

# The Effects of Actual and Perceived Body Weight on Unhealthy Weight Control Behaviors and Depressed Mood among Adult Women in Seoul, Korea

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**Objectives** : This study was conducted to examine the mediating function of body weight perception (BWP) on the relationship between body mass index (BMI) and unhealthy weight control behaviors (UWCB: e.g., fasting, or taking diet pills or laxatives) and between BMI and depressed mood, and to explore the effect of distorted BWP on UWCB and depressed mood among adult women.

**Methods** : A regionally representative sample of 8,581 women aged 20-64 years residing in Seoul, the capital of Korea, completed the 2001 Seoul Citizens Health Indicator Survey which provides self-reported information about height, weight, BWP, UWCB, depressed mood, demographic/socioeconomic characteristics, and health-related behaviors. Data were analyzed using bivariate and multivariate logistic regression.

**Results** : BMI was significantly associated both with UWCB and depressed mood, even controlling for all covariates. However, the magnitude and significance of each association was considerably attenuated when BWP

was taken into account, indicating that BWP functioned, in part, as a mediator between BMI and UWCB and between BMI and depressed mood, respectively. Among the combinations of BMI and BWP, women who perceived themselves to be heavier than their actual BMIs appeared more likely to use UWCB, whereas women who had a distorted BWP, either underestimation or overestimation as compared with their BMIs, tended to be at greater risk for depressed mood than those who had an undistorted BWP.

**Conclusions** : These findings suggest that how women perceive their body weight may be an important predictor and/or mediator of UWCB and depressed mood among adult Korean women.

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**Key words** : Body mass index, Weight perception, Weight reduction, Depression

## INTRODUCTION

Korea has undergone a rapid nutritional transition with the economic growth of the past three decades and, as a result, there has been a significant increase in average body mass index (BMI) among Korean women [1]. Along with economic growth, Western cultural ideals that valorize and idealize slim female physiques have been introduced into Korean culture and have, in turn, promoted an increase in concerns about body image for this population [2]. However, recently, a substantial difference between the rates of increase among adult Korean women who are overweight in terms of BMI and those who perceive themselves as overweight has appeared. Between 2001 and 2005, the prevalence of

actual overweight (BMI  $\geq$  25 kg/m<sup>2</sup>) decreased by 4.3%, whereas the prevalence of perceived overweight increased by 12.6%, according to the Korean National Health and Nutrition Examination Surveys [3]. This phenomenon may reveal that the gap between BMI and body weight perception (BWP) among adult Korean women has widened in recent years, promoting an increased interest in their health behavior and health status. Nonetheless, this population, with all these factors relating to BMI, BWP, health behavior and health status, has been relatively understudied.

Body image is an important part of evaluating ourselves and others in the context of social interaction [2]. This said, not only overweight or obese women, who deviate

greatly from cultural ideals of body type, but also normal-weight women are often vulnerable to a distorted BWP, a negative body image, or body weight dissatisfaction [4,5]. When persistent, a distorted BWP can lead women to adopt unhealthy weight control behaviors (UWCBs) such as fasting, self-induced vomiting, taking diet pills, and using laxatives, as well as the option of maintaining a healthy diet and exercise [6,7]. It has also been reported that BWP has a direct or indirect, or mediating, effect on depression [8,9]. However, these previous studies focused only on high-risk populations, such as adolescents (a period of increased body dissatisfaction associated with how one looks, due to rapid physical changes that are more marked than at any other age period) [8] and overweight adults who participated in weight-loss treatment programs (a higher probability of being dissatisfied with

body weight, depressed, or exposed to UWCB as compared to non-clinical adults) [9]. Therefore, we do not know if such effects exist among the general female population. We believe that, in contrast to the adolescent and overweight adult populations, general adult women may show disparate patterns, due to a diverse range of ages, BMIs, and demographic and socioeconomic characteristics. Making an effort to answer the above questions may provide information about BWP and help to promote further understanding of adult women’s experience with UWCB and depressed mood.

This study had two objectives; to examine the mediating function of BWP on the relationship between BMI and UWCB and between BMI and depressed mood; and the effect of distorted BWP on UWCB and depressed mood among adult women, controlling for various individual characteristics significantly associated with both outcomes.

## METHODS

### I. Data and Participants

Data from the 2001 Seoul Citizens Health Indicator Survey (SCHIS) conducted by the Korea Institute for Health and Social Affairs were analyzed. The SCHIS used a stratified multistage sampling design from 20,981 households in 25 examination KUs (districts)

throughout Seoul; consequently, 19,360 residents (10,604 women and 8,756 men aged 20 and older) participated in the survey (the response rate was 92.5%). The SCHIS was officially approved by the Korea National Statistical Office (KNSO Certificate Number : 20108). After obtaining informed consent, trained interviewers made house-to-house visits and conducted face-to-face interviews with participants from July 15 through October 14, 2001. Further details regarding the survey design and methods have been given elsewhere [10].

Of the females surveyed, those aged 65 and older were excluded from our analysis in order to avoid a potential overestimation of the results. This is because elderly women tend to report their height or weight less accurately and tend to consider being chubby as a healthy and ideal body image [11]. Of the study population, 275 (3.1%) who had missing data on important questions, such as height, weight, BWP, UWCB and depressed mood, also were excluded from the analysis. Consequently, information from 8,581 women aged 20-64 (mean age 39.2 years ± 12.1) residing in Seoul was available for analysis.

### II. Measures

Our study design had two dependent variables: UWCB and depressed mood. As in a

number of previous studies [7,12-14], UWCB was measured by the question, “Have you ever engaged in at least one of the following [weight control] methods to lose weight or keep from gaining weight during the past year, such as skipping meals, taking diet pills/products, using laxatives/diuretics, and weight loss surgeries?” Responses were dichotomized into “yes” if they had used any of these methods and “no” if none had been used. Depressed mood was ascertained by asking, “How often did you feel depressed during the past year?” using a four-point answer scale: always, sometimes, seldom, and never. The responses were also divided into a dummy variable for the analysis: the “always” (7.6%) category was regarded as “depressed mood,” and the “sometimes” category was not, because the majority of the respondents (59.4%) fell into this category.

The SCHIS included information on self-reported weight and height without clothes and shoes, which were used for the BMI calculations (kg/m<sup>2</sup>). The BMI criterion suggested by the World Health Organization (WHO) [15] was used for the analysis. BMI was classified into four groups: underweight (< 18.5), normal weight (18.5 to 24.9), overweight (25.0 to 29.9), and obese (≥ 30.0). The SCHIS asked participants to self-rate their BWP using a five-point answer scale: very underweight, slightly underweight, about the right weight, slightly overweight (hereafter referred to as “overweight”), and very overweight (hereafter referred to as “obese”). Since few participants selected “very underweight (0.7%),” the category was collapsed into the “slightly underweight” category, and so four BWP categories were determined as BMI categories. From the combination of BMI and BWP, three different categories were produced as shown in Figure 1: e.g., correspondence (BWP = BMI), underestimation (BWP < BMI), and overestimation (BWP > BMI). We defined a distorted BWP as any category calculated above where there was a mismatch between BMI and BWP (underestimation and overestimation).

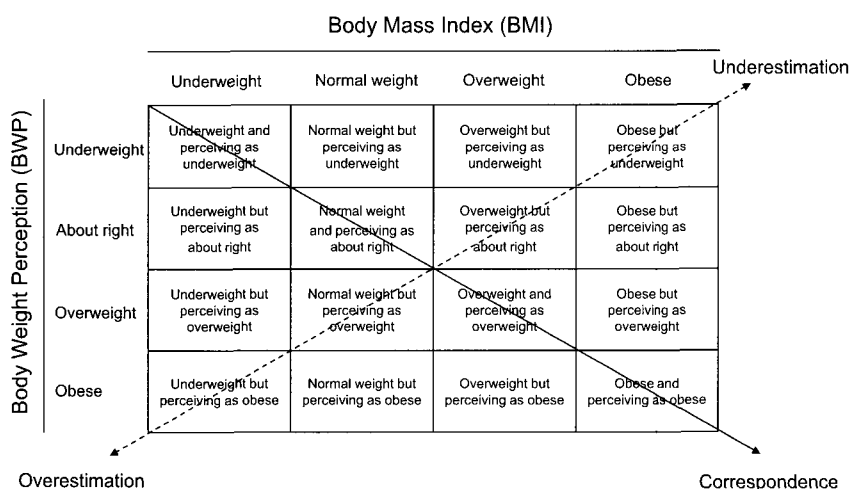


Figure 1. Combination of body mass index and body weight perception.

Categorizations of covariates such as demographic characteristics (age and marital status), socioeconomic status (educational attainment, monthly household income, and employment status) and health-related behaviors (cigarette smoking, alcohol consumption, and physical activity) were conventional and straightforward as shown in Table 2.

### III. Statistical Analysis

Descriptive analysis (weighted percentages and unadjusted odds ratios [95% confidence intervals]) was conducted to examine the univariate relationships of significant factors of interest for the study, including BMI and BWP, with UWCB and depressed mood (Table 2).

To test the mediating role of BWP on the relationships between BMI and both outcomes of UWCB and depressed mood, the method proposed by Baron and Kenny [16] was utilized. They noted that the following three conditions should be accepted (Figure 2): (1st condition) BWP is related to BMI (Table 3); (2nd condition) BMI is related to both outcomes (Model 1 of Tables 4 and 5); and (3rd condition) BWP is related to both outcomes, controlling for BMI, and the significant relationships of BMI to both outcomes are weaker when BWP is added than when BWP is not considered (Model 2 of Tables 4 and 5). The first condition was tested

**Table 1.** Weighted percentage distributions\* of body mass index (BMI), body weight perception (BWP) and combination of BMI and BWP among adult Korean women

	%	Unweighted total N
<b>BMI</b>		
Underweight	9.7	837
Normal weight	76.4	6,569
Overweight	12.7	1,074
Obese	1.2	101
<b>BWP</b>		
Perceiving as Underweight	9.8	853
Perceiving as about right	49.4	4,285
Perceiving as overweight	34.3	2,901
Perceiving as obese	6.5	542
<b>Combination of BMI and BWP</b>		
Underestimation	6.3	552
Correspondence	57.4	4,957
Overestimation	36.3	3,072

**Table 2.** Weighted percentage distributions and unadjusted odds ratios (95% confidential intervals) of body mass index (BMI), body weight perception (BWP), combination of BMI and BWP, demographic/socioeconomic characteristics, and health behaviors by unhealthy weight control behaviors (UWCB) and depressed mood among adult Korean women (N=8,581)

	UWCB			Depressed mood			Unweighted total N
	% <sup>†</sup>	Unadj. OR	95% CI	% <sup>†</sup>	Unadj. OR	95% CI	
<b>BMI</b>							
Underweight	9.2	0.60 <sup>†</sup>	0.47-0.77	5.7	0.84	0.62-1.14	837
Normal weight	11.1	1.00		6.7	1.00		6,569
Overweight	20.3	1.50 <sup>†</sup>	1.27-1.76	9.0	1.36 <sup>†</sup>	1.08-1.71	1,074
Obese	31.7	2.74 <sup>†</sup>	1.79-4.19	16.8	2.80 <sup>†</sup>	1.65-4.77	101
<b>BWP</b>							
Perceiving as underweight	4.5	0.40 <sup>†</sup>	0.29-0.57	8.3	1.47 <sup>†</sup>	1.12-1.94	853
Perceiving as about right	10.5	1.00		5.8	1.00		4,285
Perceiving as overweight	21.0	2.28 <sup>†</sup>	2.00-2.60	7.8	1.37 <sup>†</sup>	1.14-1.66	2,901
Perceiving as obese	32.3	4.09 <sup>†</sup>	3.34-5.01	10.7	1.95 <sup>†</sup>	1.45-2.63	542
<b>Combination of BMI and BWP</b>							
Underestimation	6.3	0.53 <sup>†</sup>	0.37-0.76	10.8	1.79 <sup>†</sup>	1.33-2.40	552
Correspondence	11.3	1.00		6.3	1.00		4,957
Overestimation	22.2	2.24 <sup>†</sup>	1.99-2.53	7.5	1.20 <sup>†</sup>	1.01-1.43	3,072
<b>Age</b>							
20 to 29	23.9	1.00		4.6	1.00		2,113
30 to 39	14.5	0.54 <sup>†</sup>	0.46-0.63	5.4	1.18	0.90-1.54	2,665
40 to 49	11.9	0.43 <sup>†</sup>	0.37-0.51	6.7	1.48 <sup>†</sup>	1.15-1.92	1,916
50 to 64	8.1	0.28 <sup>†</sup>	0.23-0.34	12.2	2.88 <sup>†</sup>	2.27-3.66	1,888
<b>Marital status</b>							
Married	11.9	1.00		6.7	1.00		5,768
Unmarried	25.3	2.52 <sup>†</sup>	2.22-2.87	4.4	0.65 <sup>†</sup>	0.51-0.82	1,813
Divorced/separated/widowed	11.7	0.99	0.78-1.26	17.6	3.00 <sup>†</sup>	2.41-3.74	1,000
<b>Educational attainment</b>							
College or more	18.2	1.00		3.5	1.00		3,061
High school graduate	14.7	0.78 <sup>†</sup>	0.68-0.89	6.3	1.86 <sup>†</sup>	1.47-2.35	3,562
Less than high school	10.0	0.50 <sup>†</sup>	0.42-0.60	14.1	4.55 <sup>†</sup>	3.62-5.73	1,958
<b>Household income (unit: won)</b>							
≥ 3,000,001	19.5	1.00		3.9	1.00		978
1,000,001 to 3,000,000	14.5	0.70 <sup>†</sup>	0.60-0.82	5.5	1.42 <sup>†</sup>	1.04-1.95	5,510
≤ 1,000,000	12.9	0.61 <sup>†</sup>	0.50-0.75	15.1	4.37 <sup>†</sup>	3.17-6.04	2,093
<b>Employment status</b>							
Non-manual	21.4	1.00		3.7	1.00		1,528
Manual	13.3	0.56 <sup>†</sup>	0.47-0.67	8.6	2.44 <sup>†</sup>	1.79-3.32	2,199
Unemployed	13.6	0.58 <sup>†</sup>	0.50-0.67	7.4	2.08 <sup>†</sup>	1.56-2.76	4,854
<b>Smoking status</b>							
Never smoker	14.4	1.00		6.6	1.00		7,927
Ex-smoker	31.0	2.69 <sup>†</sup>	1.86-3.87	10.9	1.74 <sup>†</sup>	1.01-2.99	145
Smoker	21.3	1.62 <sup>†</sup>	1.25-2.10	16.3	2.77 <sup>†</sup>	2.07-3.71	509
<b>Alcohol intake</b>							
Never drinker	9.7	1.00		8.6	1.00		3,509
Moderate drinker	17.8	2.02 <sup>†</sup>	1.77-2.31	5.4	0.61 <sup>†</sup>	0.51-0.72	4,646
Heavy drinker	27.4	3.61 <sup>†</sup>	2.74-4.49	13.1	1.61 <sup>†</sup>	1.18-2.21	426
<b>Physical exercise</b>							
4 or more days per week	12.8	1.00		6.2	1.00		1,131
1 to 3 days per week	19.2	1.62 <sup>†</sup>	1.30-2.01	5.3	0.86	0.62-1.19	1,416
Sometimes or never	14.3	1.13	0.94-1.37	7.6	1.26	0.97-1.63	6,034
<b>UWCB</b>							
No				6.8	1.00		7,335
Yes				8.2	1.22	0.98-1.52	1,246
Unweighted total N	1,246			670			8,581

<sup>†</sup>p<0.05, <sup>††</sup>p<0.01.

<sup>†</sup>Positive responses (weighted %) to each independent variable by dependent variables were described

using multinomial logistic regression to evaluate the odds of perceiving oneself as underweight in contrast to about the right weight and overweight or obese in contrast to about the right for each BMI category.

Although UWCB and depressed mood were both response variables, we included UWCB as a covariate because this variable may reduce

the possibility that significant finding result from a spurious relationships of BMI and BWP with depressed mood (Model 3 of Table 5), as did Eaton et al. [13]. Multivariate analyses were also performed to ascertain the effect of distorted BWP on UWCB (Model 3 of Table 4) and depressed mood (Model 4 of Table 5).

Age, marital status, educational attainment, employment status, household income, cigarette smoking, alcohol consumption, and physical activity were basically controlled in the analyses. Weights originally provided by the SCHIS were employed to estimate the population parameters in both descriptive and multivariate analyses. All analyses were done using SAS (version 9.1).

## RESULTS

Table 1 provides the weighted percentage distributions of BMI, BWP, and combination of BMI and BWP. The majority of women (76.4%) are within normal BMI ranges, followed by the overweight (12.7%), the underweight (9.7%), and the obese (1.2%). Although the order of magnitudes for BWP is the same as for BMI, the distributions slightly differ among them: e.g., about the right (49.4%), overweight (34.3%), underweight (9.8%), and obese (6.5%). From the combination of BMI and BWP, over half report an adequate BWP of their BMI, while 42.6% have mismatched BWPs (6.3% underestimated and 36.3% overestimated their weight, compared to their BMIs).

Table 2 presents the weighted percentage distributions and unadjusted odds ratios (95% confidential intervals) of all variables of interest used in the current study by UWCB and depressed mood. The higher the BMI women have, the more likely they are to be exposed to UWCB and depressed mood. BWP also shows a similar pattern, except for the association between underweight BWP and depressed mood. The highest proportion of UWCB is observed in women perceiving themselves to be heavier than their BMI. For depressed mood, such a pattern is more observable in those with both underestimation and overestimation BWPs in contrast to their BMIs. Indeed, women at risk for UWCB tend to be more depressed than their non-UWCB

**Table 3.** Adjusted odds ratios (95% confidential intervals)<sup>†</sup> for the association between body mass index (BMI) and body weight perception (BWP) among adult Korean women

	BWP			
	Underweight compared to about right		Overweight or obese compared to about right	
	OR	95% CI	OR	95% CI
BMI				
Underweight	12.03 <sup>†</sup>	9.86-14.67	0.10 <sup>†</sup>	0.07- 0.15
Normal weight		1.00		1.00
Overweight or obese	0.31 <sup>*</sup>	0.11- 0.92	23.29 <sup>†</sup>	18.43-29.45

<sup>\*</sup>p<0.01; <sup>†</sup>p<0.01

<sup>†</sup> Adjusted for age, marital status, educational attainment, household income, employment status, smoking status, alcohol intake, and physical exercise

**Table 4.** Adjusted odds ratios (95% confidence intervals)<sup>†</sup> for the effects of body mass index (BMI), body weight perception (BWP), and combination of BMI and BWP on unhealthy weight control behaviors (UWCB) among adult Korean women

	Model 1		Model 2		Model 3	
	OR	95% CI	OR	95% CI	OR	95% CI
BMI						
Underweight	0.36 <sup>†</sup>	0.28-0.47	0.71 <sup>*</sup>	0.53-0.94		
Normal weight		1.00		1.00		
Overweight	2.47 <sup>†</sup>	2.06-2.95	1.25 <sup>*</sup>	1.02-1.53		
Obese	4.86 <sup>†</sup>	3.10-7.63	1.98 <sup>†</sup>	1.22-3.22		
BWP						
Perceiving as underweight			0.43 <sup>†</sup>	0.30-0.61		
Perceiving as about right				1.00		
Perceiving as overweight			2.49 <sup>†</sup>	2.15-2.88		
Perceiving as obese			4.36 <sup>†</sup>	3.38-5.61		
Combination of BMI and BWP						
Underestimation					0.62 <sup>†</sup>	0.43-0.89
Correspondence						1.00
Overestimation					2.11 <sup>†</sup>	1.86-2.39

<sup>\*</sup>p<0.05; <sup>†</sup>p<0.01.

<sup>†</sup> Adjusted for age, marital status, educational attainment, household income, employment status, smoking status, alcohol intake, and physical exercise

**Table 5.** Adjusted odds ratios (95% confidence intervals)<sup>†</sup> for the effects of body mass index (BMI), body weight perception (BWP), combination of BMI and BWP, and unhealthy weight control behaviors (UWCB) on depressed mood among adult Korean women

	Model 1		Model 2		Model 3		Model 4	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
BMI								
Underweight	1.12	0.81-1.56	1.05	0.73-1.52	1.08	0.74-1.56		
Normal weight		1.00		1.00		1.00		
Overweight	0.96	0.76-1.23	0.78	0.59-1.03	0.78	0.59-1.03		
Obese	2.15 <sup>†</sup>	1.23-3.75	1.55	0.85-2.85	1.50	0.82-2.76		
BWP								
Perceiving as underweight			1.42 <sup>*</sup>	1.04-1.95	1.44 <sup>*</sup>	1.05-1.98		
Perceiving as about right				1.00		1.00		
Perceiving as overweight			1.32 <sup>†</sup>	1.08-1.62	1.28 <sup>*</sup>	1.04-1.57		
Perceiving as obese			1.78 <sup>†</sup>	1.23-2.58	1.65 <sup>†</sup>	1.13-2.40		
UWCB								
No					1.00		1.00	
Yes					1.41 <sup>†</sup>	1.10-1.79	1.44 <sup>†</sup>	1.14-1.83
Combination of BMI and BWP								
Underestimation							1.49 <sup>†</sup>	1.09-2.03
Correspondence								1.00
Overestimation							1.26 <sup>†</sup>	1.05-1.52

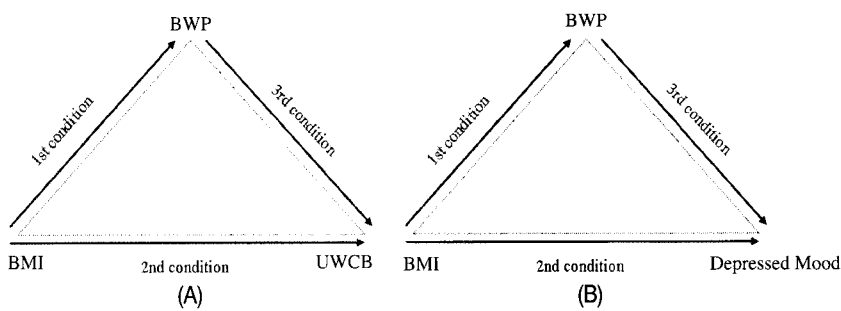
<sup>\*</sup>p<0.05; <sup>†</sup>p<0.01.

<sup>†</sup> Adjusted for age, marital status, educational attainment, monthly household income, occupational class, smoking status, alcohol intake, and physical exercise

counterparts, albeit in insignificant proportions (p=0.0711).

Table 3 documents the association between

BMI and BWP, controlling for covariates. Compared to normal-weight women, underweight women appear more likely to



**Figure 2.** Three conditions for the test of mediation effect of body weight perception (BWP) on the associations of body mass index (BMI) with unhealthy weight control behaviors (UWCB) (A) and depressed mood (B).

describe themselves as underweight, and overweight or obese women are more likely to perceive themselves to be overweight or obese. This finding supports the first condition of mediation.

Table 4 shows multivariate logistic regression analyses, in the forms of odds ratios (ORs) and 95% confidence intervals (CIs), for the association between BMI and UWCB without BWP (Model 1) and with BWP (Model 2), after controlling for covariates. Model 1 shows that the patterns of BMI are similarly observed to that of the descriptive analysis: the higher the BMI women have, the more likely they are to use UWCB (i.e., the second condition is accepted). Although, overall, the associations of individual profiles with UWCB do not change in their magnitudes and significances (results not shown), the association between BMI and UWCB is considerably weaker when BWP is included, in Model 2, than when BWP is not included; then, BWP is independently and positively associated with UWCB (i.e., the third condition is accepted).

Model 3 includes the combination of BMI and BWP. Note that among three different categories, the category of the same BWP as BMI (correspondence) is used as a reference in the analysis. This shows that odds ratios increase or decrease when women perceive themselves as heavier (overestimation, OR=2.11 and 95% CI=1.86-2.39) or smaller (underestimation, OR=0.62 and 95% CI=0.43-0.89) than their BMIs.

Table 5 demonstrates the findings of the multivariate logistic regression analyses (OR

and 95% CI) for the association between BMI and depressed mood without BWP (Model 1) and with BWP (Model 2). Model 1 shows that obese women are more likely to be depressed than their normal-weight counterparts, even controlling for all covariates (i.e., the second condition is accepted). When BWP is added to the model, the association between obese BMI status and depressed mood become nonsignificant; BWP is significant, with greater odds of depressed mood among women who perceive themselves as obese (OR=1.65 and 95% CI=1.13-2.40), overweight (OR=1.28 and 95% CI=1.04-1.57), and underweight (OR=1.44 and 95% CI=1.05-1.98) than among those who perceive themselves as about the right (i.e., the third condition is accepted). On the one hand, Model 3, in which UWCB is a covariate, illustrates that the magnitude and significance of UWCB in relation to depressed mood not only increase but also become significant (OR=1.41 and 95% CI=1.10-1.79).

Like data observed in the descriptive analysis, Model 4 also shows that women with distorted BWPs, either overestimation (OR=1.26 and 95% CI=1.05-1.52) or underestimation (OR=1.49 and 95% CI=1.09-2.03), tend to be at higher risk for depressed mood than those with an undistorted BWP (correspondence), controlling for individual risk factors including UWCB.

## DISCUSSION

Our study demonstrates that overweight and obese women were more likely, and

underweight women were less likely, to perform at least one UWCB compared to their normal-weight counterparts. This finding is consistent with a previous investigation on BMI status and dieting behavior among Dutch women aged 20-65 years [17]. Following the mediation procedures proposed by Baron and Kenny [16], we found that a considerable proportion of the UWCB among them was attributable to their BWP. For instance, the odds ratios of the associations of underweight, overweight, and obese BMIs with UWCB, compared to the association between normal BMI and UWCB, decreased to 49.3%, 49.4%, and 59.3%, respectively, when BWP was considered. These results are consistent with previous studies among adult U.S. women aged 24-42 years [18] and among Lebanon youth aged 15-23 years [19], which reported that BWP partially mediated the association between BMI status and dieting behavior. From the decreased magnitude of the odds ratio by BMI status, BWP may be more detrimental to obese women than to those of other BMI categories when they perform UWCB. Because women are socio-culturally expected to be thin, obese women are less likely to have an ideal shape and more likely to feel social pressure and/or make negative comparisons with others that are affected by their BWP; these phenomena might drive them to have a higher risk of UWCB, as compared to others with underweight, normal-weight, and even overweight BMIs [6].

The mediating effect of BWP on the relationship between BMI and depressed mood observed in the present study was restricted to obese women, in line with a previous study among Dutch adolescents [8]. However, this finding should be interpreted with caution because their study had a different population focus and did not conduct separate analyses by gender and we divided "the overweight category" into "the overweight category" and "the obese category." Furthermore, these two studies utilized different measurements to

determine body fat. Friedman et al.'s [9] study of U.S. women aged 22-70 years who had a mean BMI of 38.4 kg/m<sup>2</sup> also showed a similar pattern, but it is also difficult to draw a direct comparison between their and our studies due to the utilization of different confounders and measurements of BWP. Even so, we cannot say that BWP only functions as a mediator between obese BMI status and depressed mood. The findings, derived from descriptive and multivariate analyses, illustrated that the odds ratio of the association between overweight BMI and depressed mood was no longer observed when demographic/socioeconomic characteristics and health-related behaviors were taken into account. This suggests that depressed mood may be more significantly associated with individual disadvantages in relation to demographic/socioeconomic characteristics and health-related behaviors than with BMI among the general population of adult women who are overweight.

Of particular interest is that, contrary to UWCB, used less among women who were not only actually underweight but who also perceived themselves as underweight, depressed mood occurred less among women who only perceived themselves as the right weight. This may point to different points of view behind the health behaviors (UWCB) and health status (depressed mood) of adult women. As described in the Methods, the primary and decisive reason for the use of UWCB is to lose weight in order to have a desirable body, i.e., to attain thinness. Women who are actually underweight or perceive themselves to be underweight may be more likely to have higher body satisfaction than those of other BMI and BWP categories [6], because they already have the slimmer body type that is, socio-culturally speaking, desirable throughout Korean society. We predicted that this would cause them to engage less in UWCB, in comparison with others. Although the range of "normal mental health" is wide,

the term is usually used to describe a subjective (internal) state rather an objective (outer) state. The meaning of BWP used in this study is closer to the former state. In addition, Keel et al. [4] and Xie et al. [5] suggest that the perception of being either overweight or underweight may reflect weight dissatisfaction status, or negative body image, which is significantly associated with depressive symptoms. Thus, women who perceived themselves as the right (closer to normal-weight) may seem to have a lower tendency to be depressed compared to others with extreme perceptions of body size [8].

In this study, we considered three different combinations of BMI and BWP (i.e., underestimation, correspondence, and overestimation) and found that the difference in the likelihood and extent of UWCB was considerably dependent on BWP, regardless of BMI. That is, overestimation of BWP compared to BMI was related to higher levels of UWCB (OR=2.11 and 95% CI=1.86-2.39), while underestimation of BWP compared to BMI was related to lower levels of UWCB (OR=0.62 and 95% CI=0.43-0.89). This finding is congruent with Conley and Boardman's work [20], which showed that weight overestimation significantly increased the risk of disordered eating behaviors (e.g., vomiting and taking laxatives/diuretics). Moreover, this finding supports prior studies on body image discrepancies between actual and ideal body size in that women with greater body image discrepancy (body size overestimation) are more likely to use UWCB than their counterparts with no discrepancy [21,22]. With regard to women at risk of greater depressed mood among three different combinations of BMI and BWP, we found that women who had a distorted BWP, either overestimation or underestimation, were more vulnerable to depressed mood than those who had an undistorted BWP. This result is consistent with a previous study [8], which reported that individuals who actually had a

normal BMI but perceived themselves to be overweight or underweight had a greater risk of depressed mood than did their counterparts with a normal BMI and good BWP. Similar results were also reported by Stock et al [23], who found that young college women with higher psychosocial stress were more likely to overestimate or underestimate their body weight.

We found the significant association between UWCB and depressed mood (OR=1.41 and 95% CI=1.10-1.79). Despite the different outcome variables and study population, this study is similar to previous studies among Korean and U.S. adolescents [12,13,24], which reported that engaging in UWCB was associated with elevated risk for suicidal thoughts and suicidal attempts. Other individual profiles (e.g., demographic and socioeconomic characteristics and health-related behaviors) significantly associated with UWCB and depressed mood were consistent with findings of previous studies of a similar nature [25-27].

This study has the following limitations. First, we used self-reported weight and height information to calculate BMI status. Although the self-reported information of these values has been found to be highly correlated with measured ones [11], some authors point out that applying this information to an adult population, especially women, is slightly limited due to their misperceptions of weight (underestimation) and height (overestimation) [28]. Second, if UWCB is not socio-culturally desirable, it is possible that study participants would not provide correct information [29], which may have caused underestimation of the results reported here. Third, depressed mood, as one of the outcome variables, was measured by a single item that may not only result in reliability and validity problems but might also be unable to be directly compared to past studies that used more sophisticated measures to assess adult depression. However, Khang and Kim [30] applied that same question to the

adult Korean population and then found a high correlation between depressed mood and mortality. Furthermore, a recent INTERHEART study, which was a global case-control study including participants from 52 countries around the world, indicated that self-reported psychological stressors, including depressed mood, were associated with increased of acute myocardial infarction, regardless of age, gender or race/ethnicity [31]. Fourth, the time frames of UWCB/depressed mood (during the past 12 months) and BMI/BWP (at the time of the survey) differed. In addition, the drawing of inferences about causal pathways among the variables of interest in this study was difficult, due to the cross-sectional nature of the data. To identify the underlying causal mechanisms, future research should consider a longitudinal and structural equation modeling approach to analyze the interrelationships among these variables.

Despite these limitations, this study has several strengths. The major strength of the present study was the use of a large population-based survey and its high survey response rate, which may generalize our findings to the whole women population. Moreover, this is the first study to suggest that BWP may, in part, mediate between BMI and UWCB, and between BMI and depressed mood, underscoring the importance of BWP. Particularly, this phenomenon was similarly observed, even when the subjects were divided into two groups of 20-39 years and 40-64 years. Thus, we encourage the inclusion of BWP as a variable in models that address the risks of UWCB and depressed mood among the general female population. Given recent trends and the persistent pressure toward thinness in Korean society, the number of Korean women who have a distorted BWP continues to increase. Educational programs or effective treatments that help them to critically evaluate socio-cultural ideal body image should be developed to reduce the potential risks of UWCB and depressed mood.

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