

The following publication Cheng, Man Yan BSc; Wang, Shu-Mei PhD; Lam, Yin Ying BSc; Luk, Hiu Tung BSc; Man, Yuk Ching BSc; Lin, Chung-Ying PhD The Relationships Between Weight Bias, Perceived Weight Stigma, Eating Behavior, and Psychological Distress Among Undergraduate Students in Hong Kong, The Journal of Nervous and Mental Disease: September 2018 - Volume 206 - Issue 9 - p 705-710 is available at <https://doi.org/10.1097/NMD.0000000000000869>.

**The relationships between weight bias, perceived weight stigma, eating behavior and
psychological distress among undergraduate students in Hong Kong**

Abstract

We examined the relationships between weight bias, perceived weight stigma, eating behavior and psychological distress among Hong Kong young adults. Using cross-sectional design, 400 undergraduate students (61 self-reported overweight; 84 self-perceived overweight; 175 males) completed questionnaires and were assigned into a self-reported overweight or non-overweight group using body mass index, and a self-perceived overweight or non-overweight group based on self-perception. For self-reported and self-perceived overweight groups, the more weight bias they had, the higher depression they suffered. Self-perceived group additionally showed that weight bias was related to perceived weight stigma and inappropriate eating behaviors; perceived weight stigma related to inappropriate eating behaviors. For self-reported and self-perceived non-overweight groups, weight bias was related to perceived weight stigma, inappropriate eating behaviors, anxiety, and depression; perceived weight stigma was associated with inappropriate eating behaviors, anxiety, and depression. Thus, healthcare providers should take care of weight bias issue in both overweight and non-overweight people.

Keywords: Asian; overweight; psychological distress; weight bias; young adults

Introduction

Weight bias (aka weight stigma or weight discrimination), a critical public health problem, refers to negative attitudes, beliefs, and behaviors towards individuals on judging their weight. Manifestation of weight bias can be taken in subtle form of inwardly attributing negative stereotypes (e.g., lazy, incompetent, insanitary, undisciplined to overweight individuals; Puhl et al., 2014) or be expressed explicitly in form of discriminatory behaviors (e.g., teasing, bullying and hostility; Puhl et al., 2008). Unfortunately, some societies generally prefer lean and thin figure (Puhl and Latner, 2007), and may result in high prevalence in weight-based discrimination. For example, a recent German study showed that 38% of people with obesity had encountered weight bias (Sikorski et al., 2016). Moreover, weight bias exists in diverse settings, including interpersonal relationship, workplaces, healthcare and teaching institutions (Brownell et al., 2005), and can be effectuated by social media, family, friends and the stigmatized individuals themselves (Puhl and Heuer, 2009).

Weight bias, however, does not solely exist in people with overweight. In the aforementioned German study (Sikorski et al., 2016), the prevalence of encountering weight bias regardless of weight status was 7.3%. Indeed, non-overweight individuals may also suffer from perceived weight stigma (Latner et al., 2008). According to Carr and Friedman (2005), people at any weight, including within and beyond normal body mass index (BMI), are vulnerable to perceived weight stigma by attributing their negative experiences to weight-based discrimination. Amongst, obese individuals reported more experiences in perceived weight stigma, including day-to-day interpersonal discrimination (e.g. being treated rudely) and work-related discrimination (e.g. being passed over for a job promotion; Carr and Friedman, 2005). Moreover, it is worth noticing that self-reported BMI may not be coherent with self-perceived weight status (Paeratakul et al., 2002). People who are less aware about their weight may not perceive themselves as overweight in comparison to

BMI-matched individuals who are more concern about weight, and vice versa (Williamson et al., 2000). The influences of self-reported and self-perceived weight status on experience and perception of weight discrimination are thus uncertain.

Weight bias and perceived weight stigma (weight stigma perceived by the individuals) are crucial concern for healthcare providers because both are found to be important determinants related to health outcomes, including health behaviors and psychological health (Puhl and Heuer, 2009). For example, people who receive, perceive, or accept weight bias may have disordered eating behaviors, including binge eating, purging, emotional eating and uncontrolled eating, regardless of weight strata (O'Brien et al., 2016; Schvey and White, 2015). Furthermore, the effects of weight bias and perceived weight stigma on eating behavior vary between overweight and non-overweight individuals: overweight individuals are more resistant to diet (Puhl et al., 2007); non-overweight individuals are more likely to be on diet (Schvey and White, 2015). In terms of psychological health, individuals receiving weight bias or having perceived weight stigma may have depression, body dissatisfaction, low self-esteem, or other types of psychological distress (Friedman et al., 2005; Puhl and Heuer, 2009).

However, the aforementioned studies on investigating weight bias, perceived weight stigma, and health problems were mainly conducted in western countries with a lack of evidence in Asian culture (Friedman et al., 2005; Latner et al., 2008; O'Brien et al., 2016; Puhl et al., 2007; Puhl and Heuer, 2009; Schvey and White, 2015). Asians nowadays may have conflicting thoughts in overweight: plumpness signifies prosperous and feminine beauty in Asian traditions (Nasser, 1988), while Asians receive the information of “thin is attractive” from mass and modern media (Harrison and Hefner, 2006). Such phenomenon is demonstrated in the eating patterns in Asia. Epidemiological studies suggested that eating disorders have been emerging in Asian countries since 1900s (Gordon, 2001), at the time

when weight consciousness was found to be pervasive in Hong Kong (Lee et al., 1996). The eating disorder risk for Hong Kong adolescents, as revealed by the Eating Attitudes Test, raised from 6.5% in 1993 to 22.1% in 2007 (Lee et al., 1996; Mak and Lai, 2011).

Unfortunately, interplay between weight bias, perceived weight stigma, and eating behaviors for adolescence in Asian context remains unraveled. Also, the relationship between weight bias, perceived weight stigma and psychological distress in the East Asia is scarce.

The purpose of the present study was to address the insufficiency of information regarding the relationships among weight bias, perceived weight stigma, eating behavior and psychological distress in an Asian society. Specifically, the aforementioned relationships were tested in a sample of Hong Kong undergraduate students. Given the nature of weight bias and perceived weight stigma, there is a predicted association between weight bias and perceived weight stigma. Further, based on previous research in the West (e.g., O'Brien et al., 2016), this study hypothesized that both weight bias and perceived weight stigma would be associated with eating behavior and psychological distress. Subsequently, healthcare providers in Hong Kong may have the information to foster effective programs on eating behavior and psychological distress, for those with or without excess weight.

Methods

Participants & Procedures

Through convenient sampling, undergraduate students aged 18 to 25, who can read Chinese, were recruited from a university in Hong Kong. Those diagnosed with chronic illness (mental health problems, physical impairments, neurological and eating disorders) were excluded. All participants signed consent form before the distribution of questionnaire to confirm their willingness to participate. Participants completed self-reported questionnaires, including a background information sheet. The data collection was conducted

from March to June, 2017. The ethical approval was obtained from the university's ethics committee.

Measures

Demographic information. The background information sheet included gender, age, current academic performance (CGPA), enrolled program (health-allied vs. non-health-allied), self-perceived weight status and self-reported height and weight. The self-reported height and weight was calculated into BMI to determine the self-reported weight status: $BMI \geq 23$ is defined as overweight and $BMI < 23$ as non-overweight in Asian population (World Health Organization [WHO], 2000).

Weight Bias. Beliefs About Obese Persons Scale (BAOP) is an 8-item measurement with 6-point Likert-type scale. A lower score indicates a stronger belief that “obesity is controllable”, which is positively linked with weight bias (Puhl and Brownell, 2003). The internal consistency of BAOP was satisfactory for undergraduate students ($\alpha=0.79$; Allison et al., 1991).

Attitudes Toward Obese Persons Scale (ATOP) is a 20-item measurement with 6-point Likert-type Scale. It measures stereotype attitudes and bias towards obesity. A lower score indicates the participant has a more negative attitude towards people with obesity. The internal consistency of ATOP was satisfactory for undergraduate students ($\alpha=0.80$; Allison et al., 1991).

Perceived Weight Stigma. Perceived weight stigma is measured using an adapted version of everyday discrimination scale measuring 10 items of experiences of unfair treatment, with good internal consistency in the original 9-item form ($\alpha=0.88$; Williams et al., 1997). A sample item is “people act as if you are inferior because of your weight”. Participants

answered either yes (scored 1) or no (scored 0) on whether they have had the described experience and feelings. A higher score indicates a higher level of perceived weight stigma.

Eating Behavior. Participant's eating behavior is measured using the Three-Factor Eating Questionnaire - Revised 18 items version (TFEQ-R18). The TFEQ-R18 measures three types of eating behaviors: 9 items for uncontrolled eating, 6 for cognitive restraint and 3 for emotional eating. Uncontrolled eating is an uncontrollable overeating behavior; cognitive restraint means a tendency to consciously reduce food intake than the desired amount, but not necessarily equal to dieting; emotional eating refers to a tendency to consume food following negative emotions (Anglé et al., 2009). A higher score indicates a stronger tendency of that type of eating disturbance. The internal consistency of the TFEQ-R18 is acceptable ($\alpha=0.78$ to 0.80 ; De Lauzon et al., 2004).

Psychological distress. The Hospital Anxiety and Depression Scale (HADS) is a 14-item scale to assess any psychological or emotional distress. It consists of anxiety and depression domains (7 items each), and a higher score indicates a stronger tendency of psychological distress (depression or anxiety). The internal consistency was satisfactory ($\alpha=0.77$ to 0.86 ; Leung et al., 1999). Also, the HADS showed good concurrent validity with the Hamilton Rating Scale for Depression ($r=0.673$; Leung et al., 1999) and the Hamilton Rating Scale for Anxiety ($r=0.63$; Leung et al., 1999) which are well-known measurements for depression and anxiety.

Data Analysis

All statistical analyses were performed using IBM SPSS 23.0 (IBM Corp., Armonk, NY.). Descriptive analyses were conducted for all demographic data and questionnaire scores. Specifically, frequencies and percentages were applied to categorical variables; mean and SD to continuous variables.

Several regression analyses were carried out for subgroups: self-reported weight status based on BMI (overweight BMI ≥ 23 vs. non-overweight BMI <23) and self-perceived weight status (self-perceived overweight vs. self-perceived non-overweight). Specifically, six regression models were constructed for each sub-sample to understand the associations among the factors (i.e. weight bias, perceived weight stigma, eating behavior, psychological distress) after controlling for age, gender, and enrolled program.

The dependent variables included perceived weight stigma; eating behavior (uncontrolled eating, cognitive restraint, and emotional eating); and psychological distress (anxiety and depression). The independent variables were two types of weight bias (ATOP and BAOP scores) for the first regression; weight bias and perceived weight stigma for the other regressions.

Results

Demographics and descriptive statistics

Table 1 summarizes the participant characteristics. The participants ($N=400$) were constituted of 43.8% ($N=175$) males and 56.2% ($N=225$) females, with a mean (SD) age of 20.22 (1.58). All participants were Han ethnicity, and 3.7% ($N=15$) self-reported having chronic illness. Among the participants, 54.0% ($N=216$) were majoring in health-allied programs. The mean BMI (SD) was 20.63 (3.23), and 15.3% ($N=61$) of them were overweight or obese according to self-reported BMI. Around one fifth (21.0%; $N=84$) of them self-perceived themselves as overweight or obese (Table 1). Among the 84 self-perceived overweight participants, only about half (52.4%; $N=44$) were overweight based on BMI; among the 316 self-perceived non-overweight participants, almost all (94.6%; $N=299$) were non-overweight

(Insert Table 1 here)

Regression results in self-reported and self-perceived overweight subgroups

For the self-reported overweight group, ATOP score was negatively correlated with anxiety ($\beta=-0.317$; $p=0.016$) and depression ($\beta=-0.403$; $p=0.004$; Table 2). For self-perceived overweight group, ATOP score was negatively correlated with perceived weight stigma ($\beta=-0.333$; $p=0.005$) and depression ($\beta=-0.290$; $p=0.015$). BAOP score was negatively related to uncontrolled eating ($\beta=-0.247$; $p=0.027$) and emotional eating ($\beta=-0.295$; $p=0.006$). Perceived weight stigma score was positively correlated with uncontrolled eating ($\beta=0.224$; $p=0.048$) and emotional eating ($\beta=0.282$; $p=0.009$; Table 3).

(Insert Tables 2 and 3 here)

Regression results in self-reported and self-perceived non-overweight subgroups

For both non-overweight groups, ATOP score was negatively correlated with perceived weight stigma ($\beta=-0.228$ and -0.180 ; $p<0.001$ and $=0.002$), anxiety ($\beta=-0.149$ and -0.157 ; $p=0.009$ and 0.007) and depression ($\beta=-0.148$ and -0.159 ; $p=0.008$ and 0.005). BAOP score was positively related to perceived weight stigma ($\beta=0.121$ and 0.136 ; $p=0.025$ and 0.017) and negatively related to cognitive restraint ($\beta=-0.163$ and -0.173 ; $p=0.003$ and 0.002). Perceived weight stigma score was positively correlated with uncontrolled eating ($\beta=0.144$ and 0.116 ; $p=0.010$ and 0.043), cognitive restraint ($\beta=0.130$ and 0.143 ; $p=0.019$ and 0.011), emotional eating ($\beta=0.154$ and 0.130 ; $p=0.006$ and 0.023), anxiety ($\beta=0.170$ and 0.145 ; $p=0.002$ and 0.010) and depression ($\beta=0.203$ and 0.193 ; $p<0.001$ and $=0.010$; Tables 2 and 3).

Discussion

Among the four subgroups, we found that self-reported overweight group had somewhat different significant results from self-perceived overweight group. In contrast, self-reported non-overweight group had the same significant results to self-perceived non-overweight group. A possible reason for the abovementioned phenomenon may be due to the composition of the subgroups: self-reported and self-perceived non-overweight groups were composed of 94.6% of the same participants; while self-reported and self-perceived non-overweight groups had shared only 52.4% of the same participants.

The relationships between weight bias, depression and anxiety in the overweight group could be related to the condition that overweight people are likely to have weight bias and accept negative attitudes towards obese people (Puhl et al., 2007). Hence, they develop depression and anxiety after accepting the distorted and negative concepts on overweight (Hilbert et al., 2014). Perceived weight stigma was correlated with emotional eating in the self-perceived overweight group. The relationship existed in the self-perceived overweight group may be because of the nature of emotional eating. Emotional eating is a type of eating disturbance, and is usually used as a mean to escape from negative self-awareness and cope with psychological distress for self-perceived overweight individuals (Puhl et al., 2007; O'Brien et al., 2016). In addition, the aforementioned psychological distress based on weight dissatisfaction partially explain the association between perceived weight stigma and emotional eating (Ashmore et al., 2008; Nolan and Eshleman, 2016; O'Brien et al., 2016).

As compared with the correlations among the studied factors in the self-reported overweight group, we found that there were more significant correlations in the self-perceived overweight group. The results indicated that self-perceived overweight had greater impacts on eating behaviors and psychological distress than did self-reported overweight. Similar findings have been reported recently that self-perceived overweight was

associated with poor health, including life satisfaction and mental health, among 8303 American children aged between 10 and 17 (Lin et al., 2018).

For the self-reported and self-perceived non-overweight groups, weight bias was positively associated with cognitive restraint and negatively associated with perceived weight stigma. Among non-overweight individuals, eating disturbance was associated with stronger belief that obesity can be controlled indicated by BAOP scores. One possible reason is that non-overweight individuals substantially value the slender figure: thinness is the standard of beauty and losing weight becomes a norm for Asian women even they are not overweight (Wardle et al., 2006). With the belief of obesity is under one's control and value for thinness, non-overweight individuals would consciously restrain their food intake to control weight. Association between higher weight bias and lower perceived weight stigma was thus found in non-overweight individuals. Similarly, a Canadian study reveals that being teased about weight was associated with dietary restraint in non-overweight people (Goldfield et al., 2010). Hence, we concluded that non-overweight individuals might try to control their weight through restrictive eating and prevent possible weight-based teasing.

In addition, perceived weight stigma was associated with depression in the self-reported non-overweight group, and weight bias was associated with anxiety and depression in the self-perceived non-overweight group. As people with normal weight also believe in slender is beauty (Wardle et al., 2006), they are at risk of developing perceived weight stigma with negative experiences of weight-based discrimination (Latner et al., 2008; Carr and Friedman, 2005). Individuals with felt stigma and associated negative self-evaluation are likely to suffer psychological distress like depression (Hilbert et al., 2014). As suggested by the integrated threat theory, the concept of "ideal weight" poses symbolic threat to people who perceived themselves as non-overweight (Stephan and Stephan, 1985). They may feel anxious of negative evaluations from in-group members about their weight status, which will affect their

social identity (Puhl and Brownell, 2003). Our findings echo the aforementioned theory that weight bias and perceived weight stigma can contribute to the psychopathology of psychological distress, despite their actual weight status and how they feel about their weight status.

The major findings of this study were in accordance with previous western studies, which demonstrated that weight bias or perceived weight stigma was associated with psychological distress regardless of actual or perceived weight status (O'Brien et al., 2016; Schvey and White, 2015). Our findings showed that weight bias was associated with emotional eating for self-perceived overweight individuals, while it was associated with cognitive restraint eating for the self-reported and self-perceived non-overweight counterpart. It is consistent with western studies that suggested overweight individuals are resistant to diet while non-overweight individuals are more likely to be on diet (Puhl et al., 2007; Schvey and White, 2015). This finding showed that eating pattern in response to weight bias in east is similar to the west. Previous studies suggested that westernized Asian regions would adopt the thin ideal and result in more body dissatisfaction and eating disorders (Lee et al., 1996; Makino et al., 2004; Pike and Dunne, 2015, Wong and Huang, 1999). Therefore, it is reasonable that similar relationships among the aforementioned factors were found in a westernized city like Hong Kong (Tanenbaum et al., 2016).

There were several limitations in the current study. First, the convenience sampling method with a relatively small sample size recruited in the same university might restrict the generalizability of our results. Second, the self-reported nature of the questionnaires could be influenced by the social desirability and recall bias. For example, our respondents might tend to report less eating problems knowing healthy eating is a social norm. Third, the cross-sectional design could not provide evidence for causal relationship among the variables.

Lastly, the BMI might wrongly define those muscular individuals as overweight and subsequently influence on our findings.

Conclusion

In summary, this study investigated the relationships between variables of weight bias, perceived weight stigma, eating behavior and psychological distress among undergraduate students in Hong Kong. Interestingly, weight bias or perceived weight stigma was correlated with depression regardless of weight status. Overweight group was less likely to diet while non-overweight group was more likely to be on diet in response to weight bias or perceived weight stigma, which was consistent with the western findings. However, our findings showed no correlation of perceived weight stigma with uncontrolled eating. Further investigation may be devoted to study the distinctive eating behaviors and causes of weight-based psychological distress in Asian culture and thus therapeutic strategies to cope with weight-related health problems.

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Table 1. Participant characteristics (*N*=400)

	Mean±SD	<i>n</i> (%)
Age (Year)	20.22±1.58	
Gender (Male)		175 (43.8%)
Program (health-allied)		216 (54.0%)
Chronic illness (No)		385 (96.3%)
Body mass index (Kg/m ²)	20.63±3.23	
Reported weight status (overweight/obese)		61 (15.3%)
Perceived weight status (overweight/obese)		84 (21.0%)
CGPA (<3.0)		127 (31.8%)
ATOP	71.70±13.74	
BAOP	20.14±5.56	
Perceived weight stigma	1.33±2.22	
Eating behavior: uncontrolled eating ^a	21.47±4.72	
Eating behavior: cognitive restraint ^a	13.86±3.28	
Eating behavior: emotional eating ^a	7.12±2.04	
Anxiety ^b	5.88±2.92	
Depression ^b	7.54±3.48	

CGPA= Cumulative Grade Point Average; ATOP= Attitudes Toward Obese Persons Scale;
BAOP= Beliefs About Obese Persons Scale;

^a Eating behavior was measured using Three-Factor Eating Questionnaire - Revised 18 items version

^b Anxiety and depression were measured using Hospital Anxiety and Depression Scale

Table 2. Predictors on perceived weight stigma (PWS), eating behavior, and emotional distress separated by body mass index (BMI)

	Standardized coefficient (p-value)			R ²	Adj. R ²
	ATOP	BAOP	PWS		
Self-reported overweight (BMI≥23; n=61)					
PWS	-0.193 (0.185)	0.090 (0.530)	-- (--)	0.040	-0.048
Uncontrolled eating ^a	-0.045 (0.750)	-0.110 (0.432)	0.188 (0.154)	0.123	0.026
Cognitive restraint ^a	-0.265 (0.062)	-0.068 (0.621)	-0.003 (0.981)	0.148	0.053
Emotional eating ^a	-0.042 (0.755)	-0.233 (0.082)	0.247 (0.051)	0.207	0.119
Anxiety ^b	-0.317 (0.016)*	0.023 (0.855)	0.022 (0.852)	0.281	0.201
Depression ^b	-0.403 (0.004)**	0.094 (0.480)	0.122 (0.331)	0.195	0.106
Self-reported non-overweight (BMI<23; n=339)					
PWS	-0.228 (<0.001)**	0.121 (0.025)*	-- (--)	0.091	0.077
Uncontrolled eating ^a	0.031 (0.593)	-0.004 (0.939)	0.144 (0.010)*	0.057	0.040
Cognitive restraint ^a	-0.040 (0.482)	-0.163 (0.003)**	0.130 (0.019)*	0.089	0.072
Emotional eating ^a	-0.016 (0.784)	-0.042 (0.441)	0.154 (0.006)**	0.058	0.041
Anxiety ^b	-0.149 (0.009)**	0.068 (0.215)	0.170 (0.002)**	0.087	0.071
Depression ^b	-0.148 (0.008)**	0.022 (0.678)	0.203 (<0.001)**	0.096	0.079

^a Measured using Three-Factor Eating Questionnaire - Revised 18 items version^b Measured using Hospital Anxiety and Depression Scale

*p<0.05; **p<0.01

ATOP=Attitudes toward Obese Persons scale; BAOP=Beliefs About Obese Persons Scale

All regressions controlled for age, gender, and enrolled program

Table 3. Predictors on perceived weight stigma (PWS), eating behavior, and emotional distress separated by self-perceived weight status

	Standardized coefficient (p-value)			R ²	Adj. R ²
	ATOP	BAOP	PWS		
Self-perceived overweight (n=84)					
PWS	-0.333 (0.005)**	0.110 (0.325)	-- (--)	0.111	0.054
Uncontrolled eating ^a	0.061 (0.604)	-0.247 (0.027)*	0.224 (0.048)*	0.150	0.084
Cognitive restraint ^a	-0.145 (0.246)	-0.048 (0.681)	-0.059 (0.616)	0.058	-0.015
Emotional eating ^a	0.026 (0.815)	-0.295 (0.006)**	0.282 (0.009)**	0.234	0.174
Anxiety ^b	-0.215 (0.079)	-0.087 (0.438)	0.045 (0.693)	0.119	0.050
Depression ^b	-0.290 (0.015)*	-0.086 (0.429)	0.125 (0.260)	0.174	0.110
Self-perceived non-overweight (n=316)					
PWS	-0.180 (0.002)**	0.136 (0.017)*	-- (--)	0.060	0.045
Uncontrolled eating ^a	0.018 (0.757)	0.031 (0.586)	0.116 (0.043)*	0.061	0.043
Cognitive restraint ^a	-0.051 (0.380)	-0.173 (0.002)**	0.143 (0.011)*	0.085	0.067
Emotional eating ^a	-0.024 (0.680)	-0.014 (0.809)	0.130 (0.023)*	0.052	0.034
Anxiety ^b	-0.157 (0.007)**	0.092 (0.103)	0.145 (0.010)*	0.090	0.072
Depression ^b	-0.159 (0.005)**	0.054 (0.332)	0.193 (0.001)**	0.108	0.091

^a Measured using Three-Factor Eating Questionnaire - Revised 18 items version

^b Measured using Hospital Anxiety and Depression Scale

*p<0.05; **p<0.01

ATOP=Attitudes toward Obese Persons scale; BAOP=Beliefs About Obese Persons Scale

All regressions controlled for age, gender, and enrolled program