Weight Stigma and Eating Behaviors in Young Adults across Weight Status

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Objectives: For this study, we adopted and expanded the Theory of Planned Behavior (TPB) by adding weight-related self-stigma (WSS) to explain avoidance in 3 eating behavior (EB) types – uncontrolled eating, emotional eating, and cognitive restraint – among overweight and obese persons and persons not overweight (underweight + normal weight). **Methods:** A total of 348 adults aged 18-30 years have participated in this study. Questionnaires were used to assess factors in TPB (viz, intention, attitude, subjective norm, and perceived behavioral control [PBC]) in relation to EB avoidance, WSS, and the 3 types of EB. In addition to structural equation modeling, path invariance was tested. **Results:** In general, WSS together with subjective norm and PBC were positively associated with intention to avoid EB; PBC to avoid EB was negatively associated with EB; however, intention to avoid EB and WSS were positively associated with EB. In addition, path invariance between the non-overweight and overweight groups was not supported. In the overweight group, WSS had a more significant impact on PBC. **Conclusions:** The extended TPB model successfully explained the intention to avoid EB and the negative effect caused by WSS. However, the intention-behavior gap emerged from our results. The underlying factors that prevent people from avoiding EB should be investigated further.

Keywords: Eating Behavior, Theory of Planned Behavior, Weight Stigma, Young Adults, Hong Kong.

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Overweight and obesity is a global issue. According to a study of 188 countries by Ng et al.[1], more than one-third of the studied samples were classified as overweight or obese. As reported by the recent Population Health Survey conducted by the Government in 2020-2022, 32.6% of Hong Kong's adults were obese, with an additional 22.0% of the adult population being overweight.[2] Furthermore, there has been a notable increase in the prevalence of overweight and obese, where obesity was 21.0% and overweight was 17.8% in 2004 among Hong Kong adult population.[3] These statistics indicate a severe weight issue faced by people in Hong Kong. People who are overweight or obese tend to have a higher likelihood of developing cardiovascular diseases and experiencing a diminished quality of life.[4] Thus, public health experts aptly raise public awareness on the importance of weight management and participation in weight management practices.

Eating is one of the crucial factors in healthy weight management.[5] Studies have identified certain eating behavior (EB) types that are

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considered unfavorable or maladaptive. These include emotional eating, uncontrolled eating, and cognitive restraint.[6,7] Emotional eating indicates that an individual consumes food because of emotional stress rather than hunger. Uncontrolled eating is characterized by an inability to stop eating or control what or how much one is eating. Cognitive restraint involves the conscious restriction of food intake. Whereas restraint itself is not necessarily unhealthy, excessive or rigid cognitive restraint can lead to cycles of restriction followed by overeating. These bahaviors are associated with weight gain and reduced weight loss effort.[6,7] The problem of EB has been raised in Asia.[6] In particular, studies show that EB is an important issue among young adults in Hong Kong.[8,9] For instance, one study found the prevalence of emotional eating was 14.8% among female university students in Hong Kong.[10] There is a need to further examine the psychosocial processes leading to EB.

The Theory of Planned Behavior (TPB), a commonly used theory, help explain and understand the psychosocial elements influencing health-related behaviors.[11] The TPB has been applied to research on smoking cessation, physical activity, COVID-19 vaccination uptake, and dietary behaviors.[12-15] The TPB postulates that 4 components are crucial in how people adopt health or health compromising behaviors – attitudes, subjective norms, perceived behavioral control (PBC), and behavioral intentions. An attitude reflects a person's evaluation of a specific behavior and its consequences, encompassing both their feelings and judgments. Subjective norm denotes the perceived social acceptance or disapproval that an individual receives from their own social environment for engaging in a particular behavior. The PBC represents an individual's assessment of their capability to perform a behavior. Behavioral intention denotes the motivational factors that influence an individual's readiness to perform a behavior, including planning the when and how.[11] According to the TPB, attitude, subjective norm, and PBC all play a role in the formulation of behavioral intention, and behavioral intention and PBC both predict behavior.[11] Many studies have applied TPB to understand EBs in different scenarios. Specifically, TPB has been employed to explain dietary choices, e.g., to identify the factors behind fruit and vegetable consumption and adherence to low-fat diets,[16] to understand the avoidance of sugary snacks and beverages,[17] and to reduce the consumption of foods with additives.[18] Kane et al.[19] adopted the TPB to understand the intention to binge eat among female university students; Dawson et al.[20] used the TPB to measure motivation for recovery in anorexia nervosa. All these examples illustrate that the TPB could be used to explain factors influencing EB.

Most TPB studies on eating were conducted in Western countries, and the majority of these studies focused on dieting or healthy eating, e.g., fruit and vegetable consumption, as mentioned.[16] These studies of eating mainly captured the aspect of specific food choice, whereas the concerns of EB, such as emotional eating and uncontrolled eating, extend beyond food choice. EB also involve the quantity and frequency of food consumption. TPB could provide a good analytical framework for studying factors influencing EB in East Asian countries. This study applied the TPB to improve understanding of the intention behind EB avoidance among Hong Kong's young adults.

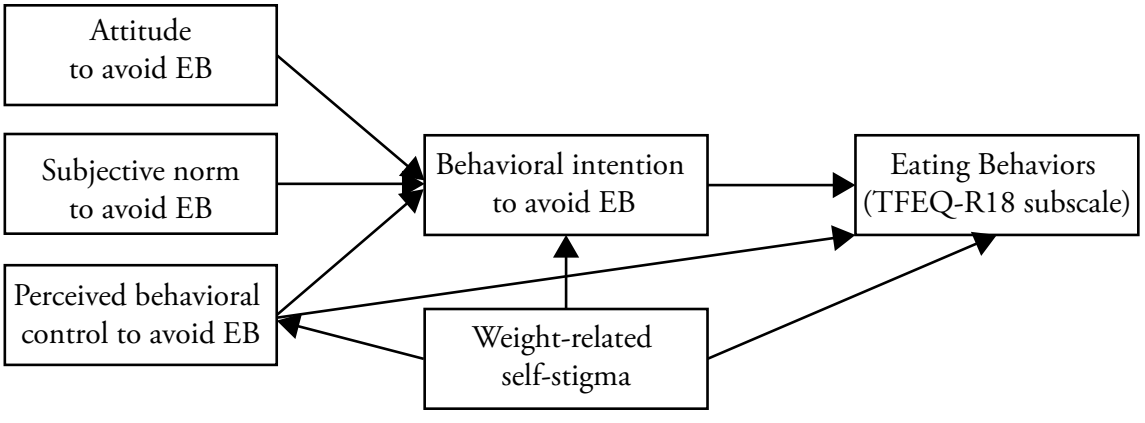
Whereas there were many studies about helping and understanding people with EB,[21] people's attitude, PBC, subjective norm, and intention to avoid EB were less investigated. The TPB was used in assessing the motivation to gain weight among people with anorexia nervosa.[20] Wood and Ogden[22] investigated the behavioral intention to reduce binge eating among people with gastric banding surgery. However, few studies examine EB avoidance (i.e., to avoid performing EB, including uncontrolled eating, emotional eating, and cognitive restraint) using the TPB. Additionally, cognitive restraint is not consistently associated with negative outcomes; instead, it has a mixed impact. It may be conducive to weight regulation or, conversely, create food cravings that increase the risk of further weight gain.[7] Thus, it remains unclear if the TPB can offer an improved understanding of EB, a question worth investigating.

Weight-related self-stigma (WSS) is another factor that may impact EB. Weight stigma is characterized by the devaluation and discrimination caused by one's body weight.[23,24] People who are overweight or obese are frequently at increased risk of being stigmatized by other people because of their body weight.[25] Individuals who have unfavorable experiences or views about their weight could develop weight-related self–stigma, the internalization of weight-related beliefs associated

with self–devaluation.[26] This internalization is not simply the product of direct life events, but also could develop under the influence of cultural values and stigmatizing content in media. Self-stigma has been linked to poor health outcomes in previous studies.[8,27] Concern about weight stigma increases stress and impaired self–control in stigmatized people, according to Major et al.[28]. Furthermore, people who have WSS have a lower self-concept, which implies that it could be a risk factor for PBC.[29] For example, Fung et al.[12] found that WSS was negatively associated with the PBC and level of physical activity (estimated metabolic equivalent task). In a similar vein, WSS may also have an impact on PBC and intention in EB avoidance. Moreover, individuals experiencing self-stigma will, in turn, be more prone to uncontrolled eating, emotional eating, and cognitive restraints, hence resulting in further weight gain.[8]

As it has been proposed that the TPB should be extended to include potentially related variables under some specific scenarios,[30,31] we thus postulate that WSS would interact with both intention and PBC and impact on EB directly and indirectly. In this regard, the original TPB becomes an extended TPB model (with WSS added), and the extended TPB would be beneficial for healthcare providers to design appropriate weight management programs. Figure 1 shows the proposed conceptual model. The study purpose was to determine whether the extended TPB (i.e., adding WSS concept into the original TPB), could explain EB avoidance among Hong Kong young adults. Specifically, we used 3 models to investigate 3 types of EB (i.e., uncontrolled eating, emotional eating, and cognitive restraints).[6] As some studies suggest that individuals who are overweight (or not) may have significant differences in EB,[6] we also examine whether the extended TPB model could be applied to 2 groups of participants – overweight or not overweight. The hypotheses of this study are: (1) Intention is associated with WSS, attitude, subjective norm, and PBC; (2) PBC and intention to avoid EB are negatively associated with EB; (3) WSS is positively associated with EB and negatively associated with PBC; (4) There are significant differences between weight statuses (i.e., path invariance is not supported).

Figure 1
The Conceptual Model of the Weight-related Self-stigma Incorporated with TPB Model on Eating Behaviors Avoidance



Note.
TPB = Theory of Planned Bahavior; EB= Eating Behavior. EB refers to the three types of eating behaviors measured by the Three-Factor Eating Questionnaire-Revised 18-item version (TFEQ-R18): emotional eating, uncontrolled eating, and cognitive restraint,. A higher score on each subscale indicates a higher level of the corresponding eating behaviors.

METHODS

Participants and Procedures

Prior to data collection, the university's Ethics Review Board granted ethical approval (application code: HSEARS20201120002). Through the use of a QR code, participants were

asked to complete a series of questionnaires on the university's online survey platform. Electronic informed consent (i.e., selecting an "agree" icon after showing the study information and participation right) was obtained before accessing the questionnaire section of the online survey. Once participants clicked "Agree", they were directed to the questionnaire.

Participants fulfilled the inclusion criteria mentioned below: (1) they were between 18 and 30 years old, (2) they understood traditional Chinese, which means they were able to comprehend the questionnaire, and (3) they agreed to participate. Individuals were excluded from participation with the following self-reported conditions: any history of neurological illnesses such as stroke, functional disabilities like blindness, or any form of intellectual disability or psychosis that would significantly affect their ability to complete the online survey successfully.

Participants were recruited by distributing flyers and posters throughout the campus of the Hong Kong Polytechnic University from March to June 2021. The researchers successfully recruited 348 young adults to join the study.

Measures

Background Information

Participants' self-reported gender, age, height, and weight were collected. Based on their weight status calculated using body mass index (BMI), two groups were categorized: (i) "non-overweight (including those who were underweight or normal weight)" and (ii) "overweight (including those who were overweight or obese)". Specifically, we used the following BMI cutoffs for Asian: participants with a BMI below 23 kg/m^2 were categorized as non-overweight, and those with a BMI equal to/greater than 23 kg/m^2 were classified as overweight.[32] Furthermore, as the pandemic of COVID-19 potentially changes people's lifestyles (e.g., working from home, government preventive measures, fear of going out), a single yes-no question asked the participants to indicate if their EB was affected by the pandemic or not.

Three-Factor Eating Questionnaire-Revised 18-item version (TFEQ-R18)

TFEQ-R18 measures EB through three different dimensions: emotional eating (3 items), uncontrolled eating (9 items), and cognitive restraint (6 items). Cognitive restraint assessed the degree to which an individual managed weight by restricting food intake consciously. Uncontrolled eating evaluated the degree to which an individual often consumed more than usual due to a lack of control over their eating, along with subjective feelings of hunger. Emotional eating assessed whether a person ate because of the inability to resist emotional cues. All items of the TFEQ-R18 were evaluated on a 4-point Likert scale, where higher scores represent the greater tendency to the corresponding aspect of EB. The TFEQ-R18 has good internal consistency (0.87 for emotional eating, 0.83 for uncontrolled eating, and 0.84 for cognitive restraint).[33] The Chinese version of the TFEQ-R18 used in the present study has been used in Hong Kong for Asian populations.[8] The Cronbach's α of the present study were 0.82 for emotional eating, 0.84 for uncontrolled eating and 0.80 for cognitive restraint.

Weight Bias Internalization Scale (WBIS)

The WBIS (11 items) was used to measure participants' WSS.[26] All WBIS items were assessed using the Likert scale of five points, with responses ranging from 1 (strongly disagree) to 5 (strongly agree). A higher WBIS score represent a greater level of WSS. The WBIS in its Chinese version has satisfactory psychometric properties.[34] The Cronbach's α of the present study was 0.91 for the WBIS.

TPB Measures

Based on the guidance provided for constructing the TPB questionnaire,[35] we constructed a questionnaire to assess the factors of TPB towards avoiding inappropriate EBs, namely: attitude, subjective norms, PBC, and behavioral intention. A pilot study was conducted to evaluate if participants encountered any issues on understanding and answering the questionnaire (N=20, mean age of 25.15 years (SD = 3.13), comprising 15 males and 5 females). Feedback from the pilot participants indicated that they had a consistent understanding of what constitutes inappropriate EBs, such as consuming unusual amounts of food, eating due to emotions, or eating too little intentionally, all of which could lead to health problems. Additionally, we positioned the TFEQ-R18 before the TPB

scale. Consequently, when participants respond to items regarding attitude, PBC, subjective norms, or intention related to avoiding inappropriate EBs, they can relate their responses to EBs mentioned in the TFEQ-R18. This approach was confirmed useful, from the feedback of those who participated in the pilot study.

For attitude toward avoiding EB, eight items rated using a 7-point Likert scale on a semantic differential scale were employed.[8,35] Specifically, we utilized pairs of bipolar adjectives (enjoyable-unenjoyable, good-bad, pleasant-unpleasant, useful-useless, beneficial-harmful, satisfying-unsatisfying, correct-incorrect, wise-foolish) in conjunction with the sentence beginning with "For me to avoid inappropriate EBs is…". A more favorable attitude in avoiding EB was represented by a higher score. The Cronbach's α of the present study was 0.92 for the attitude.

Three items rated using a 7-point Likert scale were adopted to assess the subjective norms towards avoiding EB.[8,35] Sample item was: "People who are important to me would think that I should avoid inappropriate EBs every day". A higher score represent a greater level of the subjective norm. The Cronbach's α of the present study was 0.72 for the subjective norm.

Four items rated using a 7-point Likert scale were used to assess PBC towards avoiding EB.[8,35] The sample item was: "How much personal control do you feel you have over whether you avoid inappropriate EBs in the next week?". A higher score indicates a greater level of PBC. The Cronbach's α of the present study was 0.86 for the PBC.

Three items rated using a 7-point Likert scale were used to assess the behavioral intention to avoid EB.[8,35] Sample item was: "I plan to from now on avoid inappropriate EBs". A higher score reflected a greater level of intention. The Cronbach's α of the present study was 0.95 for the behavioral intention.

Data Analysis

Pearson's correlation was conducted to assess the associations among the TPB factors, WSS, and each aspect of EB. With the use of multiple group analysis, structural equation modeling (SEM) with maximum likelihood estimator was used to evaluate the fit of the three proposed models and to test path invariance between the two groups: overweight and non-overweight groups. In addition, age, gender, and whether they thought COVID-19 affected their EBs were controlled in the models.

Figure 1 illustrates the conceptual model. All the factors were entered using their total scores in the SEM to be observed variables. Specifically, for the behaviors in TPB, we used uncontrolled eating, emotional eating, and cognitive restraints separately. Hence, we tested three models (Figure 2). We evaluated the multiple group SEMs' fit of the proposed models using the following fit indices: root mean square error of approximation (RMSEA), comparative fit index (CFI), and the standardized root mean square residual (SRMR). The χ^2 test was used to determine model fit. The models were considered to be acceptable if they had a nonsignificant χ^2, CFI greater than 0.9, RMSEA and SRMR smaller than 0.08.

The χ^2 difference ($\Delta\chi^2$) test was used to examine path invariance for the EB models. Path invariance across groups would be supported by a nonsignificant χ^2 difference test. Specifically, the two groups (i.e., the group of overweight and non-overweight) had all their path coefficients constrained to be equal and were tested to determine if the constrained model significantly differed from the original model without constraints. The entire path invariance was supported when the constrained and non-constrained model were not significantly different. However, each path coefficient was tested for path invariance if the two models were significantly different.

SPSS version 28.0 (SPSS Inc., Chicago, IL, USA) and R software with the lavaan package[36] were performed for data analyses.

RESULTS

The demographic information and scores on the instruments were shown in Table 1. The mean age was 22.97 (SD = 3.37), the mean BMI was 21.24 (SD = 3.64), and there were relatively more females (63.5%) than males (36.5%). The correlation matrix between TPB factors on EB and WSS was shown in Table 2. WSS was significantly correlated with all TPB factors, except intention; all TPB factors were also significantly correlated with each other. Furthermore, the self-stigma was significantly correlated with emotional eating, uncontrolled eating, and cognitive restraint. The results of the SEMs would be presented in the following paragraphs.

Table 1
Demographic Information Among Participants (N=348)

	n (%) or M (SD)	Possible Range of Score
Gender		
Male, n (%)	127 (36.5)	
Female, n (%)	221 (63.5)	
Age (years), M (SD)	22.97 (3.37)	
Body Mass Index (kg/m2), M (SD)	21.29 (3.58)	
Weight Group		
Non-overweight, n (%)	272 (78.2)	
Overweight, n (%)	76 (21.8)	
Three–factor Eating Questionnaire–revised 18–item Version		
Cognitive restraint, M (SD)	43.69 (19.2)	0 - 100
Uncontrolled eating, M (SD)	37.37 (17.9)	0 - 100
Emotional eating, M (SD)	42.40 (25.0)	0 - 100
Weight Bias Internalization Scale, M (SD)	27.16 (8.48)	11 - 55
Theory of Planned Behavior Factors Toward Avoiding Eating Behaviors		
Attitude, M (SD)	5.41 (1.27)	1 - 7
Subjective norm, M (SD)	4.45 (1.34)	1 - 7
Perceived behavioral control, M (SD)	5.17 (1.21)	1 - 7
Behavioral intention, M (SD)	4.74 (1.50)	1 - 7
Perceived Impact of COVID-19 on Eating		
Yes, n (%)	191 (54.9)	
No, n (%)	157 (45.1)	

Table 2
Correlations among Theory of Planned Behavior Factors, Weight–related Self–stigma, and Eating Behaviors

Variables	r						
	2.	3.	4.	5.	6.	7.	8.
1. Weight–related self–stigma	-0.13*	0.11*	-0.25***	0.06	0.27***	0.30***	0.31***
2. Attitude toward avoiding EB	--	0.30***	0.45***	0.34***	0.05	-0.23***	-0.16**
3. Subjective norm toward avoiding EB		--	0.29***	0.48***	0.30***	-0.04	0.11*
4. Perceived behavioral control toward avoiding EB			--	0.57***	0.12*	-0.38***	-0.32***
5. Behavioral intention toward avoiding EB				--	0.31***	-0.15**	-0.04
6. Cognitive Restraint					--	0.01	0.03
7. Uncontrolled eating						--	0.60***
8. Emotional eating							--

EB = eating behaviors. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

Model Fit of the Three Models

The cognitive restraint model (Fig. 2a) had excellent model fit: χ^2 (df) = 35.00 (20); p = 0.020, CFI = 0.97, SRMR = 0.043, and RMSEA = 0.066. However, the relationship between PBC and cognitive restraint was not significant in both groups. In the overweight group, the intention, as well as the self-stigma, was not associated with cognitive restraint. This implies that cognitive restraint with perceived control and stigma-related aspects is not as strong or straightforward as in other models.

The uncontrolled eating model (Fig. 2b) had excellent model fit: nonsignificant χ^2 (χ^2 [df] = 27.53 [20]; p = 0.121), CFI = 0.98, SRMR = 0.040, and RMSEA = 0.047. For the non-overweight group, WSS and PBC were significantly associated with intention and uncontrolled eating; PBC was negatively associated with WSS. Regarding the results of the overweight group, subjective norm and PBC were the only two factors that significantly linked to behavioral intention; while WSS showed a negative association with PBC; PBC was significantly associated with uncontrolled eating. The model underscores the different dynamics in uncontrolled eating between overweight and non-overweight groups, highlighting the role of WSS and PBC in these behaviors.

The emotional eating model (Fig. 2c) had excellent model fit: χ^2 (df) = 34.44 (20); p = 0.023, CFI = 0.97, SRMR = 0.043, and RMSEA = 0.064. For the non-overweight group, WSS, PBC, and subjective norm showed significant associations with intention; both

PBC and WSS had a significant association with emotional eating. For the group of participants with overweight, the subjective norm and PBC showed a significant association with behavioral intention; PBC and behavioral intention were significantly associated with emotional eating; WSS was negatively associated with PBC. This model suggests that while similar factors influence emotional eating across different weight groups, their specific interactions and impacts vary, emphasizing the nuanced nature of emotional EBs.

Figure 2
Multiple Group Analysis of the Weight-related Self-stigma Incorporated with on Eating Behaviors

Figure 2a

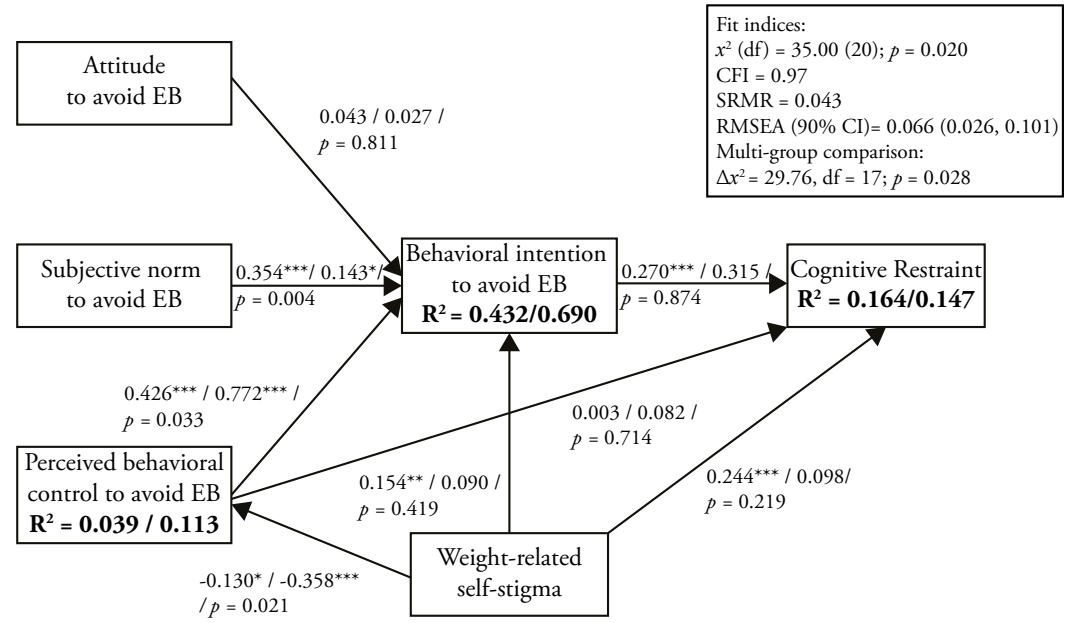


Figure 2b

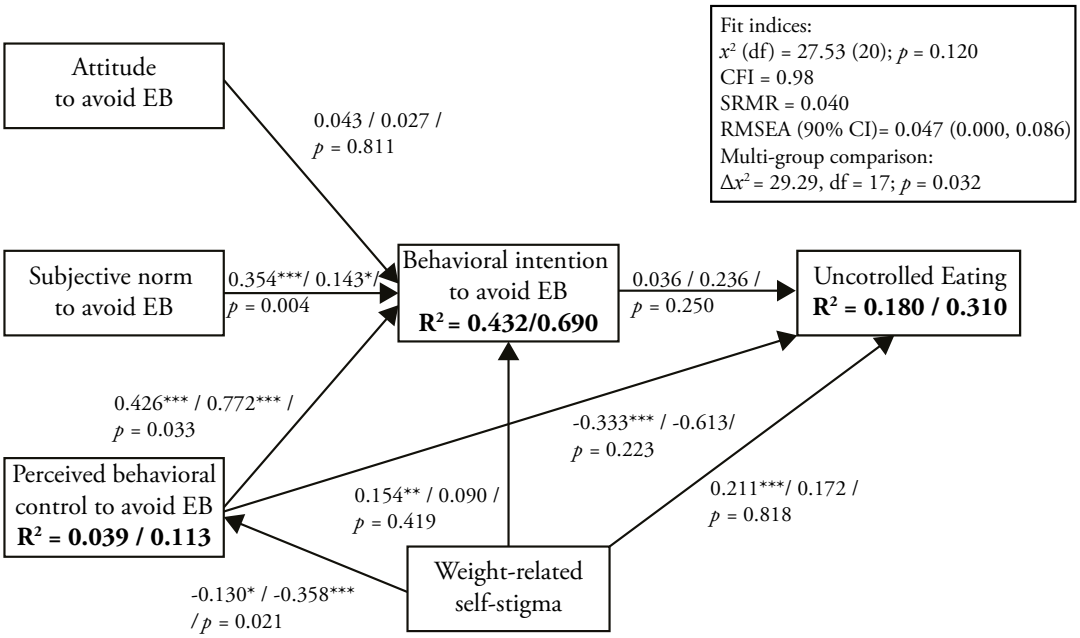
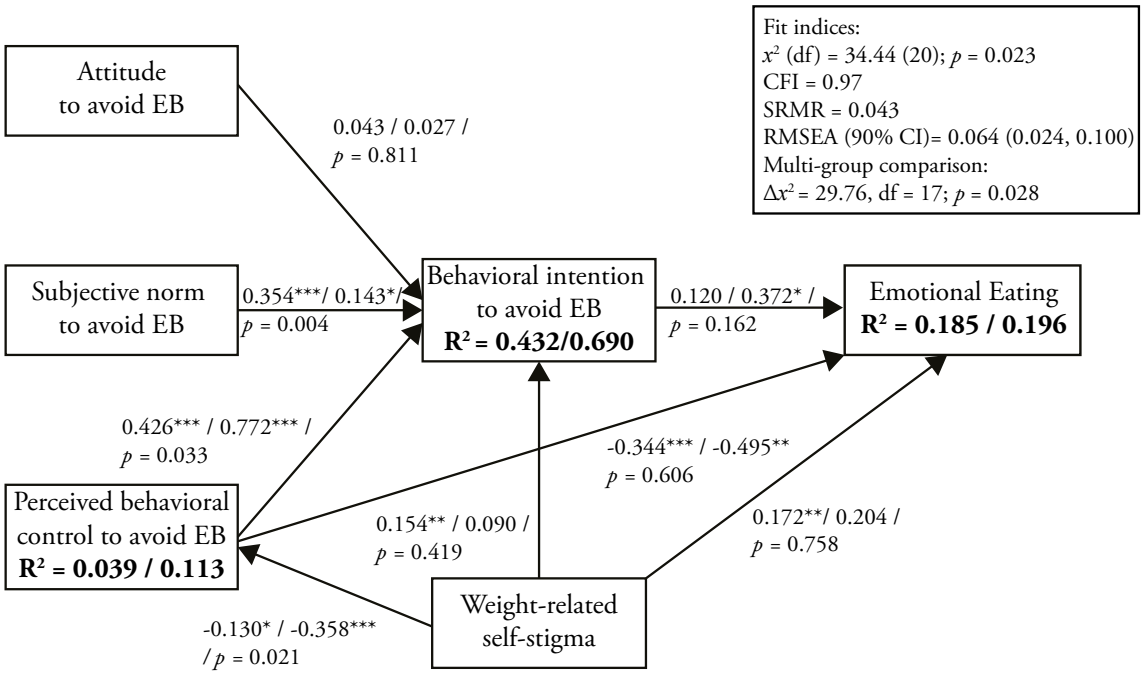


Figure 2c



Note.
(a) cognitive restraint, (b) uncontrolled eating, (c) emotional eating. TPB = Theory of Planned Behavior; CFI = comparative fit index; SRMR = root mean square residual; RMSEA = root mean square error of approximation. Path coefficients are presented for the non-overweight group before the slash and for overweight group after the slash. Likewise, R-squared are presented for the two groups. The p-value below each pair of path coefficients indicates the significance of the differences in path coefficients between the two groups. * p < 0.05. ** p < 0.01. *** p < 0.001

χ^2 Difference Test

The χ^2 difference test suggested that constrained and unconstrained cognitive restraint models ($\Delta\chi^2$ = 29.76, df = 17; p = 0.028); uncontrolled eating models ($\Delta\chi^2$ = 29.29, df = 17; p = 0.032); and emotional eating models ($\Delta\chi^2$ = 29.76, df = 17; p = 0.028) were significantly different. Additional path invariance tests were carried out, each time constraining only one of the paths and comparing it to the unconstrained model. The associations mentioned below were significantly different between overweight and non-overweight groups: PBC with intention ($\Delta\chi^2$ = 4.52, df = 1; p = 0.033), subjective norm with intention ($\Delta\chi^2$ = 8.47, df = 1; p = 0.004), and wss with PBC ($\Delta\chi^2$ = 5.33, df = 1; p = 0.021). In other words, the relationships between PBC and intention, as well as between WSS and PBC, were significantly stronger in the overweight group. Meanwhile, the relationship between subjective norms and intention was significantly stronger in the non-overweight group. See Figures 2a to 2c for details.

DISCUSSION

TPB along with WSS was used to investigate EB in three types (cognitive restraint, uncontrolled eating, and emotional eating). These models exhibited an acceptable to excellent model fit. Although the significance of path coefficients varied across these models, results generally indicated that WSS, PBC, and subjective norm were positively associated with intention to avoid EB; PBC was negatively associated with EB, whereas intention and WSS were positively associated with EB. In addition, path invariance was not fully supported for all path coefficients. The results suggested that different models might be used in different weight groups.

WSS was an additional variable to serve as an extension of the TPB model in this study. It was significantly associated with PBC, intention, and EB. Notably, for the association between PBC and stigma, we found a significantly greater association in the overweight group compared to the non-overweight group. The results are in line with another TPB study on physical activity, which found that WSS was associated with PBC in the overweight group but not in the non-overweight group.[12] WSS induces self-devaluation and reduces people's belief in their

ability to avoid EB. Furthermore, we found that while stigma was associated with greater intention to avoid EB in the future, stigma was associated with increased EB at the time of data collection, possibly due to a recognition of elevated EB and a desire to reduce it. Several studies have found that weight stigma may lead to EB,[6] and these results reinforce this association. Regarding the result of our study, participants did intend to manage their EBs; however, WSS hindered their management. Similar situation has been reported by Major et al.[37], which indicated that weight stigma increased motivation to lose weight but reduced the perceived capacity, accompanied by a greater propensity to participate in improper weight-loss practices. In other words, stigma could potentially reduce self-control and perceived capacity, which made it difficult for people to inhibit their eating impulses.[37] On the other hand, weight stigma has been found to be a stressor. Experiencing weight stigma could induce distress, which leads to the use of emotional eating as a maladaptive coping response.[38-40] Also, the psychological distress induced by weight stigma might lead to EB as well.[8] Taken together, what stands out most in this study is the negative role of WSS in avoiding EB. Especially, we should be aware of the effect of self-stigma on PBC. Our study has shed light on eating and weight management by providing further variables to consider. In order to reduce EB and thereby reduce weight, healthcare practitioners should simultaneously handle the stigma and PBC instead of focusing on the behavior only.

Unlike the results of many TPB studies,[13,41-42] our SEM results indicated that attitude was not significantly associated with intention. Nonetheless, we found a positive relationship between attitude and intention in our correlation analysis, which is consistent with the concept of TPB. Similar results have been found in some studies. For example, in a study on smoking cessation, the intention to quit smoking could not be predicted by attitude;[43] attitude did not predict the intention toward healthy eating among university students;[44] attitude was not associated with the intention to exercise and diet in a weight loss program.[45] It implied that participants in our study may not be motivated to avoid EB by their attitude towards doing so. Other factors, such as subjective norm and PBC, are more important in motivating them.

Our findings in EB models aligned with previous studies of EBs that subjective norm and PBC are associated with intention;[15,46] PBC to avoid EB was also negatively associated with the behaviors, namely, a high level of PBC to avoid EB, a lower level of EB. However, the PBC was not related to cognitive restraint. One possible explanation for this result is that cognitive restraint requires additional knowledge or strategies beyond the expectations of the participants. For example, in a dietary decision-making task from Masterson et al.[47], they found that a high level of cognitive restraint was positively related to health perception and decisions were made faster than those with a low level of cognitive restraint. Also, cognitive restraint could be counteracted by distraction from the environment, such as entertainment or social interaction.[48,49]

Moreover, the intention to avoid EB failed to predict a decrease in EB in this study. Particularly, we did not find a significant relationship between intention and uncontrolled eating (Fig. 2b); and surprisingly, the intention to avoid EB was positively associated with increased EB (Fig. 2a,c). The failure to translate intention into actual behavior could be explained by the "intention-behavior gap" documented in the literature. Several studies had mentioned that there was an intention-behavior gap in EBs.[50,51] One study showed no relationship between intention and food consumption frequency.[15] Reichenberger et al.[50] suggested that the gap was possibly due to people's optimistic thoughts which overestimated their abilities. Further, they pointed out people might underestimate daily barriers and suggested that stress, emotion and personal traits such as disinhibition are potential barriers to actual behavior that make the gap greater.[50] Thus, it is worth investigating any underlying factor which can help to understand this gap in the future. On the other hand, it was suggested that intention fluctuates from time to time, and the fluctuation was associated with subsequent unhealthy snacking.[52] Therefore, the instability of intention strength could be another factor that contribute to the intention-behavior gap. Furthermore, these issues may also be related to WSS, as individuals with self-stigma showed reduced self-control.[37] The negative impact of WSS has been discussed in more detail in the previous paragraph.

The study has several limitations. First, because we used a cross-sectional design, causal links were unable to be determined. We recommend conducting longitudinal investigations to confirm our results in these models. Second, convenience sampling was used to recruit young adults in one university, which may limit the representativeness and generalizability. Future studies should explore a broader population or other cultural contexts. Third, given that all the

variables were self-reported, social desirability may have affected the accuracy of the results.

CONCLUSION

This study added to our understanding of how to avoid EB using the extended TPB model with WSS. Specifically, our findings highlight the significance of WSS in impeding PBC and fostering EB. Paradoxically, while stigma can amplify the intention to avoid EB, it also ironically contributes to an increase in these behaviors. This paradox reveals a complex relationship where the shame or guilt associated with self-stigma might lead to more uncontrolled eating as a coping mechanism. Notably, for those who are overweight, WSS exerts a more pronounced negative impact on perceived behavioral control, thereby making it more challenging for them to believe in and alter their eating habits. In light of these findings, healthcare programs and research focusing on weight management and EBs should take into account the potential effects of weight stigma. Future research should delve into intervention strategies aimed at mitigating the negative effects of WSS. It's also crucial to examine the role of social support and community in moderating the effects of subjective norms and stigma. Additionally, more research is necessary to investigate the factors that facilitate the translation of intentions into behaviors. Conducting long-term studies to observe how the relationship between self-stigma, psychosocial factors, and EBs evolves over time can provide insights into the chronicity of these relationships and the potential for change.

List of abbreviations

TPB: Theory of Planned Behavior; PBC: Perceived behavioral control; EB: Eating behavior; WBIS: Weight Bias Internalization Scale; TFEQ-R18: Three-Factor Eating Questionnaire-Revised 18-item version; BMI: Body mass index; SEM: Structural equation modeling; CFI: comparative fit index; RMSEA: root mean square error of approximation; SRMR: standardized root mean square residual.

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Human Subjects Approval Statement

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. The present study has been approved by the ethics committee at the Hong Kong Polytechnic University (IRB ref. HSEARS20201120002). All the participants have provided an electronic informed consent (i.e., hitting an "agree" icon after showing the study information and participation right).

Conflict of Interest Disclosure Statement

The authors have no conflicts of interest or competing interests to disclose.

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