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Ph.D. Dissertation of Nursing

Unhealthy weight control
behaviors and related factors by
gender and weight status: Results
from a nationally representative
sample of Korean adolescents

한국 청소년의 성별과 체중 상태에 따른
부적절한 체중조절 행동 및 관련 요인

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Unhealthy weight control behaviors and related factors by gender and weight status: Results from a nationally representative sample of Korean adolescents

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이 논문을 간호학박사 학위논문으로 제출함

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Abstract

Adolescence is a period of extremely rapid and diverse growth and development, and changes in the bodies of adolescents can make them self-conscious about their body shape. When they perceive that their changing body does not match the thin ideal, adolescents may engage in unnecessary or unhealthy strategies to control their weight. Regrettably, the proportion of adolescents using unhealthy tactics such as fasting, vomiting, the use of laxatives or diuretics, or diet pills, has reached 44% worldwide, indicating that these are now prevalent strategies. Given the negative physical and psychological consequences of unhealthy weight control behaviors, it is extremely important to identify the factors associated with such behaviors in this population. Thus far, multiple studies have uncovered a range of factors and identified gender differences in the extent to which they influence unhealthy weight control behaviors. However, studies that examine how these factors vary according to weight status are limited.

Therefore, using a nationally representative sample of Korean adolescents, this study aimed to identify whether sociodemographic, health-related behavioral, psychosocial, and school factors are differentially associated with unhealthy weight control behaviors according to gender and subdivided weight status. To achieve this, the data of 18,159 adolescents who completed the Korea Youth Risk Behavior Survey were extracted for analysis. A complex sample logistic regression analysis was performed to

identify factors related to unhealthy weight control behaviors among adolescents. Odds ratios and 95% confidence intervals were obtained from the logistic regression models and disaggregated by gender and weight status.

The results revealed that factors associated with unhealthy weight control behaviors were not consistently associated across weight groups. In normal-weight male adolescents, consumption of fast food three or more times per week, current alcohol use, underestimation of weight status, and experience of depressive symptoms or violent victimization were related to a higher risk of UWCB. By contrast, regular breakfast consumption lowered the risk of UWCB in this group. In overweight male adolescents, experience of depressive symptoms was correlated with a higher risk of UWCB, whereas regular breakfast consumption and experiences of nutrition education were correlated with a lower risk. In obese male adolescents, experience of depressive symptoms or violent victimization were correlated with a higher risk of UWCB, but regular breakfast was a protective factor for UWCB. All health-related behavioral, psychosocial, and school factors were related to UWCB in normal-weight female adolescents. However, in overweight female adolescents, the only risk factor for UWCB was the experience of depressive symptoms, and only regular breakfast consumption was a protective factor. In the case of obese female adolescents, fast food consumption three or more times per week, current smoking, and experiencing depressive symptoms or violent victimization were risk factors

for UWCB. By contrast, consuming vegetables three or more times a day and physical education classes that involved physical exercise three or more times a week were protective factors for UWCB.

The results suggest that the establishment of intervention strategies to prevent and manage unhealthy weight control behaviors in adolescents should be differentiated according to weight status as well as gender.

Keyword : adolescent, disordered eating, health behavior, weight management, unhealthy weight control behavior, KYRBS

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Bae, E., & Yoon, J. (2023). Unhealthy weight control behaviors and related factors by gender and weight status: Results from a nationally representative sample of Korean adolescents. *Archives of Psychiatric Nursing*, 42, 75-83.

This dissertation offers an expansion of the literature review and the conceptual framework according to the doctoral dissertation format of College of Nursing, Seoul National University.

In addition, the study uses the data collected by the Korea Disease Control and Prevention Agency. It is clearly stated that neither the organizations have been involved in the process of the study, nor did they intervene with the study results.

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I. Introduction

1. Study Background

Obesity in adolescents has become a serious public health issue, increasing concerns about adolescents' weight control practices. Adolescence is a period of diverse and rapid development, and changes in the bodies of adolescents can make them self-conscious about their body shape (Voelker et al., 2015). Contemporary culture promotes slim and thin bodies for girls and lean bodies for boys. As a consequence, adolescents, regardless of their gender and weight status, may have a distorted body image, leading to unnecessary or unhealthy weight control behaviors (UWCB). Regrettably, strategies such as fasting, vomiting, the use of laxatives or diuretics, or diet pills, are now prevalent among adolescents worldwide (Leal et al., 2020; López-Guimerà et al., 2013; Nagata et al., 2018). A recent systematic review of 19 studies of adolescent weight loss behaviors reported that the proportion of young people using such unhealthy tactics had reached 44% (Houle-Johnson & Kakinami, 2018). In South Korea, the proportion of adolescents who attempted weight loss through UWCB increased from 14.9% in 2014 to 22.5% in 2019 (Ministry of Education et al., 2019).

Engaging in UWCB is associated with negative health and

psychological consequences. For instance, previous longitudinal studies have reported that UWCB predict significant weight gain over time, demonstrating that UWCB are not only ineffective for weight management but could also increase the risk of obesity (Neumark Sztainer et al., 2006; Neumark Sztainer et al., 2012). UWCB among adolescents are significant risk factors that predict the onset of clinical eating disorders (Hazzard et al., 2021; Stice et al., 2017). In addition, although there has been mixed evidence according to type of UWCB and gender, UWCB increases the risk of suicidal ideation and suicide attempts (Crow et al., 2008; Johnson et al., 2016; Lee et al., 2016).

Importantly, the stability of UWCB has been demonstrated across critical developmental stages from adolescence to adulthood (Neumark-Sztainer et al., 2011; Neumark-Sztainer et al., 2018). Persistent patterns of UWCB and its adverse consequences necessitate the development of effective prevention strategies by identifying the related risks and protective factors in adolescents.

There are a variety of factors associated with adolescent UWCB, some of which differ by gender. For example, male adolescents are more likely to undertake UWCB when they perceive themselves as underweight, whereas female adolescents are more likely to do so when they perceive themselves as overweight (Gonsalves et al., 2014; Kennedy et al., 2019). Like gender, weight status is also an important factor associated with UWCB, with a higher risk of UWCB among adolescents in the overweight group than in

the normal-weight group (de Santana et al., 2016; Gonsalves et al., 2014; Kim et al., 2018; Weng et al., 2020). In addition, body concern and attitudinal evaluations toward the body, namely body esteem and body dissatisfaction, depend on weight status (Fowler et al., 2021; Trompeter et al., 2018; Vander Wal, 2004). Moreover, being overweight and UWCB among adolescents share risk and protective factors (Neumark-Sztainer et al., 2007). In this context, the potential factors associated with UWCB may differ by weight status. Therefore, for interventions to be effective, it is essential to understand whether the factors involved in UWCB vary according to weight. However, research on differences in UWCB factors by weight status is limited, in contrast to the volume of evidence for gender differences in UWCB-related factors.

To fill this gap, a recent study by Nagata et al. (2018) investigated differences in socioenvironmental risk factors for the engagement of UWCB by gender and weight status. The researchers found that socioenvironmental factors such as family functioning, family connectedness, and being cared for by friends, teachers, and other adults were only associated with UWCB in underweight or normal-weight female adolescents. However, the study did not find any significant differences in subgroups because it considered all adolescents with a weight above the 85th percentile, namely overweight and obese adolescents, as one group. Moreover, it did not comprehensively examine modifiable personal and school factors for UWCB. Given the importance of adolescence, schools are a key setting for health promotion

and provide a comprehensive and sustainable means of reaching this population (Langford et al., 2015). Accordingly, exploring school factors for UWCBS is essential to provide effective interventions for adolescents. Hence, this study aimed to identify the prevalent, common, and differential factors in sociodemographic, health-related behavioral, psychosocial, and school factors for UWCBS by gender and segmented weight status using a nationally representative sample.

2. Purpose of the Study

This study aimed to investigate the prevalence of UWCB status in adolescents and differences in the factors related to it by gender and weight.

The specific research questions were as follows.

1. What is the prevalence and type of UWCB among adolescents by gender and weight status?
2. What factors are related to UWCB among adolescents by gender and weight status?

3. Definition of terms

1) Unhealthy weight control behaviors

Unhealthy weight control behaviors (UWCB) are referred to as a potentially harmful practice used by people to achieve a certain body image or control their weight (Neumark-Sztainer et al., 2002). The term was first proposed by the Project Eating and Activity over Time (EAT: Neumark-Sztainer et al., 2002), who divided weight control behaviors into healthy (exercised, ate more fruits and vegetables, ate less high-fat foods, ate fewer sweets), unhealthy (fasted, ate very little food, used food substitute, skipped meals, smoked more cigarettes), and extreme (Take diet pills, make yourself vomit, use laxatives, use diuretics). In this study, UWCB refers to losing weight through fasting (skipping meals for >24 h), taking diet pills without a doctor's prescription, one-food diets, vomiting, and using laxatives or diuretics based on indicators generated by the Korea Youth Risk Behavior Survey (KYRBS: Ministry of Education et al., 2019).

2) Weight status

Weight status is determined by body mass index (BMI). BMI is calculated by dividing weight in kilograms by the square of height in meters. For children and adolescents, BMI differs by age and sex because of different growth patterns. Thus, by calculating BMI percentiles, the BMI level among children and adolescents is expressed relative to other children

and adolescents of the same age and gender.

The cut-off points by sex and months of age are based on reference data from the 2017 Korean National Growth Charts for children and adolescents (Kim et al., 2018). Based on the BMI percentiles, weight status in children and adolescents is categorized as underweight (less than the 5th percentile); normal-weight (5th percentile to less than the 85th percentile); overweight (85th percentile to less than the 95th percentile); and obese (95th percentile or greater).

3) Adolescents

The World Health Organization (WHO) defines an adolescent as any person aged between 10–19 years. Recently, Sawyer et al. (2018) proposed a new definition of an adolescent as a person aged between 10–24 years, taking into account the growth of adolescents and this life phase. In the current study, adolescents are defined as persons aged 12–18 years from the 1st year of middle school to the 3rd year of high school who participated in KYRBS.

II. Literature Review

1. Unhealthy weight control behaviors among adolescents

The physical, psychological, and social changes that characterize adolescence shape the body image of young people through unique interactions (Voelker et al., 2015). Adolescents may adopt various weight control behaviors when they judge that the physical changes related to puberty are not congruent with the “thin ideal.” According to a recent systematic review, the prevalence rate of adolescents attempting to lose weight was reported to range from 27% to 61% (Houle-Johnson & Kakinami, 2018), with the prevalence in male adolescents ranging from 15% to 63%, and in female adolescents from 26% to 74% (Houle-Johnson & Kakinami, 2018). Although a combination of regular physical activity and dietary changes is recommended for healthy and effective weight loss (Duncanson et al., 2021; Moeini et al., 2021), heterogeneity in weight loss strategies among adolescents has been reported (Lampard et al., 2016). For instance, a study by Lampard et al. (2016) of a large population-based sample of US adolescents found that 24.0% of female adolescents and 29.2% of male adolescent exclusively used healthy strategies such as exercise, increasing vegetable and fruit consumption, and reducing soda. Whereas 13.0% of males and 16.4% of females adopted only UWCB,

25.2% of males and 34.0% of females used a mix of healthy and unhealthy weight control behaviors.

UWCB are conceptualized as potentially harmful practices people use to attain a particular body image or control body weight (Neumark-Sztainer et al., 1998; Neumark-Sztainer et al., 2002). UWCB was first proposed by the Project Eating and Activity over Time (EAT), a large body of research investigating the trajectories and predictors of a wide range of weight-related outcomes across the life course from adolescence through to adulthood. In their original proposal, UWCB included fasting, eating very little food, using a food substitute (powder or a special drink), skipping meals, and smoking more cigarettes. Furthermore, taking diet pills, self-induced vomiting, and using laxatives and/or diuretics were classified as extreme weight control behaviors (Boutelle et al., 2002; Neumark-Sztainer et al., 2002). Their subsequent studies pooled extreme weight-control behaviors into UWCB (Neumark-Sztainer et al., 2003; Neumark-Sztainer et al., 2006). Since then, a number of studies have investigated UWCB among adolescents, and although the type of UWCB described by researchers is not entirely consistent, they generally include fasting, skipping meals, replacing foods, vomiting, the use of laxatives or diuretics, and ingesting diet pills (Houle-Johnson & Kakinami, 2018; Lampard et al., 2016; Leal et al., 2020; López-Guimerà et al., 2013; Nagata et al., 2018). In Korea, the weight control behaviors of adolescents are evaluated through the Korea Youth Risk Behavior Survey, where UWCB is regarded as taking diet pills without a

doctor's prescription, one food diet, vomiting, and using laxatives or diuretics (Ministry of Education et al., 2019). UWCB and disordered eating share their symptoms. For example, fasting, laxative use, and vomiting for weight loss are types of UWCB and included among disordered eating (Whyte & Findlay, 2004). For this reason, UWCB and eating disorders are sometimes used within the same context (Al-Kloub et al., 2019; Leal et al., 2020).

A recent systematic review of 19 studies of weight-loss behavior among Canadian and American sample of adolescent reported that the proportion of adolescents using unhealthy tactics had reached 44% (Houle-Johnson & Kakinami, 2018). Moreover, the prevalence of UWCB differed by gender and weight status; among females, 3-68% and 15-75% of normal-weight and overweight/obese adolescents, respectively attempted to lose weight using UWCB, while among males, 46% of normal-weight adolescents and 62% of overweight/obese adolescents engaged in UWCB (Houle-Johnson & Kakinami, 2018). The high prevalence of UWCB in females and overweight adolescents has also been reported in adolescent samples from other countries, such as Brazil, Palestine, and Greece (Al Sabbah et al., 2010; Leal et al., 2020; Thøgersen-Ntoumani et al., 2009). In Korea, the weight control behaviors of adolescents are regularly reported, with a recent survey in 2019 reporting that the prevalence of UWCB was 16.9% in males and 26.3% in females, indicating clear gender differences.

It should be noted that UWCB in adolescence tends to be tracked into

adulthood. Previous longitudinal studies examining trends in the prevalence of UWCB over time have shown that the high prevalence in adolescence remains high during the transition to adulthood (Neumark-Sztainer et al., 2011; Neumark-Sztainer et al., 2018). Such findings suggest that early efforts are needed before the onset of UWCB.

2. Health consequences of unhealthy weight control behaviors

Weight loss behavior has been associated with potentially negative physical health outcomes. Adolescents who use unhealthy weight loss strategies while over-restricting their food intake do not meet their nutritional needs (Whyte & Findlay, 2004). In growing adolescents, reduced energy intake could lead to growth deceleration accompanied by nutritional deficiencies (Yaktine & Stallings, 2007; Whyte & Findlay, 2004).

Long-term effects of UWC on weight status have been reported (Neumark-Sztainer et al., 2006; Neumark-Sztainer et al., 2012). Large longitudinal studies have revealed that UWC precedes the onset of obesity. For instance, in a 5-year longitudinal study of a large sample of adolescents, Neumark-Sztainer et al. (2006) found that those with UWC had a greater BMI and a higher risk for being overweight than those who did not participate in any weight-control behaviors. A later study by Neumark-Sztainer et al. (2012), using the same sample as a previous longitudinal study, investigated the 10-year association between UWC and changes in BMI from adolescence to adulthood. The results indicated that in both male and female adolescents, UWC at both Time 1 and Time 2 significantly predicted greater BMI increases at Time 3 compared with not using UWC. Specifically, female adolescents who participated in UWC at both Time 1 and Time 2 increased their BMI by 4.63 units, while those who did not use UWC increased their BMI by 2.29 units. This association was found in

both non-overweight and overweight adolescents, regardless of their weight status.

UWCB in adolescents is known to be an antecedent to eating disorders. These disorders are mental illnesses with severe physical and psychological consequences and high mortality rates (Rome & Strandjord, 2016). More than half of patients with eating disorders do not fully improve after receiving the most empirically supported treatment (Linardon & Wade, 2018); hence, continuous emphasis is given to the need to identify early markers of an eating disorder. In this context, studies have been conducted to confirm the value of interventions for UWCB as an antecedent of eating disorders. For instance, Stice et al. (2017) conducted a study that identified predictors of eating disorders in female high school and college students with body dissatisfaction. They found that dieting behaviors predicted the onset of binge eating disorder, and fasting predicted the onset of bulimia nervosa and elimination disorder. A prospective cohort study by Hazzard et al. (2021) reported an association between the use of laxatives and diet pills for weight loss and diagnoses of eating disorders among female adolescents. The researchers found that female adolescents who used diet pills and laxatives were at greater risk of receiving a first-time eating disorder diagnosis within five years than those who did not.

Suicide risk is a serious psychological consequence of UWCB. There is a wealth of evidence to suggest that UWCB is cross-sectionally correlated with suicidal thought and behavior among adolescents (Johnson et al., 2016;

Lee et al., 2016; Rafiroiu et al., 2003). Adolescents using extreme weight control behaviors, regardless of gender and race, were more likely to attempt suicide than those not using these behaviors (Rafiroiu et al., 2003). Similarly, Extreme weight control behaviors are related to suicidal thoughts and plans in both male and female adolescents (Johnson et al., 2016). A longitudinal study by Ceow et al. (2008) reported gender differences in associations revealed in cross-sectional studies. In female adolescents, suicidal ideation and suicide attempts at Time 2 were predicted by extreme weight control behaviors at Time 1, whereas in male adolescents, extreme weight control behaviors had no effect on suicidal ideation or suicide attempts 5 years later.

3. Factors related to unhealthy weight control behaviors

1) Sociodemographic factors

The importance of gender differences is now being emphasized to better understand weight-related problems in adolescents. Males and females differ in how they feel about their body shape and weight status. These features could create differences in the motivations for and patterns of weight control among male and female adolescents (Brown et al., 2016). Females attempt weight loss more than males, and for this reason, many studies of weight control behavior in adolescents have focused on females. In fact, female adolescents are more likely to be involved in dieting, whether healthy or unhealthy weight control behaviors, than male adolescents (Houle-Johnson & Kakinami, 2018; Lampard et al., 2016), and the risk of UWCB is also higher in females than in males (Kim et al., 2018; Stephen et al., 2014).

A large study by Dzielska et al. (2020) investigated changes in the prevalence of weight loss behaviors by age among adolescents. The results revealed that among male adolescents, the prevalence of weight loss behaviors did not increase with age in any country, but none exhibited a decreasing trend. By contrast, among female students, the prevalence of weight loss behavior significantly increased with age in almost all countries. Age groups who are more likely to attempt to lose weight are also more likely to engage in UWCB. A more extensive prevalence of UWCB has

been reported in middle school and high school female students than in elementary school students (Houle-Johnson & Kakinami, 2018). Using a representative sample of adolescents aged 12-18, Kim et al. (2018) reported that older age correlated with UWCB in both male and female adolescents.

The findings of previous studies on the association between household economic status and UWCB among adolescents have been inconsistent. For instance, some studies using a sample of U.S. adolescents have found that adolescents with low socioeconomic status have a greater risk of UWCB than those with high socioeconomic status (Neumark-Sztainer et al., 1999; Story et al., 1995). By contrast, a recent study by Kim et al. (2018) of a representative sample of Korean adolescents identified a U-shaped correlation between adolescents' household economic status and UWCB, whereby both high and low household economic status displayed a stronger positive correlation with UWCB than middle household economic status.

2) Personal factors

(1) Weight status

Abundant evidence has shown that overweight status is associated with UWCB. Adolescents with a higher body mass index (BMI: i.e., overweight, and obese adolescents) tend to engage in UWCB more often than non-overweight adolescents (de Santana et al., 2016; Gonsalves et al., 2014; Kim et al., 2018; Vander Wal, 2012; Weng et al., 2022). The researchers noted that this correlation may be due to the fact that higher body mass index

(BMI) increases concerns about weight in adolescents. However, the correlation between weight status and UWCB was not consistent across all studies, and differed according to gender and grade. For instance, Kim et al. (2018) reported that the risk of UWCB was higher in adolescents who were overweight or obese than in those with normal weight for both males and females. Conversely, Weng et al. (2022) reported that female adolescents were more likely to engage in UWCB when they were overweight than when they were of normal weight, and this correlation was not found in male adolescents. Gonsalves et al. (2014) identified that both middle and high school female students classified as overweight or obese reported more UWCB than those with normal weight. In the case of male students, the risk of UWCB was higher when they were obese than when they were of normal weight for both middle and high school students. Thus, male adolescents were more likely to engage in UWCB at much higher BMI levels.

(2) Health-related behavioral factors

Eating habits and dietary choices are strongly related to UWCB. Skipping breakfast may be the result of weight loss, and the association with weight control may also vary depending on the type and quality of breakfast (Guevara et al., 2020). Nonetheless, previous studies have reported that more breakfast days lowers the risk of UWCB, whereas irregular breakfasts increase the risk of UWCB (Neumark-Sztainer et al., 2011; Weng et al., 2022). Diet could affect engagement in UWCB among adolescents, as

eating fried foods and nighttime snacks (Liou et al., 2012) elevated the odds of exhibiting UWCB. However, contrary to the hypothesis, Weng et al. (2022) reported that female adolescents who ate vegetables three or more times a week had a higher risk of UWCB than those who ate vegetables fewer than three times per week. The researchers suggested that this was because women were more eager to lose weight, engaging in both UWCB and healthy weight-control behaviors. In a similar vein, a longitudinal study by Neumark Sztainer et al. (2017) found that eating something from a fast-food restaurant in Time 1 was not associated with extreme weight control behaviors in Time 2 in both male and female adolescents.

A strong correlation has been found to exist between UWCB and other health compromising behaviors (Eichen et al., 2012; Neumark-Sztainer et al., 1998; Sim et al., 2017; Weng et al., 2020). Eichen et al. (2012) noted that such risk behaviors, including UWCB, may be part of a cluster of health behaviors among adolescents. These could be based on adolescent characteristics, such as greater risk-taking than at other life stages (Duell et al., 2018; Steinberg, 2008) and problem behavior syndrome in which diverse problem behaviors reflect a single common factor (Donovan & Jessor, 1985). The literature also reports the co-occurrence and correlation of substance use and UWCB. In Korean adolescents, current smoking was a risk factor for UWCB in both male and female adolescents, and this correlation was stronger in females (Sim et al., 2017). However, these patterns emerged somewhat differently among the samples in other studies.

For example, in a representative sample of U.S. adolescents, the correlation between current smoking and UWCB was only found in male adolescents (Weng et al., 2022). In addition, among Serbian adolescents, male adolescent smokers were twice as likely to report smoking for weight control than female adolescents (Kilibarda et al., 2020). This relationship also differed by weight status: smoking was a risk factor for UWCB in normal-weight adolescents, but not in overweight adolescents (Eichen et al., 2012). Despite these differences by gender and weight status, more evident was the fact that adolescents who currently smoked were more likely than non-smokers to participate in extreme weight control behaviors (Neumark-Sztainer, 1998; Sim et al., 2017).

Alcohol use is the most common and frequently clustered risk behavior among adolescents, along with smoking (Lazzeri et al., 2018). Researchers have therefore hypothesized that drinking, like smoking, is also related to UWCB. For instance, Weng et al. (2022) found that alcohol use increased the risk of UWCB in both male and female adolescents, although the strength of the association differed depending on levels of drinking. Eichen et al. (2012) reported that binge drinking was related to fasting, diet pill use, and purging in both normal-weight and overweight adolescents, but when the overweight group was grouped by gender, binge drinking was only significantly associated with females.

(3) Psychosocial factors

There is consistent evidence to suggest that body image and weight-related concerns play a pivotal role in engagement in UWCB. Body image is defined as “a person’s perceptions, thoughts, and feelings about his or her body” (Grogan, 2021). Adolescents' physical development is more extensive than their experiences in any other life course (Markey, 2010). Their concern about these physical changes contributes to developing an appearance self-concept (Voelker et al., 2014). Adolescents develop a negative body image when they perceive that their changing bodies do not match the thin ideal promoted by their culture (Voelker et al., 2014). In other words, negative body image could be explained by dissatisfaction and distortion with one’s shape and size. Although existing evidence reveals that male adolescents have greater appearance esteem than female adolescents (Nanu et al., 2013), males are not immune to the concern around body image as they pursue the ideal of a muscular body (Voelker et al., 2014). In this context, the interaction between body dissatisfaction and body image distortion among adolescents and their desire to be the ideal shape (i.e., thin or lean) may lead to UWCB.

In fact, perception of one's body image is a critical UWCB related factor. In particular, an inaccurate perception of one’s weight status is a prime example of body image distortion (Blashill & Wilhelm, 2014; Liechty, 2010). Gonsalves et al. (2014) reported that both middle school and high school students who perceived themselves as underweight or overweight

were more likely to engage in UWCBS than those who perceived themselves to be of normal weight. Lim et al. (2014) have also reported that adolescents who overestimated their actual weight were at a higher risk of attempting fasting, one-food diets, and laxative or diuretic use, and this was more prevalent among female adolescents (Lim et al., 2014). However, a study by Han et al. (2020) revealed gender differences in this pattern; male adolescents were more likely to be involved in UWCBS when they accurately or underestimated their weight, and female adolescents when they overestimated their weight. Similarly, female adolescents who perceived themselves to be slightly overweight were more likely to engage in fasting than those who perceived themselves to be the correct weight, while females who perceived themselves to be very overweight were most likely to engage in both fasting and vomiting or the use of laxatives. A longitudinal study by Liechty (2010) also reported that non-overweight female adolescents who overestimated their weight status were 4.3 times more likely to experience the onset of EWCB than those who correctly perceived their weight status. The researchers postulated that this gender difference arises because females idealize thinness and males idealize the muscular body (Han et al., 2020; Voelker et al., 2014). Whilst body dissatisfaction does not develop solely from an inaccurate perception of one's weight status (Grogan, 2010), previous evidence strongly indicates that low satisfaction with one's body size and shape is a clear risk factor for UWCBS (Hutchinson et al., 2010; Leal et al., 2020; Neumark-Sztainer et al., 1995).

It has been well documented that depressive symptoms (Armstrong et al., 2014; Gonsalves et al., 2014; Neumark-Sztainer et al., 2007; Stephen et al., 2014; Weng et al., 2022) and victimization (Haines et al., 2006; Puhl et al., 2017; Rodgers et al., 2021) can lead to UWCB. In particular, the correlation between depressive symptoms and UWCB may exist because depressive symptoms and UWCB share risk factors (Leal et al., 2020; Madowitz et al., 2012; Richard et al., 2016). Victimization includes bullying, assault, physical abuse, verbal abuse, and sexual abuse (Lee & Vaillancourt, 2018; Volk et al., 2006). Adolescents with victimization are at higher risk of experiencing negative body image than those who are not victimized (Day et al., 2022). In particular, body weight is the most common cause of being teased and bullied among adolescents (Lumeng et al., 2010; Puhl et al., 2017). According to a study by Qiao-Zhi et al. (2010), the incidence rates of victimization among school-aged adolescents classified as being of normal weight, overweight, and obese were 8.2%, 17.3%, and 11.5%, respectively, and adolescents who were overweight were more likely to be bullied and teased because of their appearance than those of normal weight. As noted previously, weight-based teasing, stigma, and bullying can lead adolescents to become preoccupied with weight loss (Puhl et al., 2017). In fact, the results of a systematic review by Day et al. (2022) reveal that weight-related victimization and various types of non-specific victimization influence UWCB.

These psychological factors often accompany and intertwine, suggesting

a path to UWCB. Blashill and Wilhelm (2014) prospectively investigated the relationship between body image distortion and depressive symptoms among male adolescents, and found that male adolescents who perceived themselves to be very underweight or overweight reported higher levels of depressive symptoms than those who accurately perceived their weight status (Blashill & Wilhelm, 2014). It could therefore be hypothesized that body image distortion is associated with depressive symptoms and increases the risk of UWCB. In this regard, a study by Armstrong et al. (2014) reported a mediating effect of depressive symptoms between perceptions of being overweight and the use of UWCB, after controlling for actual weight status. Similarly, the fact that weight-related teasing is one of the links to body dissatisfaction is strongly supported by empirical evidence (Menzel et al., 2010). A longitudinal study by Rodgers et al. (2021) constructed a pathway through which weight-related teasing leads to UWCB by negatively affecting body satisfaction.

3) Social environmental factors

Adolescents face considerable sociocultural pressure to pursue unrealistic ideals of appearance (Voelker et al., 2015). In particular, the mass media is a very important factor in perpetuating weight-related pressure. The results from a meta-analysis of 23 studies by Groesz et al. (2002) reported that viewing thin images in the media had a distinctly negative effect on women's body image, which was stronger in women younger than

19 years. The pressure to attain an ideal image comes not only through traditional media. According to a study by Meier and Gray (2014), increased appearance exposure on social networking sites correlates with increased body image disturbance, including thin ideal internalization. In a similar vein, a longitudinal study by Tiggemann and Slater (2017) found that greater engagement with Facebook among female adolescents increased their drive for thinness and body surveillance after two years. Reflecting on these results, the researchers posited that this is because appearance-related images posted on social media provide opportunities for social appearance comparisons, which can lead to negative perceptions of one's body image (Fardouly & Vartanian, 2016). Research on the mechanisms by which these media influences lead to UWCB is limited. However, as suggested earlier, the well-known correlations between sociocultural ideals and negative body image, and body dissatisfaction and UWCB, suggest that media-highlighted thinness can lead to UWCB. Indeed, a longitudinal study by Neumark-Sztainer et al. (2007) reported that exposure to messages about weight loss in magazines are related to extreme weight control behaviors among adolescents.

Family environment plays an important role in adolescent weight management. Parental beliefs, perceptions, behavior, and the social climate created by parents at home may influence weight-related behavior in adolescents (Cislak et al., 2012; Cromley et al., 2010). For example, the use of contemporary dieting styles among parents, such as reduced carbohydrate

intake and use of liquid diet supplements, increase the risk of engagement UWCB in adolescents (Cromley et al., 2010). In a study by Neumark-Sztainer et al. (2010), female adolescents who reported hearing a substantial amount of talk about their weight from their parents exhibited a higher risk of engaging in extreme weight control behaviors than those who did not. Additionally, female adolescents whose mothers encouraged them to weight loss were five times more likely to engage in extreme weight control behaviors than female adolescents who were not encouraged to lose weight. Conversely, the higher the frequency of family meals and the more positive the family meal atmosphere, the less likely female adolescents were to engage in UWCB (Neumark-Sztainer et al., 2007).

Given the importance of adolescence, schools are a key setting for supporting healthy behavior and offer a sustainable means of reaching this population (Langford et al., 2015). Students are given opportunities to learn about and practice healthy physical activity and eating behaviors in school (Centers for Disease Control and Prevention, 2011). Health and physical education can limit UWCB by guiding youth to adopt healthy weight control practices. This assumption is supported by a large body of literature examining the effectiveness of school-based obesity prevention and weight control programs (Jacob et al., 2021). For example, using a randomized controlled trial design, a study by Austin et al. (2007), confirmed the effectiveness of school-based interventions designed to promote healthy eating and physical activity. The curriculum included health messages

focusing on the consumption of vegetables and fat, and physical activity in classes. Although the intervention had no effect on male adolescents, disordered weight control behaviors such as self-induced vomiting or laxative or diet pill use were reduced in female adolescents.

III. Conceptual framework

Based on the review of previous studies, the conceptual framework for this study was constructed (Figure 1). Among the factors reported to be related to UWCB, those selected as variables for the current study were those that can be used in the KYRBS. These were classified into four groups: Sociodemographic factors, health-related behavioral factors, psychosocial factors, and school-related factors.

Sociodemographic factors included age, subjective household economic status, and cohabitation with family.

Health-related behavioral factors included eating habits such as fast-food consumption, vegetable consumption, and breakfast consumption, and risk behaviors such as smoking and alcohol use.

Psychosocial factors included body weight perception, depressive symptoms, and violent victimization.

School-related factors included nutrition education and physical education related to the school curriculum.

Finally, the conceptual framework focused on the fact that the relationship between sociodemographic factors, health-related behavioral factors, psychosocial factors, and school-related factors and UWCB among adolescents may differ according to gender and weight status.

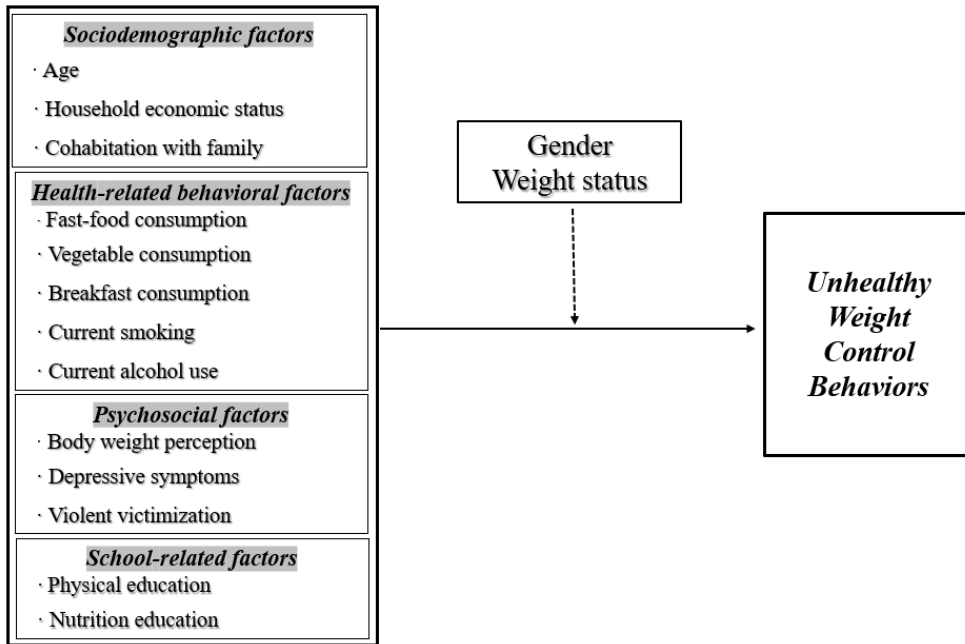


Figure 1. Conceptual framework of this study

IV. Methods

1. Study design

This study was conducted to investigate differences in the prevalence of UWCB and related factors in adolescents according to gender and weight status. In terms of design, this was a cross-sectional descriptive study using data from 2019 Korea Youth Risk Behavior Survey.

2. Study data

The data were collected from the 15th Korean Youth Risk Behavior Survey (KYRBS), which was conducted in 2019. KYRBS is an ongoing national cross-sectional survey that evaluates health-risk behaviors among adolescents and provides data for the development and assessment of school health policies in South Korea. KYRBS uses stratified two-stage cluster sampling to obtain a nationally representative sample of Korean adolescents from 800 schools (400 middle and 400 high schools). Schools are selected as the primary sampling unit, following which one classroom in each grade within a school is sampled using a systematic sampling method. Participants who anonymously provide informed consent complete the self-administered questionnaire in a computer laboratory within each sampled school. To further ensure the reliability of the responses, the homeroom teachers were prohibited from participating in the survey of students in their class. In addition, teachers in charge of the survey were instructed to adhere to the following: a prohibition on viewing computer screens used by students and a prohibition on answering questions in the survey. The KYRBS is public and accessible to anyone requesting the data (<https://www.kdca.go.kr/yhs>).

3. Study participants

For the 15th KYRBS, out of 60,100 students targeted, 57,303 (from 400 middle schools and 400 high schools) completed the survey. In this study, the sample comprised 19,167 participants who attempted weight loss in the past 30 days. Of these, 754 participants who did not provide sufficient information about their height and weight were excluded. Moreover, consideration was given as to whether the sample size for the analysis was met when the participants were classified into subgroups. Based on observational studies with large sample sizes, Bujang et al. (2018) recommended a sample size of 500 for logistic regression analysis. Therefore, underweight groups were excluded from the analysis as they did not meet the required sample size (males: 67, females: 187), resulting in a final sample size of 18,159 participants (Figure 2).

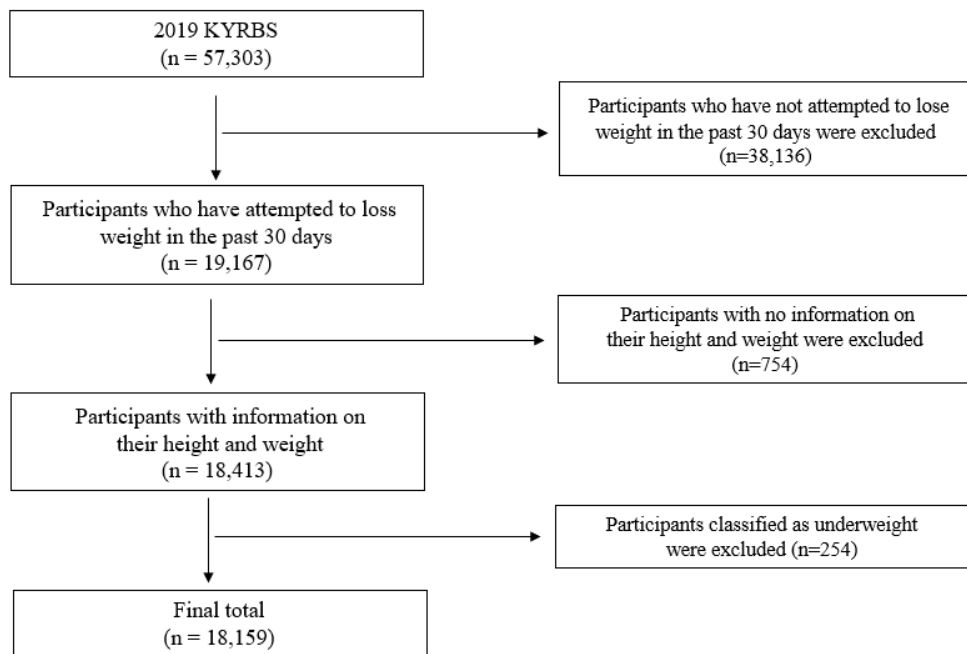


Figure 2. Flow chart for study subject selection

4. Study variables

1) Weight status

Weight status was determined by BMI based on self-reported height and weight. The criteria for weight classification as per the 2017 Korean National Growth Charts for children and adolescents are as follows (Kim et al., 2018): normal weight ($<85^{\text{th}}$ but $\geq 5^{\text{th}}$ BMI percentile), overweight ($<95^{\text{th}}$ but $\geq 85^{\text{th}}$ BMI percentile), and obese ($\geq 95^{\text{th}}$ BMI percentile).

2) Unhealthy weight control behaviors (UWCB)

UWCB was assessed according to whether participants had attempted any of the following behaviors to control weight in the past 30 days (comprising “Yes” or “No” response options): fasting (skipping meals for >24 h), taking diet pills without a doctor’s prescription, one-food diets, vomiting, and using laxatives or diuretics.

3) Sociodemographic factors

Sociodemographic factors comprised gender, age (years), household economic status (low, middle, or high), and cohabitation with family (with family or relatives, dormitory, or others).

4) Health-related behavioral factors

Factors associated with health-related behavior comprised fast-food

consumption, vegetable consumption, breakfast consumption, current smoking, and current drinking. The responses were recategorized per the nationally generated statistical indicators for the 15th KYRBS (Ministry of Education et al., 2019). Fast-food consumption was measured by the item, “How often did you eat fast food in the past 7 days?” There were seven response options, ranging from never to ≥ 3 times/day, which were reclassified as ≥ 3 times/week and < 3 times/week. Breakfast intake was measured by the item, “On how many days did you eat breakfast in the past seven days?” There were seven response options, ranging from 0 to 7 days, which were classified into ≥ 5 times/week (regular) and < 5 times/week (irregular). Current smoking was measured by the item, “Have you smoked in the last 30 days?” The response options were “No” and “Yes.” Current alcohol use was assessed by the item, “Have you used alcohol in the last 30 days?” The response options were “No” and “Yes.”

5) Psychosocial factors

Psychosocial factors comprised body weight perception, depressive symptoms, and violent victimization. Body weight perception was measured by the item, “How do you think about your body shape?” Comparing this with their weight status based on the BMI, participants were classified into the following three groups: accurate perception, underestimate, and overestimate. Violence victimization was assessed as a “Yes” or “No” response option depending on whether participants had been exposed to

violence requiring a hospital visit (e.g., physical violence, intimidation, and bullying) in the past 12 months. Depressive symptoms were measured as a “Yes” or “No” response option to the question, “During the past 12 months, did you ever feel so sad or hopeless almost every day for two weeks or more in a row that you stopped your daily activities?”

6) School-related factors

School-related factors included the characteristics of school curriculum that might affect weight management and comprised physical education and nutrition education. Physical education was assessed by the item, “How many times have you exercised directly at the playground or gym during the physical education class in the past 7 days?” There were four response options, ranging from never to ≥ 3 times/week, which were reclassified as ≥ 3 times/week and < 3 times/week. Nutrition education was assessed as a “Yes” or “No” response option depending on whether participants had received any education on nutrition and eating habits at school in the past 12 months.

5. Statistical analysis

The KYRBS uses a multistage cluster sampling design to ensure a nationally representative sample of middle and high school students. Therefore, this study conducted a complex sample analysis that considered stratification, clustering, and sample weight in order to minimize sampling error and obtain results representative of the entire population (Byeon et al., 2015). Descriptive statistics were used to describe the characteristics of participants. A Rao–Scott χ^2 -test was performed to assess the differences in sample characteristics by gender, UWCB distribution according to each sample characteristic and the prevalence of UWCB. Followign this, a complex sample logistic regression analysis was performed to identify the factors related to UWCB in adolescents. The odds ratios and 95% confidence intervals were attained from the logistic regression models disaggregated by gender and weight status. All statistical analyses were conducted using Complex Samples Procedures in IBM SPSS 25.0 (IBM Corp., Armonk, NY). A p-value of less than 0.05 was considered significant.

6. Ethical considerations

The KYRBS was reviewed and approved by the institutional review board of Korea Centers for Disease Control and Prevention, which conforms to the ethical standards of the Helsinki Declaration (Ministry of Education et al., 2019). This study was conducted with exemption from research review by the Seoul National University Institutional Review Board (IRB No. E2107/003-002).

V. Results

1. Sample characteristics by gender

The sample of 18,159 adolescents who attempted to lose weight is described in Table 1. Of these, 7,184 were males and 10,975 were females. Regarding the sociodemographic characteristics of the sample, 75.8% responded that their household economic status was middle. Overall, 95.7% of participants lived with their families. In terms of health-related behaviors, 23.4% of the participants consumed fast food more than 3 times a week, and only 10.8% of the participants consumed vegetables more than 3 times a week. A total of 61.6% regularly consumed breakfast. Among the participants, 6.6% were current smokers and 17.1% were current alcohol users.

In terms of psychosocial factors, 33.8% of participants accurately perceived their weight status, 5.7% underestimated it, and 60.5% overestimated it. Approximately 33.7% of participants reported depressive symptoms, and 2.2% reported experiencing violent victimization.

With regard to school-related factors, 31.9% of participants responded that they exercised at least three times a week either in the playground or gym during physical education class, and 48.6% of participants reported that they had received education on nutrition and eating habits at school during the past 12 months.

The results revealed statistically significant gender differences in all sample characteristics and that UWCB was more prevalent in female adolescents (26.0%) than male adolescents (16.6%).

Table 1. Sample characteristics by gender

Variables	Categories	Total (<i>n</i> = 18,159)	Males (<i>n</i> = 7,184)	Females (<i>n</i> = 1,975)	<i>p</i> ^c
		<i>n</i> ^a (%) ^b	<i>n</i> ^a (%) ^b	<i>n</i> ^a (%) ^b	
Sociodemographic factors					
Age	12	1,541 (8.0)	641 (8.2)	900 (7.9)	.037
	13	3,033 (15.3)	1,185 (15.0)	1,848 (15.5)	
	14	3,192 (16.5)	1,179 (15.3)	2,013 (17.3)	
	15	3,128 (17.5)	1,160 (16.3)	1,968 (18.2)	
	16	3,022 (17.6)	1,221 (18.0)	1,801 (17.3)	
	17	2,880 (17.0)	1,202 (18.1)	1,678 (16.3)	
	18	1,363 (8.2)	596 (9.2)	767 (7.6)	
Household economic status	High	1,950 (10.8)	1,025 (14.4)	925 (8.5)	<.001
	Middle	13,735 (75.8)	5,218 (72.6)	8,512 (77.9)	
	Low	2,479 (13.4)	941 (13.0)	1,538 (13.6)	
Cohabitation with family	Yes	17,247 (95.7)	6,782 (95.1)	10,465 (96.1)	.019
	No	912 (4.3)	402 (4.9)	510 (3.9)	
Health-related behavioral factors					
Fast-food consumption	<3 times/week	1,3946 (76.6)	5,423 (75.1)	8,523 (77.6)	<.001
	≥3 times/week	4,213 (23.4)	1,761 (24.9)	2,452 (22.4)	
Vegetable consumption	<3 times/day	16,148 (89.2)	6,202 (86.8)	9,946 (90.9)	<.001
	≥3 times/day	2,011 (10.8)	982 (13.2)	1,029 (9.1)	
Breakfast consumption	Regular	11,150 (61.6)	4,637 (64.5)	6,513 (59.8)	<.001
	Irregular	7,009 (38.4)	2,542 (35.5)	4,462 (40.2)	
Current smoking	Yes	1,154 (6.6)	636 (9.3)	518 (4.9)	<.001
	No	17,005 (93.4)	6,548 (90.7)	10,457 (93.4)	
Current alcohol use	Yes	3,015 (17.1)	1,307 (19.0)	1,708 (15.9)	<.001
	No	15,144 (82.9)	5,877 (81.0)	9,267 (84.1)	
Psychosocial factors					
Body weight perception	Underestimate	1,044 (5.7)	319 (4.3)	725 (6.6)	<.001
	Accurate perception	6,149 (33.8)	1,939 (27.1)	4,210 (38.2)	
	Overestimate	10,966 (60.5)	4,926 (68.6)	6,040 (55.1)	
Depressive symptoms	Yes	6,027 (33.3)	1,759 (24.7)	4,268 (38.9)	<.001
	No	12,132 (66.7)	5,425 (75.3)	6,707 (61.1)	
Violent victimization	Yes	404 (2.2)	247 (3.5)	157 (1.3)	<.001
	No	6,937 (97.8)	10,818 (96.5)	6,937 (98.7)	

School-related factors					
Physical education	<3 times/week	12,047 (68.1)	4,295 (62.0)	7,752 (72.0)	<.001
	≥3 times/week	6,112 (31.9)	2,889 (38.0)	3,223 (28.0)	
Nutrition education	Yes	8,990 (48.6)	3,756 (51.8)	5,234 (46.4)	<.001
	No	9,169 (51.4)	3,428 (48.2)	5,741 (53.6)	
Weight status	Normal-weight	11,818 (65.4)	3,586 (50.2)	8,232 (75.4)	<.001
	Overweight	2,861 (15.8)	1,470 (20.6)	1,391 (12.7)	
	Obese	3,480 (18.8)	2,128 (29.2)	1,352 (11.9)	
UWCB	Yes	4,105 (22.3)	1,216 (16.6)	2,889 (26.0)	<.001
	No	14,054 (77.7)	5,968 (83.4)	8,086 (74.0)	

Note. ^aunweighted; ^bweighted; ^c*p* values for testing differences using a Rao–Scott χ^2 test; UWCB=unhealthy weight control behaviors.

2. Prevalence of UWCB by gender and weight status

Table 2, Table 3, and Figure 3 present the prevalence of UWCB by gender and weight status. Overall, 15.5%–29.7% of participants attempted at least one UWCB in the past month. Differences in the prevalence of UWCB by weight status were statistically significant ($p<.001$), as both males and females in the overweight and obese groups tended to be more engaged in UWCB than those in the normal weight group. The methods most commonly used by adolescents attempting at least one UWCB were fasting (48.3%–66.9%) and one-food diets (38.1%–46.3%), whereas the least used method was the use of laxatives or diuretics (6.3%–9.5%).

Table 2. Prevalence of UWCB by gender and weight status among adolescents

UWCB	Males (<i>n</i> = 7,184)			Females (<i>n</i> = 10,975)			<i>p</i> ^c
	Normal	Overweight	Obese	Normal	Overweight	Obese	
	(<i>n</i> = 3,586) <i>n</i> ^a (%) ^b	(<i>n</i> = 1,470) <i>n</i> ^a (%) ^b	(<i>n</i> = 2,128) <i>n</i> ^a (%) ^b	(<i>n</i> = 8,232) <i>n</i> ^a (%) ^b	(<i>n</i> = 1,391) <i>n</i> ^a (%) ^b	(<i>n</i> = 1,352) <i>n</i> ^a (%) ^b	
UWCB ^b	570 (15.5)	253 (16.6)	393 (18.5)	2,119 (25.4)	364 (25.9)	406 (29.7)	.009
No UWCB	3,016 (84.5)	1,227 (83.4)	1,735 (81.5)	6,113 (74.6)	1,027 (74.1)	946 (70.3)	

Note. ^aunweighted; ^bweighted; ^c*p* values for testing differences using a Rao–Scott χ^2 test; UWCB=unhealthy weight control behaviors

Table 3. Prevalence of each type of UWCB by gender and weight status among adolescents

Types of UWCB	Males (<i>n</i> = 1,226)				Females (<i>n</i> = 2,889)			
	Normal (<i>n</i> = 570)	Overweight (<i>n</i> = 253)	Obese (<i>n</i> = 393)	Normal (<i>n</i> = 2,119)	Overweight (<i>n</i> = 364)	Obese (<i>n</i> = 406)		
	<i>n</i> ^a (%) ^b	<i>n</i> ^a (%) ^b	<i>n</i> ^a (%) ^b	<i>n</i> ^a (%) ^b	<i>n</i> ^a (%) ^b	<i>n</i> ^a (%) ^b		
Fasting	388 (66.9)	158 (62.2)	248 (62.5)	1,251 (58.7)	212 (58.4)	210 (51.7)		
Taking nonprescription diet pills	65 (11.8)	27 (11.4)	52 (14.1)	367 (16.4)	86 (23.4)	126 (32.1)		
One-food diets	229 (41.4)	102 (40.4)	155 (38.1)	965 (45.9)	154 (43.2)	190 (46.3)		
Vomiting	68 (12.3)	28 (10.0)	37 (9.5)	251 (11.5)	43 (11.3)	45 (12.2)		
Using laxatives or diuretics	52 (9.5)	15 (6.3)	30 (7.4)	155 (6.9)	28 (7.1)	31 (8.5)		

Note. ^aunweighted; ^bweighted; UWCB=unhealthy weight control behaviors; types of UWCB: multiple responses; the prevalence of each type of UWCB among each weight group of adolescents who attempted UWCB

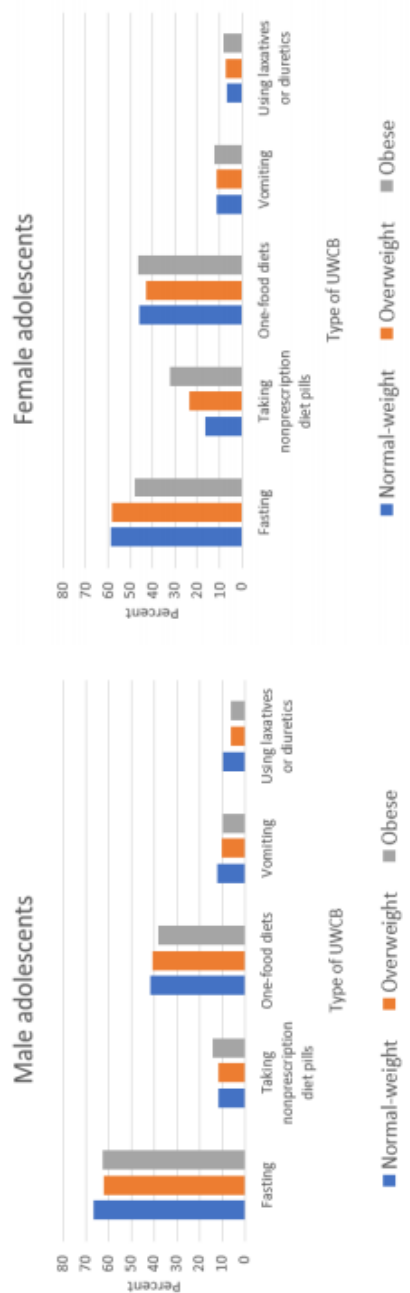


Figure 3. Prevalence of each type of UWC by gender and weight status among adolescents

Note. UWC=unhealthy weight control behaviors; types of UWC: multiple responses; the prevalence of each type of UWC among each weight group of adolescents who attempted UWC

3. Differences in UWCB by sample characteristics

Tables 4 and 5 display the differences in UWCB by sample characteristics.

In the male adolescent normal-weight group, there were significant differences in the distribution of UWCB with respect to age ($p=.003$); fast-food consumption ($p<.001$); breakfast consumption ($p<.001$); current smoking ($p<.001$); current alcohol use ($p<.001$); body weight perception ($p<.001$); depressive symptoms ($p<.001$); violent victimization ($p<.001$), and physical education ($p=.006$).

In the male adolescent overweight group, there were significant differences in the distribution of UWCB with respect to breakfast consumption ($p=.001$); current smoking ($p<.001$); depressive symptoms ($p<.001$), and violent victimization ($p<.001$).

In the male adolescent obese group, there were significant differences in the distribution of UWCB with respect to household economic status ($p=.004$); breakfast consumption ($p<.001$); current smoking ($p=.008$); current alcohol use ($p=.001$); body weight perception ($p<.001$); depressive symptoms ($p<.001$), and violent victimization ($p=.002$).

In the female adolescent normal-weight group, there were significant differences in the distribution of UWCB with respect to age ($p<.001$); household economic status ($p<.001$); cohabitation with family ($p=.017$); fast-food consumption ($p<.001$); breakfast consumption ($p<.001$); current

smoking ($p<.001$); current alcohol use ($p<.001$); body weight perception ($p<.001$); depressive symptoms ($p<.001$); violent victimization ($p<.001$) and physical education ($p<.001$), and nutrition education ($p<.001$).

In the female adolescent overweight group, there were significant differences in the distribution of UWCB with respect to breakfast consumption ($p<.001$); current smoking ($p=.009$); current alcohol use ($p<.001$); depressive symptoms ($p<.001$), and nutrition education ($p=.005$).

In the female adolescent obese group, there were significant differences in the distribution of UWCB with respect to household economic status ($p = .044$); breakfast consumption ($p<.001$); current smoking ($p=.008$); current alcohol use ($p=.001$); depressive symptoms ($p<.001$), and violent victimization ($p=.002$).

Table 4. Differences in UWCB by sample characteristics among male adolescents

Variables	Categories	Normal weight (<i>n</i> = 3,586)			Overweight (<i>n</i> = 1,470)			Obese (<i>n</i> = 2,128)			<i>p</i> ^c
		No UWCB	UWCB	<i>p</i> ^a	No UWCB	UWCB	<i>p</i> ^a	No UWCB	UWCB	<i>p</i> ^a	
		<i>n</i> (%) ^b	<i>n</i> (%) ^b		<i>n</i> (%) ^b	<i>n</i> (%) ^b		<i>n</i> (%) ^b	<i>n</i> (%) ^b		
Sociodemographic factors											
Age	12	310 (9.6)	39 (6.7)		117 (8.5)	19 (6.3)		128 (6.7)	28 (5.6)		
	13	528 (15.9)	84 (12.9)		209 (15.4)	32 (12.2)		282 (15.1)	50 (11.1)		
	14	486 (15.3)	89 (13.6)		205 (15.6)	41 (14.4)		298 (16.0)	60 (13.4)		
	15	466 (15.5)	82 (13.5)	.003	205 (17.3)	48 (18.8)	.560	293 (17.5)	66 (17.6)		.087
	16	479 (16.8)	103 (19.2)		218 (19.4)	47 (20.1)		305 (18.0)	69 (19.1)		
	17	498 (17.9)	113 (21.8)		179 (16.2)	43 (18.6)		285 (17.7)	84 (22.9)		
Household economic status	18	249 (9.1)	60 (12.4)		84 (7.6)	23 (9.6)		144 (9.1)	36 (10.3)		
	High	433 (14.4)	93 (16.2)		177 (15.3)	38 (14.7)		225 (12.7)	59 (16.6)		
	Middle	2,217 (73.6)	390 (69.4)	.117	888 (71.5)	181 (71.5)	.956	1,273 (73.9)	269 (67.5)		.044
	Low	366 (12.1)	87 (14.4)		152 (13.3)	34 (13.8)		237 (13.4)	65 (16.0)		
Cohabitation with family	Yes	2,828 (94.7)	521 (92.4)	.055	1,159 (95.6)	239 (94.6)	.509	1,656 (96.0)	379 (96.7)		.623
	No	188 (5.3)	49 (7.6)		58 (4.4)	14 (5.4)		79 (4.0)	14 (3.3)		
Health-related behavioral factors											
Fast-food consumption	≥3 times/week	747 (25.3)	189 (34.6)	<.001	282 (23.4)	66 (26.3)	.351	387 (21.9)	90 (24.7)		.226
	<3 times/ week	2,269 (74.7)	381 (65.4)		935 (76.6)	187 (73.7)		1,348 (78.1)	303 (75.3)		
Vegetable consumption	≥3 times/day	380 (12.2)	74 (12.1)	.927	177 (14.0)	36 (13.6)	.875	265 (15.1)	50 (11.8)		.091
	<3 times/day	2,636 (87.8)	496 (87.9)		1,040 (86.0)	217 (86.4)		1,470 (84.9)	343 (88.2)		
Breakfast consumption	Regular	1,988 (65.6)	306 (53.6)	<.001	805 (66.2)	136 (53.5)	.001	1,179 (68.1)	223 (57.0)		<.001
	Irregular	1,028 (34.4)	264 (46.4)		412 (33.8)	117 (46.5)		556 (31.9)	170 (43.0)		
Current smoking	Yes	244 (8.4)	73 (13.9)	<.001	91 (7.8)	35 (13.1)	.009	145 (8.8)	48 (13.5)		.008
	No	2,772 (91.6)	497 (86.1)		1,126 (92.2)	218 (86.9)		1,590 (91.2)	345 (86.5)		
Current alcohol use	Yes	507 (17.2)	151 (28.9)	<.001	192 (16.8)	70 (27.9)	<.001	292 (17.9)	95 (25.6)		.001
	No	2,509 (82.8)	419 (71.1)		1,025 (83.2)	183 (72.1)		1,443 (82.1)	298 (74.4)		
Psychosocial factors											
Body weight perception	Overestimate	1,328 (44.7)	234 (41.4)		N/A	N/A		N/A	N/A		
	Underestimate	235 (7.1)	72 (13.7)	<.001	139 (12.2)	43 (16.4)	.078	40 (2.3)	12 (3.2)		.356
	Accurate	1,453 (48.1)	264 (44.9)		1,078 (87.8)	210 (83.6)		1,695 (97.7)	381 (96.8)		
Depressive symptoms	perception	701 (23.5)	218 (38.5)	<.001	263 (22.0)	93 (35.9)	<.001	361 (21.3)	123 (31.2)		<.001
	Yes	2,315 (76.5)	352 (61.5)		954 (78.0)	160 (64.1)		1,374 (78.7)	270 (68.8)		
Violent victimization	No	99 (3.2)	40 (7.9)	<.001	36 (2.8)	12 (4.6)	.162	38 (2.3)	22 (5.9)		.002
	Yes	2,917 (96.8)	530 (92.1)		1,181 (97.2)	241 (95.4)		1,697 (97.7)	371 (94.1)		
School-related factors											
Physical education	≥3 times/week	1,274 (40.3)	213 (34.0)	.006	493 (37.8)	92 (35.6)	.511	678 (36.7)	139 (32.7)		.115
	<3 times/week	1,742 (59.7)	357 (66.0)		724 (62.2)	161 (64.4)		1,057 (63.3)	254 (67.3)		
Nutrition education	Yes	1,567 (51.9)	303 (51.4)	.836	665 (53.1)	115 (43.5)	.005	918 (52.4)	188 (50.1)		.372
	No	1,449 (48.1)	267 (48.6)		552 (46.9)	138 (56.5)		817 (47.6)	205 (49.9)		

Note. ^aunweighted; ^bweighted; ^c*p* values for testing differences using a Rao-Scott χ^2 test; UWCB=unhealthy weight control behaviors

Table 5. Differences of UWCB in sample characteristics among female adolescents

Variables	Categories	Normal weight (<i>n</i> = 8,232)			Overweight (<i>n</i> = 1,391)			Obese (<i>n</i> = 1,352)		
		No UWCB <i>n</i> ^a (%) ^b	UWCB <i>n</i> ^a (%) ^b	<i>p</i> ^c	No UWCB <i>n</i> ^a (%) ^b	UWCB <i>n</i> ^a (%) ^b	<i>p</i> ^c	No UWCB <i>n</i> ^a (%) ^b	UWCB <i>n</i> ^a (%) ^b	<i>p</i> ^c
Sociodemographic factors										
Age	12	518 (8.2)	127 (5.6)		127 (11.6)	28 (6.4)		84 (8.9)	16 (4.8)	
	13	1,088 (16.5)	305 (12.8)		179 (15.9)	72 (18.9)		148 (14.4)	56 (12.4)	
	14	1,197 (18.6)	375 (16.8)		181 (15.4)	69 (17.6)		138 (13.5)	53 (12.5)	
	15	1,147 (19.2)	397 (18.6)	<.001	148 (15.2)	65 (18.2)	.017	147 (15.3)	64 (14.4)	.029
	16	961 (16.7)	373 (18.6)		147 (15.8)	60 (17.5)		171 (18.0)	89 (22.3)	
	17	843 (14.5)	378 (19.1)		170 (17.8)	44 (13.3)		169 (19.8)	74 (18.8)	
	18	359 (6.3)	164 (8.5)		75 (8.2)	26 (8.1)		89 (10.1)	54 (14.8)	
Household economic status	High	522 (8.6)	185 (8.9)		92 (9.2)	31 (8.6)		64 (6.3)	31 (7.3)	
	Middle	4,868 (80.1)	1,594 (75.6)	<.001	786 (76.7)	276 (75.5)	.707	706 (74.1)	282 (69.2)	.246
Cohabitation with family	Low	723 (11.3)	340 (15.6)		149 (14.1)	57 (15.8)		176 (19.6)	93 (23.1)	
	Yes	5,856 (96.4)	2,000 (95.2)	.017	979 (96.0)	356 (97.8)	.125	893 (95.6)	381 (95.6)	.992
	No	257 (3.6)	119 (4.8)		48 (4.0)	8 (2.2)		53 (4.4)	25 (4.4)	
Health-related behavioral factors										
Fast-food consumption	≥3 times/week	1,314 (21.7)	575 (26.9)	<.001	189 (18.0)	84 (24.1)	.011	173 (18.6)	117 (28.8)	<.001
	<3 times/ week	4,799 (78.3)	1,544 (73.1)		838 (82.0)	280 (75.9)		773 (81.4)	289 (71.2)	
Vegetable consumption	≥3 times/day	597 (9.7)	151 (6.8)	<.001	110 (10.1)	33 (7.9)	.189	109 (11.5)	29 (6.2)	.001
	<3 times/day	5,516 (90.3)	1,968 (93.2)		917 (89.9)	331 (92.1)		837 (88.5)	377 (93.8)	
Breakfast consumption	Regular	3,910 (64.0)	974 (46.8)	<.001	647 (63.3)	176 (50.6)	<.001	584 (62.9)	222 (54.5)	.004
	Irregular	2,203 (36.0)	1,145 (53.2)		380 (36.7)	188 (49.4)		362 (37.1)	184 (45.5)	
Current smoking	Yes	196 (3.5)	200 (9.3)	<.001	29 (3.4)	26 (7.0)	.007	26 (2.5)	41 (11.0)	<.001
	No	5,917 (96.5)	1,919 (90.7)		998 (96.6)	338 (93.0)		920 (97.5)	365 (89.0)	
Current alcohol use	Yes	788 (13.1)	506 (24.5)	<.001	119 (12.6)	69 (19.9)	.006	124 (13.0)	102 (24.4)	<.001
	No	5,325 (86.9)	1,613 (75.5)		908 (87.4)	295 (80.1)		822 (87.0)	304 (75.6)	
Psychosocial factors										
Body weight perception	Overestimate	2,449 (40.2)	965 (46.9)		N/A	N/A		N/A	N/A	
	Underestimate	548 (9.1)	176 (7.9)	<.001	72 (6.9)	27 (6.8)	.937	11 (1.3)	7 (1.6)	.678
Depressive symptoms	Accurate perception	3,116 (50.7)	978 (45.1)		955 (93.1)	337 (93.2)		935 (98.7)	399 (98.4)	
	Yes	2,089 (34.4)	1,150 (54.1)	<.001	340 (32.4)	184 (49.3)	<.001	314 (33.9)	191 (47.9)	<.001
Violent victimization	No	4,024 (65.6)	969 (45.9)		687 (67.6)	180 (50.7)		632 (66.1)	215 (52.1)	
	Yes	60 (1.0)	56 (2.3)	<.001	8 (0.7)	6 (1.4)	.249	11 (1.1)	16 (3.8)	<.001
	No	6,053 (99.0)	2,063 (97.7)		1,019 (99.3)	358 (98.6)		935 (98.9)	390 (96.2)	
School-related factors										
Physical education	≥3 times/week	1,914 (29.9)	535 (23.7)	<.001	310 (28.4)	107 (30.6)	.490	273 (27.0)	84 (19.4)	.004
	<3 times/week	4,199 (70.1)	1,584 (76.3)		717 (71.6)	257 (69.4)		673 (73.0)	322 (80.6)	
Nutrition education	Yes	3,047 (48.9)	905 (41.1)	<.001	508 (46.5)	176 (46.1)	.895	431 (44.7)	167 (40.6)	.211
	No	3,066 (51.1)	1,214 (58.9)		519 (53.5)	188 (53.9)		515 (55.3)	239 (59.4)	

Note: ^aunweighted; ^bweighted; ^c*p* values for testing differences using a Rao-Scott χ^2 test; UWCB, unhealthy weight control behaviors

4. Factors related to UWCB by gender and weight status among adolescents

Tables 6 and 7 present the adjusted odds ratios of UWCB based on sociodemographic, health-related behavioral, psychosocial, and school factors.

Normal-weight male adolescents who consumed fast-food three or more times a week (OR = 1.42, 95% CI 1.16–1.74), reported current alcohol use (OR = 1.50, 95% CI 1.17–1.91), underestimated their weight status (OR = 1.85, 95% CI 1.32–2.59), and experienced depressive symptoms (OR = 1.77, 95% CI 1.46–2.14) or violent victimization (OR = 1.89, 95% CI 1.30–2.74) were more likely to engage in UWCB. By contrast, those who consumed breakfast regularly (OR = 0.61, 95% CI 0.50–0.74) had a lower risk of UWCB.

In overweight male adolescents, those who experienced depressive symptoms (OR = 1.76, 95% CI 1.27–2.43) correlated with higher odds of UWCB. By contrast, those who consumed breakfast regularly (OR = 0.62, 95% CI 0.45–0.86) or had received nutrition education in the past 12 months (OR = 0.73, 95% CI 0.56–0.96) correlated with lower odds of UWCB.

In obese male adolescents, those who experienced depressive symptoms (OR = 1.50, 95% CI 1.17–1.91) or violent victimization (OR = 2.33, 95% CI 1.23–4.42) had a higher risk of UWCB. By contrast, those who consumed breakfast regularly (OR = 0.65, 95% CI 0.51–0.82) were less likely to

engage in UWCB.

Normal-weight female adolescents who consumed fast-food three or more times a week (OR = 1.16, 95% CI 1.03–1.31), reported current alcohol use (OR = 1.46, 95% CI 1.25–1.71) or that they were a current smoker (OR = 1.55, 95% CI 1.25–1.93), overestimated their weight status (OR = 1.25, 95% CI 1.12–1.40), and experienced depressive symptoms (OR = 2.02, 95% CI 1.83–2.22) or violent victimization (OR = 1.96, 95% CI 1.31–2.92) were more likely to engage in UWCB. By contrast, those who cohabitated with their family (OR = 0.76, 95% CI 0.57–0.99), consumed vegetable three or more times a day (OR = 0.76, 95% CI 0.63–0.92), consumed breakfast regularly (OR = 0.55, 95% CI 0.49–0.61), directly exercised three or more times a week in a playground or in gym during physical education class (OR = 0.87, 95% CI 0.76–0.99), or had received nutrition education in the past 12 months (OR = 0.80, 95% CI 0.71–0.89) had a lower risk of UWCB.

In overweight female adolescents, only those who experienced depressive symptoms (OR = 1.91, 95% CI 1.47–2.48) were more likely to have UWCB. By contrast, only those who consumed breakfast regularly (OR = 0.64, 95% CI 0.49–0.83) had lower odds of UWCB.

In obese female adolescents, those who consumed fast-food three or more times a week (OR = 1.56, 95% CI 1.14–2.15), reported they were a current smoker (OR = 2.56, 95% CI 1.52–4.33), experienced depressive symptoms (OR = 1.56, 95% CI 1.19–2.05) or violent victimization (OR = 2.27, 95% CI 1.16–4.41) had a higher risk of UWCB. By contrast, those

who consumed vegetable three or more times a day (OR = 0.54, 95% CI 0.35–0.83), or directly exercised three or more times a week in a playground or in gym during physical education class (OR = 0.70, 95% CI 0.51–0.968) were less likely to engage in UWCB.

Table 6. Factors related to UWCB by weight status among male adolescents

Variables	Categories	Normal weight (<i>n</i> = 3,586)		Overweight (<i>n</i> = 1,470)		Obese (<i>n</i> = 2,128)	
		OR	95% CI	OR	95% CI	OR	95% CI
Sociodemographic factors							
Age	18	1.55	0.97–2.50	1.09	0.43–2.79	1.15	0.62–2.13
	17	1.35	0.89–2.05	1.02	0.41–2.50	1.37	0.80–2.34
	16	1.31	0.85–2.02	0.97	0.40–2.31	1.13	0.65–1.94
	15	1.09	0.73–1.63	1.07	0.54–2.16	1.12	0.65–1.92
	14	1.17	0.75–1.84	1.09	0.60–1.97	0.96	0.55–1.68
	13	1.09	0.74–1.62	1.01	0.55–1.86	0.91	0.53–1.57
	12	Ref.		Ref.			
Household economic status	High	1.05	0.74–1.49	1.05	0.60–1.85	1.24	0.81–1.89
	Middle	0.88	0.68–1.14	1.11	0.73–1.70	0.86	0.61–1.21
	Low	Ref.		Ref.			
Cohabitation with family	Yes	0.74	0.49–1.10	0.87	0.48–1.59	1.46	0.66–3.23
	No	Ref.		Ref.			
Health-related behavioral factors							
Fast-food consumption	≥3 times/week	1.42	1.16–1.74	1.11	0.78–1.56	1.15	0.90–1.49
	<3 times/ week	Ref.					
Vegetable consumption	≥3 times/day	1.13	0.83–1.54	1.06	0.71–1.58	0.80	0.56–1.13
	<3 times/day	Ref.		Ref.			
Breakfast consumption	Regular	0.61	0.50–0.74	0.62	0.45–0.86	0.65	0.51–0.82
	Irregular	Ref.		Ref.			
Current smoking	Yes	1.09	0.81–1.47	1.12	0.67–1.86	1.15	0.79–1.66
	No	Ref.		Ref.			
Current alcohol use	Yes	1.50	1.17–1.91	1.50	1.00–2.25	1.26	0.94–1.70
	No	Ref.		Ref.			
Psychosocial factors							
Body weight perception	Overestimate	1.02	0.84–1.25	N/A		N/A	
	Underestimate	1.85	1.32–2.59	1.30	0.87–1.94	1.28	0.68–2.43
Depressive symptoms	Accurate perception	Ref.		Ref.			
	Yes	1.77	1.46–2.14	1.76	1.27–2.43	1.50	1.17–1.93
Violent victimization	No	Ref.		Ref.		Ref.	
	Yes	1.89	1.30–2.74	1.40	0.69–2.86	2.33	1.23–4.42
No	Ref.		Ref.		Ref.		
School-related factors							
Physical education	≥3 times/week	0.83	0.66–1.05	1.05	0.77–1.45	0.94	0.73–1.20
	<3 times/week	Ref.		Ref.		Ref.	
Nutrition education	Yes	1.07	0.89–1.29	0.73	0.56–0.96	0.99	0.80–1.23
	No	Ref.		Ref.		Ref.	

Note: OR, odds ratio; CI, confidence interval

Table 7. Factors related to UWCB by weight status among female adolescents

Variables	Categories	Normal weight (<i>n</i> = 8,232)		Overweight (<i>n</i> = 1,391)		Obese (<i>n</i> = 1,352)	
		OR	95% CI	OR	95% CI	OR	95% CI
Sociodemographic factors							
Age	18	1.52	1.11–2.07	1.78	0.98–3.23	2.08	0.97–4.50
	17	1.52	1.18–1.96	1.29	0.76–2.20	1.38	0.65–2.96
	16	1.37	1.05–1.78	1.81	1.11–2.96	1.79	0.85–3.78
	15	1.27	0.98–1.63	2.05	1.25–3.36	1.52	0.72–3.20
	14	1.25	0.98–1.59	1.82	1.14–2.89	1.63	0.76–3.49
	13	1.16	0.90–1.49	2.07	1.28–3.33	1.45	0.73–2.86
Household economic status	12	Ref.		Ref.		Ref.	
	High	1.10	0.87–1.39	0.86	0.50–1.46	1.34	0.79–2.27
	Middle	0.87	0.75–1.02	0.92	0.64–1.33	0.95	0.70–1.30
Cohabitation with family	Low	Ref.		Ref.		Ref.	
	Yes	0.76	0.57–0.99	1.82	0.87–3.79	1.29	0.78–2.16
	No	Ref.					
Health-related behavioral factors							
Fast-food consumption	≥3 times/week	1.16	1.03–1.31	1.31	0.96–1.79	1.56	1.14–2.15
	<3 times/ week	Ref.		Ref.		Ref.	
Vegetable consumption	≥3 times/day	0.77	0.63–0.92	0.81	0.52–1.28	0.54	0.35–0.83
	<3 times/day	Ref.		Ref.		Ref.	
Breakfast consumption	Regular	0.55	0.49–0.61	0.64	0.49–0.83	0.77	0.61–1.00
	Irregular	Ref.		Ref.		Ref.	
Current smoking	Yes	1.55	1.25–1.93	1.44	0.77–2.69	2.56	1.52–4.33
	No	Ref.		Ref.		Ref.	
Current alcohol use	Yes	1.46	1.25–1.71	1.42	0.91–2.21	1.41	0.99–2.02
	No	Ref.		Ref.		Ref.	
Psychosocial factors							
Body weight perception	Overestimate	1.25	1.12–1.40	N/A		N/A	
	Underestimate	0.87	0.72–1.06	1.16	0.71–1.89	1.50	0.59–3.78
	Accurate perception	Ref.		Ref.		Ref.	
Depressive symptoms	Yes	2.02	1.83–2.22	1.91	1.47–2.48	1.56	1.19–2.05
	No	Ref.		Ref.		Ref.	
Violent victimization	Yes	1.96	1.31–2.92	1.69	0.59–4.89	2.27	1.16–4.41
	No	Ref.		Ref.		Ref.	
School-related factors							
Physical education	≥3 times/week	0.87	0.76–0.99	1.14	0.80–1.63	0.70	0.51–0.96
	<3 times/week	Ref.		Ref.		Ref.	
Nutrition education	Yes	0.80	0.71–0.89	1.00	0.78–1.29	0.94	0.73–1.22
	No	Ref.		Ref.		Ref.	

Note: OR, odds ratio; CI, confidence interval

VI. Discussion

1. Prevalence of UWCB by gender and weight status

In this study, female adolescents reported UWCB more frequently than male adolescents; this finding is in line with previous studies (Stephen et al., 2014; Vander Wal, 2012). A large body of literature on gender differences in body image-related ideals support the current findings (Han et al., 2020; Nanu et al., 2013; Voelker et al., 2014; Warren et al., 2010). Female adolescents evaluate their weight and appearance more negatively than male adolescents (Nanu et al., 2013). Additionally, female adolescents reported greater pressure to conform to a “thin ideal” and engage in social comparison than male adolescents (Warren et al., 2010). As a result, they may attempt to lose weight using a variety of more aggressive strategies than male adolescents. In this regard, this study also provides evidence to support females’ vulnerability to UWCB and accentuates the need for efforts to promote females’ positive body image.

Of particular interest within the present analysis is that the prevalence of UWCB in male adolescents tended to be higher in the overweight and obese groups than in the normal-weight group, but the prevalence of each type of UWCB tended to be higher overall in the normal weight group. This result suggests that male adolescents in the normal-weight group were more

engaged in one or more UWCB simultaneously than those in the overweight and obese groups. This finding may correlate with a higher risk of engaging in UWCB when non-overweight male adolescents perceived themselves as underweight (Gonsalves et al., 2014; Han et al., 2020). Male adolescents with normal-weight were more likely to perceive themselves as underweight than those who are overweight and obese. The tendency to underestimate body size among male adolescents is because they idealize a muscular, larger body (Murray et al., 2016). More specifically, Jones and Crawford (2005) identified muscularity concerns as a distinct pathway to body dissatisfaction in adolescents with a low BMI; specific to male adolescents and associated with perceptions of being underweight, this body dissatisfaction may prompt male adolescents with normal weight to engage in higher doses of UWCB.

Also noteworthy is the fact that the prevalence of laxative and diuretic use in normal-weight male adolescents tended to be higher than in females of all weight groups. Body dissatisfaction among males differs from that observed in females in that it is characterized by an urge for muscularity rather than the pursuit of thinness. Eating disorders, including UWCB, are becoming more common in males and the gender gap is closing, yet a large number of studies and practices continue to focus on females' weight control behaviors related to thinness (Murray et al., 2016). Therefore, there is a need to shift the existing female-centered view of UWCB and provide more active interventions to lower the risk of UWCB in male adolescents.

Also notable is the fact that the prevalence of taking nonprescription diet pills among overweight and obese female adolescents tended to be higher than in other weight groups. Most overweight female adolescents perceive themselves as overweight, leading to high body dissatisfaction (Liyanage et al., 2021). Weight stigma, such as weight-related bullying and teasing, appears across all weight categories, but individuals with a higher BMI experience this more frequently (Lanza et al., 2018; Lian et al., 2018). In particular, female adolescents perceive a higher level of weight-related stigma than male adolescents (Tang-Péronard & Heitmann, 2008). Consequently, body dissatisfaction and weight stigma in female adolescents classified as overweight and obese can initiate a more extreme desire to lose weight. Reportedly, overweight adolescents are more engaged in both healthy behaviors and UWCB than non-overweight adolescents (Fonseca et al., 2009). Thus, additional educational and environmental support is required to help overweight and obese females identify and choose healthy weight control practices.

2. Factors related to UWCB by gender and weight status among adolescents

This study examined how various UWCB-related factors differed by gender and weight status. However, when the sample was disaggregated, several factors did not exhibit consistent results across groups; this finding is important because intervention strategies for UWCB could be differentially established by gender and weight status.

1) Sociodemographic factors

Cohabitation with family as a sociodemographic factor was strongly correlated with a lower risk of UWCB only in the normal-weight female adolescent group. The impact of cohabitation with family on UWCB could be associated with the functional role of parents. For overweight or obese adolescents, parental concern about weight status may act as a form of pressure to lose weight (Abdalla et al., 2020), whereas for normal-weight adolescents, parents' perception of their children's weight status as appropriate can help limit risky behaviors in this group. According to previous studies, female adolescent who heard a substantial amount of talk about their weight by their parents and were encouraged to lose weight had a higher risk of engagement in UWCB (Neumark-Sztainer et al., 2010). Parental beliefs, perceptions, behavior, and the social climate created by parents at home may influence weight-related behavior in adolescents

(Cislak et al., 2012; Cromley et al., 2010). Additional studies into how these parental weight-related parenting practices differ according to their child's weight status may elucidate more specifically the role of parents and family in the prevention of UWCB in adolescents.

2) Health-related behavioral factors

Significant correlations between UWCB and various health-related behaviors reported in the literature were also found in the current study; however, these differed by weight status, even within the same gender.

Breakfast consumption was a protective factor for UWCB in all groups except for the obese group of adolescent females. These results are in line with previous studies indicating that more breakfast days are associated with a lower risk of UWCB (Neumark-Sztainer et al., 2011) and irregular breakfasts increase the risk of UWCB (Weng et al., 2022). An overwhelming amount of evidence consistently supports the relationship between breakfast and a healthy weight (Ricotti et al., 2021; Szajewska & Ruszczyński, 2010). In this context, these findings suggest that breakfast consumption can be employed as a healthy weight control strategy while preventing the use of more risky strategies. Depending on the type, quality, and quantity of breakfast, the relevance to weight control may vary (Leidy et al., 2015), but these factors could not be controlled for in this study. Therefore, further research on which breakfast composition can induce a

healthy weight according to more segmented weight status may suggest alternative strategies for preventing UWCB.

Consumption of vegetables at least 3 times/day was a protective factor for UWCB engagement in normal-weight and obese female adolescents, but not in overweight female and male adolescents. Vegetable consumption is considered a promising approach for healthy weight control behavior. Because the co-occurrence of healthy weight control behavior and UWCB is prevalent, promoting healthy weight control behaviors such as dietary habits could be a strategy for avoiding engagement in UWCB (Lampard et al., 2016). Notably, in the current sample of female adolescents, these relationships were not consistent in the overweight group only. In terms of weight control in adolescents, the overweight group is often considered similar to the obese group. These inconsistent results in the overweight and obese groups indicate that segmentation of the two weight groups may be of paramount importance in understanding the risk of weight-related problems. Future studies should clarify whether these differences in overweight and obese groups are demonstrated in other representative samples and identify accessible profiles for healthy weight control other than vegetable consumption in overweight female adolescents. Additionally, male adolescents might choose UWCB because their level of vegetable consumption is not sufficient to induce weight loss, even when they are attempting to lose weight using healthy strategies (Kakinami et al., 2019; Lange et al., 2021). Therefore, parents, schools, and communities should be

more involved in educational and environmental measures to ensure adolescents consume the recommended amount of vegetables.

Current smoking was correlated with a higher risk of UWCB only in female adolescents with normal weight and who were obese. A previous study by Sim et al. (2017) of a representative sample of Korean adolescents identified smoking as a risk factor for UWCB in both male and female adolescents. However, when subdivided by weight status in the current study, current smoking was not correlated with UWCB in males of any weight group. A possible explanation for this finding is that female adolescents are more likely to smoke than male adolescents because of a false belief that smoking is a good way to lose weight (World Health Organization, 2010). However, this association exhibits different patterns in other adolescent samples. For example, in a representative sample of U.S. adolescents, the correlation between current smoking and UWCB was only found in male adolescents (Weng et al., 2022). In addition, among Serbian adolescents, male adolescent smokers were twice as likely to report smoking for weight control than female adolescents (Kilibarda et al., 2020). These differences are possibly attributable to variations in sociocultural background. Thus, further investigation into how the correlation between smoking and UWCB varies according to cultural background might provide new insights into the prevention of smoking for weight control and UWCB.

Current alcohol use increased the risk of UWCB only in the normal weight group for both male and female adolescents. However, previous

study has revealed that the association between alcohol use and UWCB may vary according to drinking level (Eichenet et al., 2012). Therefore, further studies considering drinking levels are needed to determine the relationship between alcohol use and UWCB at each weight status. Nonetheless, it is clear that adolescence tends to co-exist with multiple health risk behaviors (Duell et al., 2018; Eichenet et al., 2012; Steinberg, 2008). Therefore, public health interventions for UWCB should be developed that focus on these complex clusters.

3) Psychosocial factors

Consistent with previous studies (Gonsalves et al., 2014; Kennedy et al., 2019), normal-weight male adolescents had a higher risk of UWCB when they underestimated their weight, whereas normal-weight female adolescents had a higher risk of UWCB when they overestimated their weight. As stated previously, adolescent males underestimate their body size and perceive themselves as underweight as a result of idealizing a muscular, larger body (Murray et al., 2016). Consequently, they may attempt UWCB while pursuing a lean, muscular body. Therefore, a prevention program for UWCB should be prioritized to provide normal-weight adolescents with techniques to more accurately perceive their weight and education, enabling them to adjust the psychological factors that result in them misperceiving their weight.

Depressive symptoms were strong risk factors for UWCB in both males and females, regardless of weight status, as confirmed by several studies (Armstrong et al., 2014; Gonsalves et al., 2014; Stephen et al., 2014; Weng et al., 2022). This may be attributable to the fact that depressive symptoms and UWCB share common risk factors (Leal et al., 2020; Richard et al., 2016). Additionally, previous evidence of a relationship between body image distortion and depression and UWCB (Armstrong et al., 2014; Blashill & Wilhelm, 2014) suggests that depressive symptoms may be linked to other psychological factors leading to UWCB.

Violent victimization was associated with a higher risk of UWCB in all groups, except for the overweight group in both male and female adolescents. Adolescents with victimization are at higher risk of experiencing negative body image than those who are not victimized (Day et al., 2022). Fear of negative evaluation is also related to weight and body shape concerns in adolescents (Trompeter et al., 2018). Given that negative images of one's own body constitute a major risk factor for UWCB, such findings suggest a path from violence victimization to UWCB. Although numerous studies have reported a correlation between victimization and UWCB, the correlation was not reported in the overweight group in this study. Victimization takes multiple forms, including bullying, assault, physical abuse, verbal abuse, and sexual abuse (Lee & Vaillancourt, 2018; Volk et al., 2006), and may also include specific weight-related victimization (Day et al., 2022). The inconsistent results in the overweight

group may have arisen because previous studies have focused on the relationship between weight-related victimization and UWCB, whereas the current study investigated experiences of violent victimization that may not be weight-related. Further studies are needed to elucidate the mechanisms by which different types of victimization, both non-specific and weight-related, within each weight group can lead to UWCB.

4) School-related factors

School-related factors considered crucial for the prevention of UWCB in adolescents (i.e., physical education and nutrition education) have been identified as protective factors that lower the risk of UWCB, particularly in normal-weight female adolescents. In the case of normal weight female adolescents, it seems that they have led them to adopt healthy weight control practices through the acquisition of knowledge about healthy eating habits through nutrition education and by undertaking physical activities at an appropriate frequency through physical education classes. Given that 75% of females who attempted weight loss in this study were of normal weight, these findings further highlight the need for a school-based strategy to prevent UWCB. In the current study, nutrition education was investigated in terms of whether or not adolescents had received education about nutrition and eating habits at school during the past 12 months. Therefore, there was a lack of information on the specific cycles of nutrition education provided and whether specialized education contents for weight control were included.

For this reason, it was not possible to specifically identify the effect of school nutrition education on UWCB in overweight and obese groups. Moreover, in the current sample, only 48.6% of students reported having received education about nutrition and eating habits in the past year. These results may be attributable to the current curriculum in Korea. Currently, Korea's School Health Law stipulates that all students must receive compulsory systematic health education (School Health Act of Korea, 2007), but health education is not designated as a required subject. School is a key context for the development of nutrition knowledge and healthy dietary habits, and recent evidence has reported the effectiveness of school-based interventions in these domains (Jacob et al., 2021). Therefore, for these school-based interventions to be more effective and scaled-up, a policy change should take place that makes health education a required subject in the curriculum. Another related alternative in the current context is the development of nutrition curricula that can be easily integrated with curricula in other subject areas (Perera et al., 2015). In addition, given that the quality and quantity of an individual's diet for weight control may vary depending on their weight status (Leidy et al., 2015), nutrition education should include customized information that can lead to actual weight control.

In all weight groups of male adolescents, no correlation was found between physical education classes and UWCB, which was expected because the frequency or intensity of physical activity in school classes is not sufficient for them to manage their weight or obtain an ideal body shape.

For adolescents, physical education is the most important context in which physical activity can be maximally promoted across segmented days (Pope et al., 2020). Nevertheless, in this study, only 31.9% of adolescents reported that they exercised more than 3 times a week in the playground or in the gym during physical education class. Therefore, rather than depend exclusively on physical education classes to address low levels of physical activity, there is a need to reimagine the physical activity environment in schools (Pope et al., 2020). Another factor to consider is the content of physical education. According to the current national curriculum, physical education focuses on developing the core competencies of increasing physical strength through physical activities, sport game performance ability, and physical training ability (Ministry of Education, 2015). Although physical activity is emphasized due to the increase in obesity in the adolescent population, a limitation exists in that practical content elements for acquiring a healthy body image and appropriate weight status have not been explored within physical education. Content elements that focus more on evidence-based physical activity to attain healthy weight status should be included in future curricula. Because this study investigated the frequency of direct physical activity during physical education classes, there were limitations in evaluating more specific levels of physical activity (i.e., intensity, time, volume, etc.). Further investigation of the relationship between objectively assessed levels of physical activity and weight control in each weight status group will provide an opportunity to limit UWC by

identifying and guiding physical activities for healthy weight control practices according to weight status.

There is also a need for a more integrated approach to healthy weight management for adolescents. In this context, The Whole School, Whole Community, Whole Child (WSCC) approach serves as an important guide to supporting students by organizing collaborative actions and strongly engaging community resources (Lewallen et al., 2015). In particular, it focuses on family engagement and community involvement. For example, by involving families in weight management for adolescents, schools can ensure that meaningful weight management practices continue every day at home and at school. School leaders can also utilize community resources (e.g., out-of-school activities and fitness facilities) to support additional learning and activity opportunities, and the school nurse can work as a coordinator of these collaborative activities.

Another example of integrated approach is the adoption of health promoting schools (HPS). The HPS framework by WHO is a holistic approach to promoting health and educational attainment for students (Langford et al., 2015). A Cochrane review of the effectiveness of this approach reported positive effects for BMI, physical activity, and vegetable and fruit consumption that could be reflected in adequate weight management (Langford et al., 2015). Notwithstanding these positive effects, the uptake and sustainability of HPS in South Korea have remained low (Kim & Kim, 2018). School administrators should participate in the work of

the school's health team and coordinate community integration to ensure that school health promoting programs and initiatives are successfully implemented (Lewallen et al., 2015; Webster et al. 2020).

3. Nursing implications

This study provides new insight into potential prevention strategies for UWCB in adolescents by demonstrating that UWCB and its related factors are differentially associated according to gender and weight status. To prevent UWCB in adolescents, education and practices accessible in school settings are essential. School nurses are critical to enabling schools to fulfill this role and can contribute in several ways:

First, school nurses should provide various types of health education so that adolescents can discern and acquire a healthy body image, and create an environment where all types of bodies are appreciated.

Second, because depressive symptoms were strong factors for UWCB in all groups by gender and weight status, timely assessment of adolescents' depressive symptoms could prevent them from engaging in UWCB.

Third, the effectiveness of the healthy weight control method and dosage may differ according to weight status, therefore school nurses should focus on establishing a customized strategy.

Finally, school nurses are leaders and coordinators for school health. Therefore, school nurses should work together with school members and families to support adolescents' healthy weight management, and advise colleagues and administrators on how to build better school environments

based on public policy.

4. Limitations

This study has several limitations that need to be addressed. First, this was a cross-sectional study that could not establish causal relationships.

Second, the BMI values in this study were calculated using self-reported height and weight. However, self-reported BMI scores may be underestimated because adolescents tend to overestimate their height and underestimate their weight. Moreover, due to the nature of BMI, which cannot distinguish between lean and fat mass, the BMI of adolescents with dense muscle mass may be overestimated. This may have had some effect on weight status classification based on BMI.

Third, because this study used secondary data, there was insufficient information available to identify factors associated with UWCB. For example, breakfast consumption, which is considered a healthy weight control practice, was only available as a single-item measure of adolescent-reported breakfast frequency per week. The lack of information on dietary patterns including food groups and portion sizes may have limited the ability to capture more specific dietary plans for the prevention of UWCB within each weight status group. Lack of information on socioenvironmental factors is one of the major limitations of this study. In particular, given that parental beliefs, perceptions, and behaviors influence adolescents' weight-

related behaviors, a lack of information about parental interactions on weight status and weight management may have impeded the identification of significant contextual factors for UWCB. Furthermore, Insufficient information about the socio-cultural pressures, including in the mass media, has limited the ability to identify factors associated with UWCB in the macro social context. Similarly, another limitation of the variables used in this study was that school-related factors could only incorporate variables related to the the curriculum and could not reflect the physical and social environment of the school.

Finally, adolescents classified as underweight were excluded from this study because the sample size was not large enough to facilitate an analysis. Because male adolescents are at higher risk of engaging in UWCB when they underestimate their own weight, richer information about UWCB might have been created if this group had been included.

VII. Conclusions

This study contributes to expanding previous research on gender differences by examining the prevalence of UWCB according to a more subdivided weight status (i.e., classification of overweight and obese groups) and assessing whether the associated factors of UWCB are differentially associated according to each weight status.

In conclusion, the higher prevalence of UWCB in female adolescents supports research indicating their vulnerability to UWCB. Nevertheless, the highest prevalence of laxatives or diuretics in normal-weight male adolescents among all groups by gender and weight status suggests that more attention needs to be paid to male adolescents' engagement in UWCB. When participants were disaggregated by gender and weight status, several factors did not exhibit consistent results across groups; the previously identified correlations between UWCB and related factors were most consistent for normal-weight females but least consistent among overweight female adolescents. These results make an important contribution to the differential establishment of intervention strategies for UWCB according to gender and weight status.

Based on the results, the following suggestions can be made for future research.

First, disordered eating, including UWCB, is becoming increasingly common in males and differs from that observed in females (Murray et al.,

2016). However, studies focusing on adolescent males remain limited. Hence, further research is warranted to elucidate UWCB in male adolescents.

Second, in a large number of studies, weight-related issues have been addressed by equating the overweight group with the obese group. However, the overweight group is relatively more likely to transition to a normal weight or obese status than normal-weight or obese groups are to another BMI category (Tran et al., 2016). Therefore, more extensive research on prevention of UWCB and healthy weight control behaviors among overweight adolescents needs to be conducted.

Fourth, although this study reveals that factors related to UWCB are differentially related to weight status, data constraints caused by using secondary data have limited the establishment of specific strategies for UWCB. Further research should add variables that may be associated with UWCB, and measure an extensive pattern of single items, particularly of healthy weight control practices that may serve to limit UWCB.

Finally, to build on this cross-sectional study, a longitudinal study is needed to further clarify the causal relationship between UWCB and related factors.

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[health#tab=tab_1](https://www.who.int/health-topics/adolescent-health#tab=tab_1)

Appendix

Appendix 1.

IRB approval letter

심의 면제 확인서

수신

연구책임자	이름: 윤주영	소속: 간호대학 간호학과	직위: 교수
지원기관	해당없음		

과제정보

승인번호	IRB No. E2107/003-002		
연구과제명	체중상태에 따른 청소년의 부적절한 체중조절 행동 관련 요인의 비교: 제15차 청소년건강행태온라인 조사를 이용하여		
연구종류	공개된 정보 이용 연구		
면제일자	2021-07-19		
심의결과	면제승인		
검토의견	면제 검토의견	본 연구는 공개된 자료인 질병관리청의 '제15차(2019년) 청소년건강행태조사' 자료를 이용하는 연구로 「생명윤리 및 안전에 관한 법률 시행규칙」 제13조 제1항에 근거하여 심의를 면제합니다.	

상기 연구과제에 대하여 본 위원회에서는 심의면제대상임을 확인합니다.

2021년 07월 19일

서울대학교 생명윤리위원회 위원장



본 위원회가 승인한 연구를 수행하는 연구자들은 다음의 사항을 준수해야 합니다.

1. 모든 연구자들은 아래의 사항을 준수하여야 합니다.
2. 연구자께서는 제출하신 계획서에 따라 연구를 수행하여야 하며, 이와 다르게 연구를 진행하실 경우 다시 심의를 진행하셔야 함을 유의하시기 바랍니다.
3. 위원회의 요구가 있을 때에는 연구의 진행과 관련된 보고를 위원회에 제출하여야 합니다.
4. 연구윤리를 위하여 관련부처가 필요시 조사 및 감독 차원에서 현장점검을 실시할 수 있습니다.
5. 연구와 관련된 기록은 연구가 종료된 시점을 기준으로 최소 3년간 보관하여야 합니다.

국문초록

한국 청소년의 성별과 체중상태에 따른 부적절한 체중조절 행동 및 관련 요인

배 은 정

서울대학교 대학원

간호학과

지도교수 윤 주 영

청소년기는 가장 빠른 성장과 발달이 이루어지면서 체형에 대한 자의식이 형성되는 시기이다. 청소년들은 변화하는 신체가 마른 이상적 체형과 일치하지 않는다고 인식할 때 불필요하거나 건강에 해로운 전략으로 체중조절을 시도할 수 있다. 단식, 구토, 이뇨제 및 완하제의 사용, 처방되지 않은 다이어트 약 복용 등의 부적절한 체중조절 행동은 전 세계적으로 만연해 있으며, 부적절한 전략으로 체중 감소를 시도하는 청소년의 비율이 44%에 이른다고 보고되고 있다. 부적절한 체중조절 행동의 부정적인 신체적 · 심리적 결과를 고려할 때, 이 인구집단에서의 부적절한 체중조절 행동과 관련된 요인을 식별하는 것이 매우 중요하다고 할 수 있다. 지금까지 많은 연구들이 청소년의 부적절한 체중조절 행동에 영향을 미치는 다양한 요인들을 확인하고 관련 요인들의 성별 차이를 입증하였다. 그러나 이러한 요인들이 체중상태에 따라 어떻게 달라지는지에 대한 연구는 제한적이다. 따라서 본 연구는 우리나라 청소년을 대표하는 표본을 이용하여 성별과 체중상태에 따른 사회인구학적, 건강관련 행위,

심리사회적, 학교 관련 요인들과 건강하지 못한 체중조절 행동 간의 상관성의 차이를 확인하고자 하였다.

본 연구는 2019년 청소년건강행태조사 데이터를 활용하였으며, 분석을 위해 18,159명의 청소년 데이터가 산출되었다. 부적절한 체중조절 행동 관련 요인을 확인하기 위해 복합표본 로지스틱 회귀분석을 수행하고 성별과 체중 상태로 분류된 로지스틱 회귀 모델에서 승산비와 95% 신뢰구간을 산출하였다.

분석 결과 부적절한 체중조절 행동과 관련된 요인들은 각 체중 그룹간에 일관된 결과를 나타내지 않았다. 정상체중의 남자 청소년의 경우 주 3회 이상 패스트푸드 섭취, 현재 음주, 체중상태의 과소평가, 우울 증상과 폭력 피해의 경험이 부적절한 체중조절 행동의 위험요인인 반면 규칙적인 아침식사는 보호요인으로 나타났다. 과체중의 남자 청소년의 경우 우울 증상 경험은 부적절한 체중조절 행동 시도의 위험을 높였으나 규칙적인 아침식사와 영양교육은 그 위험을 낮추는 것으로 확인되었다. 우울 증상이나 폭력 피해 경험은 비만의 남자 청소년의 높은 부적절한 체중조절 행동 시도 위험과 관련 있었지만, 규칙적인 아침 식사는 그 위험을 낮추었다. 정상 체중의 여자 청소년의 경우, 건강관련 행위, 심리사회적, 학교 관련 요인의 모든 변수들이 부적절한 체중조절 행동과 관련이 있었다. 그러나 동일한 성별임에도 불구하고 과체중의 여자 청소년의 경우에는 우울 증상 경험만이 부적절한 체중조절의 위험요인이었으며, 규칙적인 아침식사만이 보호요인으로 확인되었다. 비만 여자의 청소년의 경우 주 3회 이상 패스트푸드 섭취, 현재 흡연, 우울 증상이나 폭력 피해 경험이 부적절한 체중조절 행동 시도의 위험을 높였으며, 반대로 하루 3회 이상의 야채 섭취와 일주일에 3회 이상의 체육수업에서의 직접적인 운동은 그 위험을 낮추는 것으로 나타났다.

따라서 본 연구의 결과는 청소년의 부적절한 체중조절 행동의 예방과 관리를 위한 중재전략은 성별뿐만 아니라 체중상태에 따라서도 차별적으로 수립되어야 함을 시사한다.

Keywords : 청소년, 섭식장애, 건강행위, 체중관리, 부적절한 체중조절
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