8).

2. Objectives

The aim of this investigation assess the association between body weight and weight misperception categories as well as depressive symptoms in ASEAN university students.

3. Materials and Methods

3.1. Study Design and Settings

In a cross-sectional survey, a questionnaire on a range of health behaviours was self-administered and anthropometric measurements were taken among university students in 8 ASEAN countries.

3.2. Participants

Study collaborators arranged for data to be collected from an intended 700 college students (16 - 30 years) by trained researchers in 2014 to 2015 in 1 university per country in Indonesia, Malaysia, Myanmar, Philippines, Singapore, Thailand, and Vietnam. Using Epi-Info Version 7.1 (centers for disease control and prevention, Atlanta, GA; USA), the sample size was calculated as 663 (confidence of 99%).

3.3. Study Procedure

In each participating country, undergraduate students were surveyed in their language in classrooms (inclusion criteria: all students present in class) chosen by cluster sampling (1 university department randomly chosen from each faculty as a "primary sampling unit", and for each selected department randomly ordered undergraduate courses). Participation rates were in all countries more than 90%, except for Indonesia 69% and Myanmar 73%.

3.4. Questionnaires

Anthropometric measurements. Students' weight and height was examined. Body mass index (BMI) was classified according to the Asian criteria: normal weight (18.50 to 22.99), overweight (23.00 to 24.99), and 25.00+ as obese (12).

The questionnaire was developed in English, then translated and back translated into the languages (Bahasa, Khmer, Lao, Myanmar, Thai, Vietnamese) of the participating countries.

Body weight perception was evaluated by asking students if they thought of themselves to be "very overweight, slightly overweight, about right, slightly underweight or very underweight." (13). Reclassified "very or slightly underweight" as "underweight", "very or slightly overweight" as "overweight", and thoseresponding "about the right weight" were coded as having normal weight (8, 9).

3.5. Combination of Perceived Weight with BMI

Perceived weight categories were combined with BMI classifications into 6 mutually exclusive clusters: "Perception of self as underweight by those with normal weight, perception of self as normal weight by overweight individuals, perception of self as underweight by overweight individuals, perception of self as overweight by those with normal weight, perception of self as normal weight by underweight individuals, and perception of self as overweight by underweight individuals" (8, 9).

Depressive symptoms were assessed with the 10-item "Centres for Epidemiologic Studies Depression Scale (CES-D-10)" (14), validated in various cultures, including some of the study countries such as Thailand and Vietnam. It measures depressed mood over the past week and has been shown to be able to correctly identify clinical depression in adolescent and adult samples (15). Each item is measured on a 4-point likert scale, ranging from rarely (less than one day = 0) to most or all of the time (5 - 7 days = 3). Scoring is classified as 15 or more as representing severe depressive symptoms (14) (Cronbach alpha 0.72).

3.6. Confounding Variables

Socio-demographic questions included age, gender, and subjective socioeconomic background (13).

Subjective health status, "In general, would you say your health is…?" (1 = excellent to 5 = poor) (13).

A 4-item subjective happiness scale (SHS) (16) was used. (1 = strongly disagree to 5 = strongly agree). A total happiness score was computed and dichotomized using the median as a cut-off (Cronbach alpha 0.75).

Social support was assessed with 3 items from the social support questionnaire (17). Scores were dichotomized with the median as cut-point (Cronbach's alpha 0.92).

Physical activity was measured using the "International Physical Activity Questionnaire (IPAQ) short version, for the last 7 days (IPAQ-S7S)" (18), and scored according to the IPAQ manual into high, moderate, and low physical activity (19).

Tobacco use, "Do you currently use one or more of the following tobacco products (cigarettes, snuff, chewing tobacco, cigars, etc.)?" ("Yes" or "no") (20).

Binge alcohol use, "How often do you have (for men) 5 or more and (for women) 4 or more drinks on one occasion?" ("0 = never, 1 = less than monthly, 2 = monthly, 3 = weekly, and 4 = daily or almost daily") (21).

3.7. Data Analysis

Chi-square tests were used to calculate differences in the proportion of depressive symptoms.

The association between weight and weight perception categories and depressive symptoms was analyzed with logistic regression analyses. In the 1st regression model, unadjusted odds ratios and 95% confidence intervals are reported, and in the 2nd multivariable regression model adjustments were made with all confounding variables (age, socioeconomic status, country, social support, happiness, and self-reported health status). STATA 13.00 (StatCorp LP, College Station, TX) was used for all statistical analyses, including country adjustment.

3.8. Ethical Considerations

Ethics approvals were obtained from all participating institutions. Informed consent was obtained from all participating students.

4. Results

4.1. Sample Descriptives

The total study sample consisted of 5,337 undergraduate university students, with a mean age of 20.6 years, SD = 1.8, ranging from 16 to 30 years, and from 8 ASEAN countries (Indonesia: n = 231, Laos: n = 759, Malaysia: n = 1022, Myanmar: n = 333, Philippines: n = 765, Singapore: n = 677, Thailand: n = 785 and Vietnam: n = 765). Table 1 shows the sample characteristics according to the prevalence of depressive symptoms. Results of Chi-square statistical analyses found significant differences in the prevalence of depressive symptoms according to age (11.3% in 16 - 19 year-olds compared to 6.7% in 22 - 30 year-olds), socioeconomic status (10.3% in wealthier students), country income (9.8% in Malaysia, Singapore and Thailand), subjective health status (16.1% poorer health status), happiness (10.8% unhappy), 11.2% low social support, 10.7% measured overweight, and self-perceived body weight (9.9% in overweight) (Table 1).

4.2. Associations Between BMI Weight Categories, Self-Perceived Weight Categories, and Depression Symptoms

Results of the adjusted analysis shows that overweight university students tended to have more frequent depressive symptoms than students who had a normal BMI (OR = 1.38, CI = 1.09, 1.74). Gender stratified analysis found that overweight university females tended to report more depressive symptoms than female students who had a normal BMI (OR = 1.52, CI = 1.11, 2.05). Further, in adjusted analysis overall university students and male university students with self-perceived overweight tended to report depressive symptoms more often (OR=1.30, CI=1.04, 1.64, and OR = 1.63, CI = 1.12, 2.35, respectively) than overall students and male students with perceived normal body weight (Table 2).

4.3. Associations Between Categories of Weight Misperception and Depression

The adjusted stratified analysis with gender found that male university students with perceived normal body weight, even though they were overweight and those who self-perceived to be underweight even though they had normal weight, were less likely to experience depressive symptoms (OR = 0.33, CI = 0.15, 0.72, and OR = 0.58, CI = 0.36, respectively) than male students that had accurate body weight perceptions. Further, after adjusting for confounding variables, underweight male university students with a perceived overweight tended to display more depressive symptoms (OR = 5.63, CI = 1.91, 16.62) than male students who had accurately perceived their weight (Table 3).

5. Discussion

In this large study among university students, subjective body weight perceptions were in male student's correlated with depressive symptoms, as was also identified in some previous investigations (8-12). In addition, it was found among female university students that overweight was associated with depression symptoms. In a previous review, the association between depression and obesity was found to be bi-directional and greater among females than male adolescents (6). This study seems to confirm that the association between weight perception categories and depression differed by gender (8). For male students, it appears that perceptions of their own body weight impacted depression symptoms significantly more than measured overweight. On the other hand, contrary to some previous studies (8, 10), in this study, women who were actually overweight had more depressive symptoms. It could be that women in this study, in the ASEAN region, are more aware and sensitive to their body weight so that accurate weight perceptions of overweight may be linked to more

Table 1. Sample Characteristics Stratified by Severe Depressive Symptom (Scores 15 or More) (N = 5337)

Variables	Depressive Symptoms (Scores 15 or More)		P Value
	Yes (n = 443)	No (n = 4895)	
Gender			0.190
Female	259 (7.9)	3022 (92.1)	
Male	183 (8.9)	1871 (91.1)	
Age, y			< 0.001
16 - 19	177 (11.3)	1394 (88.7)	
20 - 21	161 (7.3)	2085 (92.7)	
22 - 30	104 (6.7)	1443 (93.3)	
Family background			< 0.001
Quite well off, wealthy	242 (7.1)	3158 (92.9)	
Quite poor, Not very well off	200 (10.3)	1737 (89.7)	
Residence			0.529
With parents	134 (7.9)	1554 (92.1)	
Away from parents	308 (8.4)	3337 (91.6)	
Country income			< 0.001
Upper middle income or high income[a]	243 (9.8)	2241 (90.2)	
Lower middle income[b]	199 (7.0)	2654 (93.0)	
Subjective health			< 0.001
Good	396 (7.8)	4651 (92.2)	
Poor	46 (16.1)	240 (83.9)	
Happiness			< 0.001
High	201 (6.5)	2903 (93.5)	
Low	239 (10.8)	1970 (89.2)	
Social support			< 0.001
High	187 (6.1)	2863 (93.9)	
Low	254 (11.2)	2016 (88.8)	
Physical activity			0.174
Moderate or high	201 (8.9)	2051 (91.1)	
Low	240 (7.9)	2805 (92.1)	
Tobacco use			0.144
No	405 (8.1)	4614 (91.9)	
Yes	26 (10.7)	217 (89.3)	
Binge drinking (past year)			0.637
No	339 (8.2)	3802 (91.8)	
Yes	103 (8.6)	1093 (91.4)	
BMI			0.003
Normal weight	229 (7.7)	2762 (92.3)	
Underweight	83 (7.4)	1043 (92.6)	
Overweight	130 (10.7)	1090 (89.3)	
Body weight perception			0.009
Normal weight	166 (7.6)	2009 (92.4)	
Underweight	90 (7.2)	1157 (92.8)	
Overweight	173 (9.9)	1566 (90.1)	

[a] Malaysia, Singapore and Thailand.
[b] Indonesia, Laos, Myanmar, Philippines and Vietnam.

depressive symptoms. Further, overweight male students with perceived normal weight tended to have more depressive symptoms. It appears that the misperception of normal weight protected male students from having depressive symptoms. Moreover, male students who were measured underweight and perceived themselves as being overweight had more depressive students. This result may be considered with caution due to the small sample size in

Table 2. Associations Between BMI Weight Categories, Self-Perceived Weight Categories and Depression Symptoms Among ASEAN University Students

Variable	Total	Men	Women
BMI	**CrOR (95% CI)**	**CrOR (95% CI)**	**CrOR (95% CI)**
Normal	1 (Reference)	1 (Reference)	1 (Reference)
Underweight	0.96 (0.74, 1.25)	1.35 (0.86, 2.11)	0.86 (0.62, 1.18)
Overweight	1.44 (1.15, 1.80)[a]	1.26 (0.90, 1.76)	1.62 (1.19, 2.21)[a]
BMI	AOR (95% CI)[b]	AOR (95% CI)[b]	AOR (95% CI)[b]
Normal	1 (Reference)	1 (Reference)	1 (Reference)
Underweight	0.92 (0.71, 1.21)	1.23 (0.77, 1.95)	0.82 (0.59, 1.15)
Overweight	1.38 (1.09, 1.74)[a]	1.27 (0.90, 1.80)	1.52 (1.11, 2.05)[a]
Weight perception	CrOR (95% CI)	CrOR (95% CI)	CrOR (95% CI)
Normal	1 (Reference)	1 (Reference)	1 (Reference)
Underweight	0.94 (0.72, 1.23)	0.96 (0.65, 1.41)	0.91 (0.63, 1.32)
Overweight	1.34 (1.07, 1.67)[c]	1.62 (1.13, 2.32)[a]	1.21 (0.91, 1.61)
Weight perception	AOR (95% CI)[b]	AOR (95% CI)[b]	AOR (95% CI)[b]
Normal	1 (Reference)	1 (Reference)	1 (Reference)
Underweight	0.91 (0.69, 1.20)	0.90 (0.60, 1.35)	0.93 (0.64, 1.36)
Overweight	1.30 (1.04, 1.64)[c]	1.63 (1.12, 2.35)[c]	1.15 (0.86, 1.55)

Abbreviations: AOR, adjusted odds ratio; CI, confidence interval; CrOR, crude odds ratio.
[a] $P < 0.01$.
[b] Adjusted for age, socioeconomic status, country, social support, happiness and self-reported health status.
[c] $P < 0.05$.

Table 3. Associations Between Categories of Weight Misperception and Depression Among ASEAN University Students

BMI	Weight Perception	Total	Men	Women
		CrOR (95% CI)	**CrOR (95% CI)**	**CrOR (95% CI)**
		Underestimate		
Accurate weight perception		1 (Reference)	1 (Reference)	1 (Reference)
Normal	Underweight	0.85 (0.60, 1.19)	0.59 (0.38, 0.93)[a]	1.27 (0.74, 2.11)
Overweight	Normal	0.58 (0.33, 0.99)[a]	0.33 (0.15, 0.72)[b]	1.12 (0.51, 2.45)
Overweight	Underweight	1.06 (0.32, 3.49)	1.24 (0.37, 4.22)	1.16 (0.50, 2.73)
		AOR (95% CI)[c]	**AOR (95% CI)[c]**	**AOR (95% CI)[c]**
Accurate weight perception		1 (Reference)	1 (Reference)	1 (Reference)
Normal	Underweight	0.82 (0.57, 1.17)	0.58 (0.36, 0.93)[a]	1.40 (0.81, 2.41)
Overweight	Normal	0.54 (0.31, 0.95)[a]	0.33 (0.15, 0.72)[b]	1.18 (0.53, 2.62)
Overweight	Underweight	0.97 (0.29, 3.26)	1.11 (0.32, 3.89)	1.30 (0.44, 3.82)
		Overestimate		
Accurate weight perception		1 (Reference)	1 (Reference)	1 (Reference)
Normal	Overweight	0.85 (0.63, 1.14)	1.03 (0.55, 1.96)	0.83 (0.59, 1.17)
Underweight	Normal	0.90 (0.59, 1.37)	0.75 (0.18, 3.16)	0.94 (0.60, 1.48)
Underweight	Overweight	1.41 (0.75, 2.68)	6.96 (2.45, 19.80)[d]	0.74 (0.30, 1.85)
Accurate weight perception		1 (Reference)	1 (Reference)	1 (Reference)
Normal	Overweight	0.88 (0.65, 1.20)	0.99 (0.51, 1.92)	0.84 (0.59, 1.19)
Underweight	Normal	0.95 (0.62, 1.48)	0.76 (0.17, 3.30)	0.94 (0.59, 1.48)
Underweight	Overweight	1.11 (0.56, 2.20)	5.63 (1.91, 16.62)[b]	0.49 (0.17, 1.36)

Abbreviations: AOR, adjusted odds ratio; CI, confidence interval; CrOR, crude odds ratio.
[a] $P < 0.05$.
[b] $P < 0.01$.
[c] Adjusted for age, socioeconomic status, country, social support, happiness and self-reported health status.
[d] $P < 0.001$.

the cells producing large confidence intervals. It is possible that the perception of being overweight is a compensation for the actual underweight wanting to look as having a bigger body shape and be more muscular, indicating possible dissatisfaction and emotional problems of measured underweight male university students (8).

5.1. Study Limitations

Due to the cross-sectional nature of the study, causal conclusions cannot be drawn and findings cannot be generalized since the sample was only drawn from 1 university in each country. Most of the information collected was by self-report, which may have biased responses.

5.2. Conclusions

Female university students who were overweight, male students with perceived overweight, and male students that overestimated their weight were at an increased risk for depression symptoms. Perceptions of body weight in influencing depression symptoms may need to be considered by health care providers in the management programming needs of this population.

Acknowledgments

The following colleagues participated in this ASEAN student health survey and contributed to data collection (locations of universities in parentheses): Indonesia: Erna Rochmawati (Yogyakarta), Laos: Vanphanom Sychareun (Vientiane), Malaysia: Wah Yun Low (Kuala Lumpur), Myanmar: HlaHla Win (Yangon), Philippines: Alice Ferrer (Miagao), Singapore: MeeLian Wong (Singapore), Thailand: Tawatchai Apidechkul (Chiang Rai), Vietnam: Thang Nguyen Huu (Hanoi).

Footnotes

Authors' Contribution: Both authors (Karl Peltzer and Supa Pengpid) have participated in this work via study of analysis design and interpretation of data, and writing of the manuscript. Both authors have contributed to writing, editing, reading, and approving the paper.

Declaration of Interest: The authors declare that they have no competing interests.

Funding/Support: The authors declare that they have no competing interests.

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