
Suicidal Ideation in Underweight Adults Who Attempt to Lose Weight: Korea National Health and Nutrition Examination Survey, 2007-2012

Original
Article

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ABSTRACT

Background: Being underweight has been related to health risks. However, little is known about the relationship between suicidal ideation and attempting to lose weight. This study was conducted to examine if there is an association between suicidal ideation and attempting to lose weight among underweight adults.

Methods: A cross-sectional study of 1,122 underweight adults (range, 19 to 69 years) was conducted based on the Korea National Health and Nutrition Examination Survey, 2007-2012. We examined suicidal ideation, doctor-diagnosed depression, depressive mood, stress, physical activity, health-related behavior, comorbidity, and socioeconomic status by weight loss attempts. Logistic regression analysis was performed to examine the association between suicidal ideation and weight loss attempts. The following covariates were controlled for: age, sex, physical activity, alcohol problem, marital status, education, income, occupation, self-perception of body image, chronic disease, and body mass index.

Results: There were 101 subjects in the weight loss attempt group and 1,021 in the non-attempt group. The attempt group had a higher risk of suicidal ideation (odds ratio [OR], 2.47; 95% confidence interval [CI], 1.35 to 4.53) and depressive symptoms (OR, 2.17; 95% CI, 1.19 to 3.98). After depressive symptoms were added to the covariates, the risk of suicidal ideation was also significant (OR 2.11, 95% CI: 1.03 to 4.35). The two groups did not significantly differ in doctor-diagnosed depression and stress.

Conclusion: Weight loss attempts were associated with suicidal ideation in underweight Korean adults.

Keywords: Thinness; Weight Loss; Suicidal Ideation

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INTRODUCTION

Being obese and being underweight have been related to higher mortality rates.¹⁾ Obesity adversely affects health by increasing the risk of metabolic diseases, cancers, and inflammatory diseases.²⁾ The adverse health effects of being underweight include an increase in the susceptibility of infectious disease; moreover, underweight expectant mothers have higher perinatal risks;³⁾ however, the risks associated with being underweight are not as well-studied as the risks associated with obesity. Moreover, attention to the adverse effects of being underweight is scarce.

In the field of mental health, the association between body mass index (BMI) and suicide or depression is well-reported; actual BMI and self-perceptions of BMI have been attributed to both suicide and depression.^{4,5)} In addition, self-perceived attempts to control weight have also been related to them.⁶⁾

Obese or overweight patients are under a considerable amount of stress; they are also at greater risk for depression due to socio-cultural factors,⁷⁾ However, being underweight has been associated with suicide.⁸⁾ For instance, in a large cohort study, it was reported that the risk of depression increased as body weight increased; however, there was an inverse relation between suicide and body weight.⁹⁾ Thus, being underweight may be a risk factor for suicide; indeed, it could raise the risk of suicide. Moreover, there could be a discordance between actual BMI, self-perception of BMI (body image misperception), and attempts to control weight.

According to the 2012 Korea National Health and Nutrition Examination Survey (KNHANES), the proportion of underweight people over 19 years of age was 5% (men 2.6%, women 7.3%).¹⁰⁾ To date, there have been studies that have focused on adolescents' weight control attempts and suicide, but these studies have not solely focused on underweight individuals. However, the pressure to be slim is not limited to a certain age and weight; indeed, underweight individuals may feel pressure to be skinny or to lose weight.^{11,12)}

Therefore, the aim of this study was to determine the factors that affect suicide in underweight adults. It was hypothesized that actual weight loss attempts rather than perceptions of body image would be directly related to suicide. Thus, we examined the association between weight loss attempts and suicidal ideation in underweight adults.

METHODS

1. Population

A cross-sectional study was conducted based on data from the KNHANES, 2007–2012; the KNHANES was conducted by the Korea Centers for Disease Control and Prevention. Specifically, a sample survey targeting the entire non-institutionalized civilian population was conducted with a complex, stratified, multistage, cluster-sampling design.¹⁰⁾ Subjects included in the KNHANES, 2007–2012 were 50,405 individuals aged ≥ 1 year. Of these individuals, 32,222 were 19 to 69 years.

Subjects with no anthropometric data ($n = 1,980$) and pregnant women ($n = 214$) were excluded; this resulted in 30,028 subjects remaining (12,925 men and 17,103 women). Among the remaining subjects, 1,338 were underweight; however, 216 were excluded because they failed to complete all of the questionnaires. Therefore, 1,122 (148 men and 974 women) were included in the analysis. This study was approved by institutional review board of Samsung Medical Center (IRB file no.: 2014-07-012).

2. Measurement

All anthropometric measurements and surveys were conducted in mobile examination centers by trained health professionals. The self-administered surveys included questions about health behaviors such as smoking, drinking, physical activity, and weight control. Data on socioeconomic status and history of chronic disease or cancer were obtained through face-to-face interviews.

Anthropometric measurements were taken while participants wore light clothing and no shoes. Height was measured to the nearest 0.1 cm (range, 6 to 230 cm) using a SECA-225 apparatus (SECA Deutschland, Hamburg, Germany). Weight was measured to the nearest 0.1 kg (≤ 200 kg) using a GL-6000-20 apparatus (CASKOREA, Seoul, Korea). BMI was calculated by dividing weight (kg) by the square of height (m^2); an individual was considered underweight if their BMI was < 18.5 kg/ m^2 .

The study population was divided into a weight loss attempt group and a non-attempt group; this was based on the questionnaires (e.g., weight loss attempt vs. maintain, gain, and no attempt during the past one year). Body self-perception was answered via five items (very thin, somewhat thin, average, somewhat obese, and very obese); these were classified into thin, average, or obese. Physical activity was calculated by the Korean version of the International Physical Activity Questionnaire (IPAQ) short form;¹³⁾ it was calculated as a continuous score (unit: metabolic equivalents [MET]-min/wk) and was classified into three categories. High physical activity was any one of the following 2 criteria (vigorous-intensity activity on at least 3 days and accumulating at least 1,500 MET-min/wk or 7 or more days of any combination of walking, moderate-intensity or vigorous intensity activities achieving a minimum of at least 3,000 MET-min/wk). Moderate physical activity was any one of the following 3 criteria (3 or more days of vigorous activity of at least 20 minutes per day, 5 or more days of moderate-intensity activity and/or walking of at least 30 minutes per day, 5 or more days of any combination of walking, moderate-intensity or vigorous-intensity activities achieving a minimum of at least 600 MET-min/wk). Low physical activity was the lowest level not to meet above two criteria (IPAQ: <http://www.ipaq.ki.se>). Smoking was classified into current and noncurrent smokers. A calculated AUDIT (alcohol use disorders identification test) score was used to define alcohol use disorder; this was defined as a score of more than 16 points.¹⁴⁾ Marital status was classified into married, unmarried and other (divorced, separated, and widowed). Education level was classified into high (more than high school graduate) and low (less than middle school). Income was categorized by quartiles; subjects were classified as high or low. Occupation was classified by the Korean Standard Classification of Occupations revised in 2007; specifically, individuals were categorized as non-manual workers, manual workers, and other (students,

housewives, and unemployed; soldiers were excluded). Chronic disease was diagnosed by a doctor and was defined as hypertension, dyslipidemia, diabetes, stroke, ischemic heart disease, arthritis, asthma, liver cirrhosis, and renal failure. Doctor-diagnosed cancers of the stomach, liver, colon, breast, cervix, lung, thyroid, and other organs were also reported. Individuals who had been previously diagnosed by a doctor as having any kind of cancer were considered as having a history of cancer.

Indicators related to mental health were defined as doctor-diagnosed depression, depressive symptoms lasting more than two consecutive weeks, suicidal ideation during the past year, any suicidal attempts during the past year, and the degree of stress awareness.

3. Statistical Analysis

Complex samples analysis was used to analyze the KNHANES raw data; IBM SPSS ver. 21.0 (IBM Co., Armonk, NY, USA) was used. Data were expressed as mean \pm standard error or percentage \pm standard error. The unweighted number of each variable was not shown. Chi-square tests and Student t-tests were used to analyze every component by weight loss attempt. Logistic regression analysis was used to control for the significant factors known to influence suicidal ideation or depression. There was no cancer diagnosis in the weight loss attempt group; thus, it was subsequently excluded from the logistic regression model. Depressive symptoms are known to be a weighty factor in similar studies; therefore, depressive symptoms were added to model 2 for sensitivity analysis. Differences were considered to be statistically significant when the P-value was < 0.05 . The prevalence of suicidal ideation in adults was about 15%¹⁰⁾ and the assumption of the control group was about 30%. Therefore, if alpha was 0.05, beta was 0.8, and the proportion between two groups was 0.1, adequate sample sizes were 667 for the non-attempt group and 67 for the attempt group.

RESULTS

Among the 1,122 subjects analyzed, the weight loss attempt group comprised 101 subjects and the non-attempt group comprised 1,021 subjects. The general characteristics of the underweight adults by weight loss attempt group are shown in Table 1. The mean age of the attempt group was significantly younger than the non-attempt group (27.5 ± 0.8 , 32.8 ± 0.9 , respectively). The mean BMI of the attempt group and the non-attempt group was 17.9 ± 0.1 and 17.6 ± 0.1 , respectively; the attempt group had significantly higher BMI than the non-attempt group. In addition, there were more women in the attempt group than the non-attempt group (97.4% vs. 83.0%, $P = 0.005$). For self-perceptions, the attempt group had a higher likelihood of perceiving themselves as not thin (63.2% vs. 19.1%; odds ratio [OR], 7.279; 95% confidence interval [CI], 4.451 to 11.905). The attempt group had a higher level of physical activity and education than the non-attempt group. There was no significant difference between the two groups in smoking status, alcohol problem, and income. Unadjusted mental health indicators are presented in Table 2. The attempt group had a higher likelihood of suicidal ideation and depressive symptoms as well as a higher level of stress than the non-attempt group (OR, 2.86; 95% CI,

1.76 to 4.65; OR, 2.40; 95% CI, 1.45 to 3.96; OR, 2.01; 95% CI, 1.26 to 3.22, respectively).

Table 1. General characteristics of underweight adults by weight loss attempt group

Characteristic	No attempt (unweighted n = 1,021)	Attempt (unweighted n = 101)	P-value*
Age (y)	32.8 ± 0.9	27.5 ± 0.8	0.001
Age group (y)			<0.001
19–39	76.8 (1.6)	93.8 (2.8)	
40–69	23.2 (1.6)	6.4 (2.8)	
Sex			0.005
Women	83.0 (1.5)	97.4 (2.1)	
Men	17.0 (1.5)	2.6 (2.1)	
Body mass index (kg/m ²)	17.6 ± 0.1	17.9 ± 0.1	<0.001
Self-perception			<0.001
Thin	80.9 (1.6)	36.8 (5.4)	
Average or obese	19.1 (1.6)	63.2 (5.4)	
MET-min/wk [†]	5,625 ± 981	5,262 ± 950	0.73
Physical activity category [†]			0.02
Low	68 (1.8)	52.4 (5.8)	
Moderate	21.4 (1.5)	30.3 (5.0)	
High	10.6 (1.1)	17.3 (4.5)	
Current smoking			0.41
No	81.1 (1.6)	84.9 (4.0)	
Yes	18.9 (1.6)	15.1 (4.0)	
Alcohol problem [‡]			0.71
No	93.6 (1.1)	92.4 (3.2)	
Yes	6.4 (1.1)	7.6 (3.2)	
Marital status			0.005
Married	48.7 (2.1)	30.0 (5.0)	
Unmarried	47.5 (2.1)	67.4 (5.2)	
Other [§]	3.8 (0.7)	2.6 (1.9)	
Education			0.001
≤Middle school	10.3 (1.1)	1.8 (1.0)	
≥High school	89.7 (1.1)	98.2 (1.0)	
Income			0.26
Low	36.8 (2.1)	30.3 (5.2)	
High	63.8 (.2.1)	69.7 (5.2)	
Occupation			0.14
Non-manual	42.5 (1.9)	56.5 (5.1)	
Manual	12.9 (1.3)	3.2 (2.2)	
Other	44.6 (1.9)	40.2 (5.0)	
Chronic disease			0.031
No	93.8 (0.8)	99.0 (1.0)	
Yes	6.2 (0.8)	1.0 (1.0)	
Cancer			0.252
No	98.5 (0.4)	100.0 (0)	
Yes	1.5 (0.4)	0	

Values are presented as mean ± standard error or % (SE).

*By t-test or chi-square test. [†]Metabolic equivalents assessed by International Physical Activity Questionnaire. [‡]Alcohol problem means AUDIT (alcohol use disorders identification test) score ≥16. [§]Including divorced, separated, and widowed. ^{||}Including students, housewives, and unemployed persons (soldiers were excluded).

Table 2. Mental health of underweight adults (unadjusted)

Characteristic	No attempt (unweighted n = 1,021)	Attempt (unweighted n = 101)	Odds ratio (95% confidence interval)	P-value*
Suicidal ideation			2.86 (1.76–4.65)	<0.001
No	83.8 (1.4)	64.5 (5.4)		
Yes	16.2 (1.4)	35.5 (5.4)		
Suicidal trial			No available	0.209
No	94.0 (2.2)	100 (0)		
Yes	6.0 (2.2)	0		
Doctor-diagnosed depression			0.28 (0.06–1.33)	0.087
No	90.5 (1.0)	97.1 (2.2)		
Yes	9.5 (1.0)	2.9 (2.2)		
Depressive symptoms			2.40 (1.45–3.96)	0.001
No	86.2 (1.3)	72.3 (4.7)		
Yes	13.8 (1.3)	27.7 (4.7)		
Stress			2.01 (1.26–3.22)	0.003
Low	68.2 (1.8)	51.6 (5.4)		
High	31.8 (1.8)	48.4 (5.4)		

Values are presented as % (standard error).

*By chi-square test.

The groups did not significantly differ on doctor-diagnosed depression. Suicidal trial was ‘0’ in the attempt group; therefore, it was not available for analysis. The factors that were independently related to weight loss attempts and were not related in this study were included in the logistic regression analysis (model 1) (Table 3); however, other studies have indicated that these factors are relevant. The significance of suicidal ideation and depressive symptoms were maintained (OR, 2.47; 95% CI, 1.35 to 4.53; OR, 2.17; 95% CI, 1.19 to 3.98, respectively). Doctor-diagnosed depression remained non-significant. The odds ratio of suicidal ideation after adjusting for depressive symptoms (model 2) decreased slightly, but remained statistically significant (OR, 2.11; 95% CI, 1.03 to 4.35).

Table 3. Results of multiple logistic regression analyses on weight loss attempts

Adults	Suicidal ideation		Doctor-diagnosed depression		Depressive symptom		Stress	
	Non-attempt*	Attempt*	Non-attempt	Attempt	Non-attempt	Attempt	Non-attempt	Attempt
Model 1 [†]	1.00	2.47 (1.35–4.53)	1.00	0.36 (0.65–1.73)	1.00	2.17 (1.19–3.98)	1.00	1.58 (0.93–2.69)
Model 2 [‡]	1.00	2.11 (1.03–4.35)	ND	ND	ND	ND	ND	ND

Values are presented as odds ratio (95% confidence interval).

ND: not done.

*Unweighted no. of attempt = 1,021; non-attempt = 101. [†]Model 1: adjusted by age group, sex, physical activity category, alcohol problem, marital status, education, income, occupation, self-perception, chronic disease, and body mass index. [‡]Model 2: adjusted by model 1 and depressive symptom.

DISCUSSION

This study was conducted to examine the effect of attempting to lose weight on suicidal ideation. We found that attempting to lose weight was significantly associated with suicidal ideation in underweight adults; this finding remained significant after adjusting for depressive symptoms. In previous studies, the misperception of body image has been related to suicidal ideation; these studies have indicated both an underestimation and overestimation.⁵⁾ Attempts to control weight appear to be influenced by the misperception of body image.¹⁵⁾ The findings of the current study indicated that attempting to lose weight was associated with suicidal ideation when controlling for body image misperception. Therefore, these findings suggest that attempting to lose weight is not just a consequence of misperceiving body image but also has an independent influence on suicidal ideation.

Other studies, including one using the 10–12 KNHANES, have shown that weight loss attempts in men and weight maintenance attempts in women were associated with suicidal ideation, after controlling for actual body weight and body image misperception;⁶⁾ this finding is consistent with the findings reported herein. However, there was no association between BMI and suicidal ideation. There are several, large cohort studies that have showed an inverse relationship between BMI and suicide. For instance, in Norway, 74,332 people were followed for 20 years; results indicated that lower BMI was associated with a higher rate of suicide.⁹⁾ In addition, 1,133,019 Swedish individuals born between 1956 and 1976 were observed for 14 years; this study indicated that suicide attempts increased with decreasing BMI. After controlling for depression in the underweight group, the risk of suicide attempts still remained significant in underweight individuals.¹⁶⁾ Moreover, in a study of 4 million United States veterans, a relation between suicidal death and being underweight was reported.¹⁷⁾ Furthermore, in a study following 800,000 people for up to seven years in the UK, results indicated that being underweight was related to suicide attempts. However, this finding was no longer significant after controlling for depression.¹⁸⁾

In sum, there have been inconsistent results regarding the association between being underweight and suicide. However, it has generally been found that being underweight is a risk factor for suicide, regardless of other socio-cultural factors or mental health problems (e.g., depression). This may be attributed to the fact that lower cholesterol levels affect the metabolism of serotonin and impulsiveness.¹⁹⁾ For instance, in animal experiments, depression and stress were affected by leptin secreted in adipocytes.²⁰⁾ Furthermore, a case-control study of humans confirmed that individuals who attempted suicide had lower cholesterol levels.²¹⁾

Depressive symptoms were significantly different in the weight loss attempt group and the non-attempt group; however, the two groups did not differ significantly in the diagnosis of depression. This may be the result of a discrepancy between the ratio of prevalence and actual diagnosis.²²⁾ In addition, it was recently reported that the prevalence of depression was 6.7%,²³⁾ however, it was 2.9% in the current study. It is possible that there was a selection bias in this population; there also may be no difference in the diagnosis of depression. The non-attempt group had higher physical activity; thus, it may be that physical activity influenced depressive symptoms in a way that prevented depression.²⁴⁾ Therefore, the

lack of difference in stress can be explained; however, that possibility seemed low. Therefore, a follow-up study seems necessary to examine differences in depression diagnosis.

A cross-sectional study in Korea analyzed the characteristics of individuals who lose weight when they are already underweight. These results indicated that underweight women had more attempts to lose weight; this was associated with a misperception of body image, a higher income, and being unmarried.¹¹⁾ There were similar socioeconomic characteristics between the two groups in the current study; this is likely due to socio-cultural pressure to be thin as depicted in the media. This may result in underweight individuals losing weight.^{25,26)}

Previous studies have separated men and women. However, in this study, the subjects were predominantly women; therefore, outcome variables did not change after conducting subgroup analysis by sex. Thus, the results of the entire population were reported.

The BMI of the attempt group was higher than the non-attempt group (17.9, 17.6); ideal BMI reported by high school girls was 17.3.²⁷⁾ This is under 18.5; thus, the difference in the decision to lose weight may depend on the degree of BMI, even among underweight individuals.

The current study used data targeting an entire population; this data was highly representative of Korea and there were ample subjects to include in the analysis. This is the first study to focus only on underweight adults. Importantly, attempts to lose weight were significantly associated with suicidal ideation after controlling for depressive symptom.

The current study had some limitations that require discussion. The association reported herein was from a cross-sectional study. Therefore, it was not possible to establish the exact pathophysiology linking weight loss attempts among underweight and suicidal ideation. The difference between subjects' current condition and the survey results may also exist since subjects reported about themselves within the past year. There are also a variety of clinical forms of suicide; these include ideation, attempt, or actual death. The current study only analyzed suicidal ideation because the number of suicide attempts was not large enough to include in the analysis. However, the findings reported herein do have clinical implications given that 30% of individuals that report suicidal ideation either plan their own suicide or attempt suicide within one year.²⁸⁾ Finally, other mental illnesses associated with being underweight and suicide (e.g., anorexia nervosa) were not considered herein; however, we believe that these would have a minimal effect because the response rate for mental health counseling was small.

In this study, we found that weight loss attempts among underweight adults were associated with suicidal ideation; this finding was independent of other factors such as depressive symptoms, socioeconomic factors, and health factors. This study may be helpful in assessing suicidal risk; further studies are needed to determine the causal relations between the variables examined herein.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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