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Gender Differences in Comorbidities and Attitudes Regarding Weight Control among Young Adults with Obesity in Korea

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Keywords
Gender difference · Attitude · Weight control · Young adult · Obesity

Abstract
Introduction: Obesity in young adulthood increases the risk for premature death, and the prevalence of obesity rapidly increasing among young adults, particularly in young men. We evaluated the gender differences in accompanying comorbidities and attitudes regarding weight control among young Korean adults with obesity. ***Materials and Methods:*** We analyzed 2,050 young adults with obesity (1,325 men and 725 women) in the 7th KNHANES (2016–2018) aged 19–44 years, with body mass indexes (BMIs) ≥25.0 kg/m^2. The odds ratios (ORs) and 95% confidence intervals (CIs) for poor lifestyle factors and accompanying illnesses as well as self-perceived weight status, weight control efforts, and weight control strategies in men compared to those in women were calculated by multivariate logistic regression analysis. ***Results:*** The mean BMIs and waist circumferences were 28.2 ± 0.1 kg/m^2 and 93.6 ± 0.2 cm and 28.6 ± 0.1 kg/m^2 and 88.7 ± 0.4 cm, in men and women, respectively. The ORs and 95% CIs for abdominal obesity (1.52, 1.11–2.07), hypertension (3.11, 2.20–4.40), hypercholesterolemia (1.45, 1.09–1.93), hypertriglyceridemia (3.37, 2.38–4.78), and elevated alanine transaminase concentration (6.53, 4.56–9.36) were higher in young men compared to those in young women. Despite the higher prevalences of comorbid conditions, the odds of inappropriate weight perception (8.13, 4.17–15.86), lack of weight control efforts (2.20, 1.71–2.84), lack of diet therapy (1.56, 1.13–2.16), lack of pharmacotherapy (13.27, 6.82–25.79), heavy drinking (1.32, 1.02–1.72), current smoking (6.92, 5.00–9.59), and frequent eating out (4.38, 3.35–5.71) were higher among men. However, the odds of not engaging in exercise (0.48, 0.35–0.64) were lower among men compared to that in women. ***Discussion:*** Despite their higher prevalences of comorbidities, appropriate weight perception and weight control efforts are insufficient in young men with obesity. These gender differences should be considered to provide tailored programs for weight reduction in young adults with obesity.

Introduction

The recent prevalence of obesity among young adults was 40% in the USA, 23% in England, and 2.3%–12% in developing countries [1–3]. The prevalence of obesity in the Asia-Pacific region defined as body mass index (BMI) of ≥25 kg/m^2 among young adults in their 30s was re-

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ported as 21.7% in Indonesia, 27.1% in China, and 36.9% in Thailand [4–6]. For the definition of obesity, the cutoff of BMI ≥25 kg/m^2 is recommended in the Asia-Pacific region instead of ≥30 kg/m^2 because obesity-associated risk factors and comorbidities increase in lower BMIs [7]. Obesity prevention at a young age is important because obesity can lead to cardiovascular diseases, diabetes, and cancers in later life, making it a major cause of premature death [8]. Furthermore, obesity in young adulthood is associated with risks of higher mortality regardless of obesity status in later life, while weight reduction in young adults with obesity results in a 50% reduction in mortality risk [9, 10]. The prevalence of obesity in Korea has rapidly increased in recent years, especially among young adults [11]. Therefore, there is an urgent need to develop strategies for obesity prevention among young adults in Korea.

Obesity prevention and treatment start with acknowledging one's accurate weight status and are consummated by weight control efforts including diet therapy, exercise, behavior therapy, and pharmacotherapy [12]. Self-perceived weight refers to how a person views his or her body size and weight irrespective of the actual BMI; in other words, whether he or she regards himself or herself to be underweight, normal, overweight, or obese [13]. An accurate perception of one's weight promotes appropriate weight control behaviors and eventually leads to weight loss and maintenance [14–16]. Conversely, underestimating one's weight is associated with increased risks for the development of overweight and obesity [13].

In 2018, the prevalence of obesity in Korea was higher among men (45.4%) than in women (26.5%) [11]. Furthermore, over the past decade, this prevalence has increased by approximately 10% in men, compared to approximately 2.5% in women [11]. This difference could be due to obesity stigmatization and social norms preferring thinness in women in Asian countries [17, 18]. In the same context, gender differences in self-perceived weight status and weight control efforts have also been reported. In general, men were less likely to have accurate weight perception and to attempt weight loss compared to women [19–21].

From 2009 to 2018, the obesity prevalence in Korea increased from 29.4% to 40.5% in men aged 20–29 years and from 38.9% to 51.0% in men aged 30–39 years, while it increased from 8.6% to 15.4% and from 14.0% to 19.2% in women in the same age groups, respectively [11]. Despite the existing literature on gender differences in weight perception, few studies have evaluated the gender differences in attitudes regarding weight control and accompanying comorbidities among young adults with obesity. Therefore, this study investigated the gender differences in accompanying illnesses as well as self-perceived weight status, weight control efforts, weight control strategies, and lifestyle factors in a nationwide representative sample of Korean young adults.

Materials and Methods

Study Participants

We analyzed data from the 7th Korea National Health and Nutrition Examination Survey (KNHANES) (2016–2018). The KNHANES is a nationwide representative cross-sectional survey conducted by the Korea Centers for Disease Control and Prevention (KCDC). It applies complex, clustered, stratified, and multistage probability sampling based on sex, age, and geographic areas. Detailed information about the methodology and study design has been reported previously [22]. The study protocol was approved by the institutional review board of the KCDC, and all participants provided informed consent. Among the 7,196 adults aged 19–44 years, in the 7th KNHANES, 2,105 (32.3%) met the requirement for obesity, defined as a BMI ≥25 kg/m^2 [7]. Of the 2,105 young adults with obesity, we excluded pregnant women (n = 34) and those with chronic debilitating diseases such as liver cirrhosis (n = 2), chronic kidney disease (n = 1), and cancer (n = 18), leaving 2,050 participants (1,325 men and 725 women) for the final analysis.

Demographic and Metabolic Profiles

Demographic variables including age, sex, household income, and educational status were collected. Household income was evaluated by the following open-ended question: "Approximately what was your household's total income in the past year, including wages, real estate income, pensions, interest, government subsidies, and allowances for relatives or children?" Household income was divided into quartiles, with the highest and lowest quartiles categorized as high and low income, respectively, and the second and third quartiles as middle income. Educational levels were categorized as either <12 years or ≥12 years, and marital status was categorized as married/cohabitated, separated/widowed/divorced, and unmarried.

Height and weight were measured using standardized techniques and equipment. Height was measured to the nearest 0.1 cm using a portable anthropometry device with the participant in an erect position. Weight was measured to the nearest 0.1 kg on a balanced scale. BMI was calculated by dividing the body weight by the square of height (kg/m^2). Waist circumference (WC) was measured to the nearest 0.1 cm at the midpoint between the lowest rib and the top of the iliac crest. Systolic blood pressure (SBP) and diastolic blood pressure (DBP) were measured according to standardized methods using a sphygmomanometer, while the participants were seated. Blood pressure was measured three times at 5-min intervals, with the average of the second and third measurements used in the analysis. Blood samples were collected after the participants had fasted for at least 8 h, and biochemical values, including fasting glucose, total cholesterol, low-density lipoprotein (LDL) cholesterol, high-density lipoprotein cholesterol, triglycer-

ides, aspartate aminotransferase, and alanine aminotransferase (ALT), were measured by a certified laboratory (Hitachi Automatic Analyzer 7600-210; Hitachi, Chiyoda, Japan).

Definitions of Lifestyle Characteristics and Comorbidities

Information on lifestyle characteristics including alcohol consumption, smoking status, and physical activity was collected. We categorized participants as non-, moderate, or heavy drinkers according to their drinking status according to the definitions from the National Institute on Alcohol Abuse and Alcoholism [23]. The participants were categorized as non- or current smokers according to their smoking status. Physical activity was evaluated using the Korean version of the Global Physical Activity Questionnaire (GPAQ), and the participants were categorized as performing low, middle, or high levels of physical activity [24].

Dietary variables were evaluated using the single-day 24-h recall method. Trained dieticians visited each participant's residence and conducted in-person interviews using a food consumption table. Based on the interview responses, the total energy intake (kcal/day) and the daily intakes of carbohydrates, proteins, and fat were calculated for each participant. Excessive energy intake was defined as consuming ≥125% of the estimated energy requirement for Koreans, while high fat intake was defined as a fat intake of ≥30% of the total energy intake [25]. The frequency of eating out was evaluated according to responses to the question: "On overage, how often did you eat out (including delivery food, packaged food, meal from school or workplace, and food provided by religious groups, etc.) and not eat home-cooked food in the past year?" Frequent eating out was defined as eating out ≥1 meal/day.

Abdominal obesity was defined as WC ≥90 cm in men and ≥85 cm in women [26]. The presence of diabetes was defined as: (1) fasting glucose ≥126 mg/dL, (2) diagnosed with diabetes by a physician, or (3) taking oral antidiabetic medications or insulin. Hypertension was defined: (1) SBP ≥140 mm Hg, (2) DBP ≥90 mm Hg, or (3) taking antihypertensive medications. Hypercholesterolemia was defined as a total cholesterol level ≥240 mg/dL or taking lipid-lowering agents. Hypertriglyceridemia was defined a triglyceride level ≥200 mg/dL. Elevated ALT was defined as ALT ≥40 IU/L.

Self-Perceived Weight Status, Weight Control Efforts, and Weight Control Strategies

Self-perceived weight status was evaluated by the following question: "How do you think of your body shape?" The participants were asked to select one of the following items: "very thin," "slightly thin," "normal," "slightly obese," and "very obese." Participants who answered "very obese" or "slightly obese" were categorized as having an obese self-perception, while those who answered "normal," "slightly thin," or "very thin" were categorized as having a nonobese self-perception.

Weight control effort in the past year was evaluated according to the responses to the question: "Have you tried to control your body weight by your own will in the past year?" The participants were asked to select one of the following items: "I've tried to reduce my body weight," "I've tried to maintain my body weight," or "I've never tried to control my body weight." Participants who had tried to reduce or maintain their body weight were classified as having performed weight control efforts, while those who did not try to control their body weight were classified as not having performed weight control efforts in the past year. Participants who reported having tried to reduce or maintain their body weight were additionally asked to indicate the weight control methods that they had used in the past year from among "exercise," "diet therapy," and "pharmacotherapy."

Statistical Analysis

All analyses were performed after accounting for the complex sample design and sample weights to represent the Korean population. Descriptive statistics were used to show the distributions of metabolic profiles, lifestyle factors, and comorbidities in young men and women with obesity. For continuous variables, the values were presented as means and standard error, and Student's *t* tests were used to compare characteristics between men and women. For categorical variables, the values were presented as unweighted numbers and weighted percentages with χ^2 tests used to compare characteristics between men and women. We also compared self-perceived weight status, weight control efforts, and weight control strategies between young men and women with obesity using χ^2 tests.

To evaluate gender differences, the odds ratios (ORs) and 95% confidence intervals (CIs) for poor lifestyle factors and comorbidities in men compared to those in women were calculated by multivariate logistic regression analysis. The ORs and 95% CIs for self-perceived weight status, weight control efforts, and weight control strategies in men compared to those in women were also obtained. All analyses were conducted using IBM SPSS Statistics for Windows version 23.0 (IBM Corp., Armonk, NY, USA), and two-tailed *p* values <0.05 were considered statistically significant.

Results

Demographic, Anthropometric, and Metabolic Profiles in Young Men and Women with Obesity

Table 1 shows the basic characteristics of the study participants. The mean ages in men and women were 32.9 ± 0.2 years and 33.3 ± 0.4 years, respectively. The proportion of low household income was higher in women, whereas the proportion of high income was higher in men. There was no significant difference in educational levels between men and women. The proportion of married/cohabitated participants was higher in women, and the proportion of unmarried participants was higher in men. The mean BMIs and WCs for young men and women with obesity were 28.2 ± 0.1 kg/m^2 and 93.6 ± 0.2 cm and 28.6 ± 0.1 kg/m^2 and 88.7 ± 0.4 cm, respectively. The mean SBP, DBP, total cholesterol, triglycerides, aspartate aminotransferase, and ALT levels were higher in men, while the mean high-density lipoprotein cholesterol level was higher in women. There were no significant differences in fasting glucose and LDL cholesterol levels between men and women.

Table 1. Demographic characteristics and metabolic profiles in obese young men and women

	Men (n = 1,325)	Women (n = 725)	p value
Age, years	32.9 (0.2)	33.3 (0.4)	0.294
Height, cm	174.5 (0.2)	160.9 (0.3)	<0.001
Weight, kg	86.0 (0.3)	74.1 (0.4)	<0.001
BMI, kg/m^2	28.2 (0.1)	28.6 (0.1)	0.019
Abdominal circumference, cm	93.6 (0.2)	88.7 (0.4)	<0.001
SBP, mm Hg	121.2 (0.4)	112.6 (0.5)	<0.001
DBP, mm Hg	81.9 (0.3)	75.9 (0.4)	<0.001
Fasting glucose, mg/dL	100.5 (0.8)	99.4 (1.2)	0.473
Total cholesterol, mg/dL	200.5 (1.2)	195.6 (1.6)	0.012
LDL cholesterol, mg/dL	117.8 (1.1)	118.2 (1.4)	0.818
HDL cholesterol, mg/dL	44.6 (0.3)	51.1 (0.5)	<0.001
Triglycerides, mg/dL	190.6 (4.4)	131.1 (3.8)	<0.001
AST, IU/L	27.6 (0.4)	19.7 (0.4)	<0.001
ALT, IU/L	40.5 (0.9)	20.7 (0.7)	<0.001
Household income			
Low	92 (7.6)	70 (9.8)	
Middle	773 (59.5)	493 (66.7)	<0.001
High	458 (32.9)	162 (23.5)	
Education			
<12 years	491 (41.5)	313 (44.3)	0.256
≥12 years	764 (58.5)	380 (55.7)	
Marital status			
Married/cohabitated	731 (49.3)	484 (62.1)	
Separated/widowed/divorced	19 (1.1)	31 (3.6)	<0.001
Unmarried	575 (495)	210 (34.3)	

Values are presented as mean (standard error) or unweighted number (weighted percentage). LDL, low-density lipoprotein; HDL, high-density lipoprotein; AST, aspartate aminotransferase; ALT, alanine aminotransferase.

Prevalence of Lifestyle Factors and Comorbidities in Young Men and Women with Obesity

Table 2 shows the prevalences of lifestyle factors and comorbidities in young men and women with obesity. The proportions of heavy drinkers, current smokers, and those engaging in low physical activity were 25.6%, 43.2%, and 48.5%, respectively, in men and 20.4%, 10.2%, and 54.7%, respectively, in women. Excessive energy and high fat intake were noted in 23.6% and 20.5% of men and 19.4% and 19.8% of women, respectively. The frequency of eating out was higher in men compared to that in women. The prevalences of hypertension, hypercholesterolemia, hypertriglyceridemia, and elevated ALT were significantly higher in men than those in women (24.5%, 17.2%, 32.5%, and 34.6%, respectively, in men; 12.8%, 13.0%, 13.2%, and 9.6%, respectively, in women). There was no significant difference in the prevalence of diabetes between young men and women with obesity.

Gender Differences in Attitudes regarding Weight Control and Comorbidities

Approximately 11% and 2% of young men and women with obesity perceived themselves as nonobese and 30.8% and 16.6% reported no weight control efforts in the past year. Regarding weight control strategies, 82.2% and 67.1% of men and women, respectively, reported exercising in the past year, while 71.9% and 79.7% had tried diet therapy and 1.0% and 14.3% had received pharmacotherapy (Table 2).

Table 3 shows the ORs and 95% CIs of the attitudes regarding weight control and lifestyle in men compared to those in women. After adjusting for age, BMI, household income, education, and marital status, the odds for inappropriate self-perception of weight (OR 8.13, 95% CI: 4.17–15.86) and lack of weight control effort in the past year (2.20, 1.71–2.84) were higher among men compared to those in women. Regarding weight control strategies, the odds of a lack of diet therapy (1.56, 1.13–2.16) and not receiving pharmacotherapy (13.27, 6.82–25.79)

Table 2. Prevalence of lifestyle factors and comorbidities in obese young men and women

	Men (*n* = 1,325) *N* (%)	Women (*n* = 725) *N* (%)	*p* value
Alcohol consumption			
Nondrinker	115 (8.9)	145 (19.7)	
Moderate drinker	841 (65.5)	426 (60.0)	<0.001
Heavy drinker	358 (25.6)	149 (20.4)	
Smoking status			
Nonsmoker	737 (56.8)	650 (89.8)	<0.001
Current smoker	577 (43.2)	70 (10.2)	
Physical activity			
Low	628 (48.5)	392 (54.7)	
Middle	420 (33.3)	239 (35.9)	<0.001
High	205 (18.3)	61 (9.4)	
Excessive energy intake			
No	813 (76.4)	531 (80.6)	0.071
Yes	269 (23.6)	122 (19.4)	
Fat intake, %			
<30	867 (79.5)	524 (80.2)	0.772
≥30	215 (20.5)	129 (19.8)	
Frequency of eating out			
<1 meal/day	512 (47.4)	535 (79.7)	<0.001
≥1 meal/day	571 (52.6)	118 (20.3)	
Comorbidities			
Abdominal obesity[a]	888 (65.9)	465 (62.2)	0.141
Diabetes	79 (6.4)	52 (7.1)	0.569
Hypertension	340 (24.5)	98 (12.8)	<0.001
Hypercholesterolemia	224 (17.2)	95 (13.0)	0.019
Hypertriglyceridemia	312 (32.5)	75 (13.2)	<0.001
Elevated ALT	451 (34.6)	74 (9.6)	<0.001
Self-perceived weight status			
Obese	1,167 (88.7)	705 (98.0)	<0.001
Nonobese	147 (11.3)	15 (2.0)	
Weight control effort in the past 1 year			
Yes	914 (69.2)	589 (83.4)	<0.001
No	392 (30.8)	129 (16.6)	
Weight control strategies			
Exercise			
Yes	747 (82.2)	402 (67.1)	<0.001
No	167 (17.8)	187 (32.9)	
Diet therapy			
Yes	642 (71.9)	479 (79.7)	0.005
No	272 (28.1)	110 (20.3)	
Pharmacotherapy			
Yes	11 (1.0)	85 (14.3)	<0.001
No	903 (99.0)	504 (85.7)	

Values are presented as unweighted number (weighted percentage). ALT, alanine aminotransferase. [a] Abdominal obesity was defined as WC ≥90 cm in men and ≥85 cm in women.

were higher in men compared to those in women. In contrast, the odds for not engaging in exercise (0.48, 0.35–0.64) were lower among men compared to those in women. Furthermore, the odds for heavy drinking (1.32, 1.02–1.72), current smoking (6.92, 5.00–9.59), and frequent eating out (4.38, 3.35–5.71) were higher in men compared to those in women.

Figure 1 shows the ORs and 95% CIs for comorbidities in men compared with women. After adjusting for age, BMI, household income, education, and marital status,

Table 3. ORs and 95% CIs for attitudes regarding weight control and lifestyles in men compared to those in women

	OR (95% CI)	AOR (95% CI)[a]
Inappropriate self-perception of weight		
Women	1.00	1.00
Men	6.29 (3.35–11.83)	8.13 (4.17–15.86)
No weight control effort in the past 1 year		
Women	1.00	1.00
Men	2.24 (1.75–2.87)	2.20 (1.71–2.84)
No exercise		
Women	1.00	1.00
Men	0.44 (0.33–0.59)	0.48 (0.35–0.64)
No diet therapy		
Women	1.00	1.00
Men	1.53 (1.13–2.07)	1.56 (1.13–2.16)
No pharmacotherapy		
Women	1.00	1.00
Men	15.98 (8.11–31.50)	13.27 (6.82–25.79)
Heavy drinking		
Women	1.00	1.00
Men	1.35 (1.05–1.74)	1.32 (1.02–1.72)
Current smoking		
Women	1.00	1.00
Men	6.72 (4.94–9.14)	6.92 (5.00–9.59)
Low physical activity		
Women	1.00	1.00
Men	0.78 (0.63–0.97)	0.85 (0.67–1.07)
Excessive energy intake		
Women	1.00	1.00
Men	1.28 (0.98–1.67)	1.22 (0.92–1.63)
High fat intake		
Women	1.00	1.00
Men	1.04 (0.79–1.36)	0.96 (0.72–1.29)
Frequent eating out		
Women	1.00	1.00
Men	4.35 (3.39–5.60)	4.38 (3.35–5.71)

[a] Adjusted for age, BMI, household income, education, and marital status. OR, odds ratio; CI, confidence interval; AOR, adjusted odds ratio.

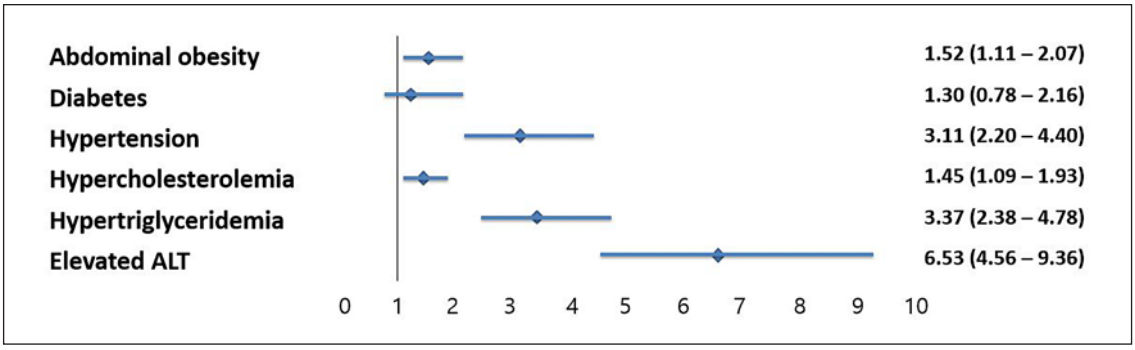

Fig. 1. Adjusted ORs and 95% CIs for comorbidities in men compared to those in women. Values are adjusted for age, BMI, household income, education, and marital status.

the odds for abdominal obesity (1.52, 1.11–2.07), hypertension (3.11, 2.20–4.40), hypercholesterolemia (1.45, 1.09–1.93), hypertriglyceridemia (3.37, 2.38–4.78), and elevated ALT (6.53, 4.56–9.36) were higher in men compared to those in women, although the average BMI was higher among women in this study population.

Discussion

The results of this study showed that despite their higher prevalences of abdominal obesity, hypertension, hypercholesterolemia, hypertriglyceridemia, and elevated ALT, young men in Korea with obesity had relatively inappropriate weight perceptions and fewer weight control efforts compared to those in young women with obesity. Furthermore, compared to young women with obesity, young men with obesity in Korea reported fewer efforts to perform diet therapy and to receive pharmacotherapy although they showed higher engagement in exercise as a means of weight control.

Among lifestyle factors, young men with obesity were more likely to engage in heavy drinking, smoke cigarettes, and eat out compared to women. In our study, more than 90% and 80% of men and women, respectively, consumed alcohol. Alcohol has a high caloric content and interferes with peripheral fat utilization and breakdown [27]. Furthermore, excessive alcohol consumption increases the risk for abdominal obesity, insulin resistance, diabetes, metabolic syndrome, and hypertriglyceridemia [12, 27]. Compared to the prevalence of alcohol consumption in the Korean general population (70.5% and 51.2% in men and women, respectively) [28], our study population had a much higher prevalence of alcohol consumption. Alcohol consumption should be reduced in young men and women with obesity.

Smoking increases the risk of metabolic syndrome and diabetes by increasing insulin resistance and central fat accumulation [29]. A study of middle-aged adults in the general population of England reported a 7% prevalence of smoking among adults with obesity [30]. The prevalences of smoking among young men and women with obesity in the present study were 43.2% and 10.2%, respectively, much higher than those reported previously in adults with obesity in Western countries. Furthermore, the prevalence of smoking in this study population was also higher than that of the general Korean population (36.7% and 7.5% in men and women, respectively) [28]. Behavior therapy in young adults with obesity should reinforce smoking cessation.

Eating out leads to increased body weight and WC due to increased energy and fat intake [31, 32]; however, more than half of the young men with obesity in Korea eat food away from home every day. This could be due to company-wide dining, which is very common in Korean working place [33]. People in the same working place eat and drink for multiple rounds at multiple venues. One study in Japan reported gender differences in unhealthy dietary behaviors among adolescents [34]. In this study, boys were more likely to skip breakfast, eat snacks, eat out, skip meals and eat alone at dinner compared with girls. Young adults should be introduced to healthy food environment, and gender differences in eating environment and dietary behaviors should be considered for obesity management. Physical activity should be emphasized more in women as the prevalence of low physical activity was higher and that of high physical activity was lower in women than in men.

Our study showed that the proportion of low income was higher in obese women, whereas the proportion of high income was higher in obese men. Previous study reported a negative relationship between income and obesity rate among women in high-income countries and no significant relationship between income and obesity rate among men in high income countries [35]. We can speculate that men with high income are more likely to be nonmanual workers, which do not involve physical activity during working hours, and women with low income are less likely to focus on exercise and good nutrition because they have to spend time for making money.

A study in England reported prevalences of SBP ≥145 mm Hg of 26.4% and 24.0%, respectively, among men and women aged ≥15 years with obesity with BMI ≥30 kg/m^2 [36]. Furthermore, the prevalences of LDL ≥3 mmol/L (117 mg/dL) were 11.5% and 10.9%, respectively [36]. Moreover, studies in Japan reported a stronger association of obesity with hypertension and diabetes in women than in men [37, 38]. Despite the relatively young age for developing comorbidities, approximately 25% and 13% of men and women with obesity with BMI ≥25 kg/m^2 in our study already had hypertension and approximately 6% and 7%, respectively, had diabetes. The prevalence of comorbidities including abdominal obesity, hypertension, hypercholesterolemia, hypertriglyceridemia, and elevated ALT was higher among men compared to that in women. Contrary to the prevalences reported in England and Japan [36–38], the prevalence of comorbidities in men was much higher than women among Koreans with obesity. In a study evaluating the prevalence, awareness, and control of hypertension, diabetes, and dyslipidemia in a Korean population, men generally showed higher prevalences of these comorbidities but lower awareness and control rates [39]. Thus, the awareness of obesity-

related comorbidities should be increased in men. According to the 2019 Obesity Fact Sheet in Korea, young adults with class I, II, and III obesity had 1.6-, 2.7-, and 4-fold increased risks of developing myocardial infarction and stroke compared to the risk in young adults of normal weight [11]. As obesity can ultimately lead to cardiovascular diseases and multiple existing comorbidities, obesity prevention in young adults is urgently needed.

The young men in this study showed approximately eightfold higher misperceptions of their weight and a twofold higher lack of weight control effort compared to those in young women with obesity in Korea. Previous studies have reported similar findings [19–21]. A nationwide study of overweight and obese adults in the USA showed that 65.6% and 84.0% of men and women had accurate weight perceptions, and that 43.3% and 58.3%, respectively, had attempted to lose weight [19]. Another study reported that for all BMI categories, men were less likely than women to have accurate weight perceptions [40]. The reason for higher misperception and lack of weight control effort among men may include social norms preferring heavier and muscular bodies in men [41]. Weight misperception was specifically associated with fewer weight loss attempts, whereas appropriate weight perception was associated with positive weight control behaviors [15, 42]. Although young men with obesity showed higher engagement in exercise compared to young women with obesity, they less often attempted diet therapy and pharmacotherapy. Thus, weight control education requires an increased emphasis in young men with obesity.

This study has several limitations. First, the KNHANES is a cross-sectional survey, which prevents us from determining causal relationships. However, as the study objective was to demonstrate gender differences in comorbidities and attitudes regarding weight control, the cross-sectional design was acceptable. Second, recall bias may have influenced the classifications of lifestyle factors and weight-associated variables in this study, as most of the classifications were made based on survey responses. Reliability and validity issues are possible, especially for self-reported weight-associated variables as participants may misreport weight-associated variables for social, cultural, and psychological reasons. Third, we could not identify individuals with secondary obesity because the KNHANES does not contain questionnaires regarding the diagnosis of endocrine disorders, hypothalamic disorders, and some congenital conditions causing obesity. However, the prevalence of secondary obesity would be very small; thus, overall results would not be significantly influenced. Last, we were not able to analyze body composition and fat distribution although these may have influenced different abdominal obesity levels and biochemical variation of men and women. Despite these limitations, our results demonstrated the seriousness of weight control behaviors and comorbidities among Korean young men. Future study comparing gender differences in comorbidities and attitudes regarding weight control among obese adults from different countries would be meaningful.

Conclusion

Despite their higher prevalences of obesity-related comorbidities, young men with obesity in Korea had relatively inappropriate weight perceptions and fewer weight control efforts compared to those in young women with obesity. These gender differences should be considered to provide tailored programs for weight reduction in young adults with obesity.

Statement of Ethics

All participants provided written informed consent to participate in the Korea National Health and Nutrition Examination Survey (KNHANES). The Research Ethics Review Committee of the Korea Centers for Disease Control and Prevention approved the survey protocol (2018-01-03-P-A).

Conflict of Interest Statement

All authors declare that they have no conflicts of interest.

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Author Contributions

Hye Soon Park and Seo Young Kang designed the study; Seo Young Kang analyzed data; Seo Young Kang wrote the manuscript; and Hye Soon Park and Seo Young Kang reviewed and critically revised the manuscript. All the authors were involved in writing the paper and had final approval of the submitted and published versions.

Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon request.

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