MODELING THE EFFECT OF WEIGHT STIGMA ON WEIGHT MANAGEMENT BEHAVIORS AND PSYCHOLOGICAL DISTRESS AMONG YOUNG ADULTS: A PROSPECTIVE STUDY

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Modeling the effect of weight stigma on weight management behaviors and psychological distress among young adults: A prospective study

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CERTIFICATE OF ORIGINALITY

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ABSTRACT

Overweight and obesity are significant global public health concerns. There are various psychosocial factors associated with these weight-related issues and how individuals manage their weight. One crucial factor is weight-related stigma, which refers to the devaluation and discrimination experienced due to body weight and is pervasive. Numerous researchers have raised concerns that weight stigma can lead to adverse health outcomes and exacerbate weight problems in a detrimental cycle. Nevertheless, there is a lack of empirical evidence to support these theories on whether weight stigma perpetuates problems in health and well-being. This thesis proposes that weight stigma, psychological distress, physical activity (PA), eating behaviors, and weight changes are interconnected, and weight stigma and weight changes potentially result in a feedback loop.

This thesis consists of three studies. Applying the Theory of Planned Behavior (TPB) model, two cross-sectional studies (Studies 1 and 2) investigated how weight-related self-stigma (WRSS) could influence PA and eating behaviors. Additionally, a one-year longitudinal study (Study 3) examined how stigma is linked to changes in body mass index (BMI), with an emphasis on the growth trajectories and the interplay of these trajectories over time. Study 3 further examined how WRSS and BMI can predict changes in each other across time points. All participants were young adults. There were 325 and 348 participants in Studies 1 and 2. Study 3 had 345 participants in Time 1 and was able to retain 232 to 251 participants in the subsequent time points. Participants completed self-reported standardized questionnaires. Structural equation modeling, parallel process latent growth curve modeling, and random intercept cross-lagged panel model were used in this thesis.

Study 1 indicated that WRSS significantly affected perceived behavioral control on PA (PBC-PA), intentions, and PA engagement, especially in overweight individuals. Study 2 showed that WRSS reduced perceived behavioral control for avoiding eating behaviors (PBC-

EB) and increased uncontrolled and emotional eating. Study 3 further found that individuals with high WRSS exhibited higher BMI, perceived weight stigma, psychological distress, and eating behaviors compared to the low WRSS group. Furthermore, the high WRSS group had consistently lower PBC-PA and PBC-EB. Temporal relationships were only found in the associations among perceived weight stigma and WRSS, WRSS and psychological distress, PBC-PA and psychological distress, and WRSS and PBC-EB. In sum, the growth trajectories of the variables were not associated with BMI changes, but WRSS was negatively associated with subsequent BMI in another analysis.

This thesis consistently demonstrated the adverse effects of WRSS on individuals' PA and eating behaviors. The proposed models indicated that PBC was the primary variable affected by WRSS, which may hinder engagement in PA and avoiding unhealthy eating practices. Furthermore, the relationship between WRSS and reduced PBC was significant in individuals who were overweight or not. Additionally, the research identified temporal associations between WRSS, perceived behavioral control, and psychological distress. However, the thesis did not find strong evidence to support the hypothesized feedback loop between WRSS and BMI. Further research is required to better understand whether weight stigma can be influenced by weight change.

LIST OF PUBLICATIONS DURING THE COURSE OF STUDY

Thesis-Related Publications

Fung, X. C. C., Pakpour, A. H., Wu, Y.-K., Fan, C.-W., Lin, C.-Y., & Tsang, H. W. H. (2020). Psychosocial variables related to weight-related self-stigma in physical activity among young adults across weight status. *International Journal of Environmental Research and Public Health, 17*(1), 64. https://doi.org/10.3390/ijerph17010064

Fung, X. C. C., Siu, A. M. H., Lin, C.-Y., Ko, P.-J., Lin, I.-C., Chen, J.-S., & Lau, B. W. M. (2024). Weight stigma and eating behaviors in young adults across weight status. *American Journal of Health Behavior*, *48*(3), 628–640. https://doi.org/10.5993/AJHB.48.3.6

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Non-Thesis-Related Publications

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LIST OF CONFERENCE PRESENTATIONS DURING THE COURSE OF STUDY

Thesis-Related Presentation

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Non-Thesis-Related Presentation

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LIST OF ABBREVIATIONS

BMI = body mass index

CFI = comparative fit index

FIML = full information maximum likelihood

HADS = Hospital Anxiety and Depression Scale

IPAQ = International Physical Activity Questionnaire

MLR = maximum likelihood estimation with robust standard errors

PA = physical activity

PBC-EB = perceived behavioral control for avoiding eating behaviors

PBC-PA = perceived behavioral control for physical activity

PP-LGCM = parallel-process latent growth curve model

PWS = perceived weight stigma

PWSS = Perceived Weight Stigma Scale

RI-CLPM = random intercept cross-lagged panel model

RM-ANCOVA = repeated measures analysis of covariance

RMSEA = root mean square error of approximation

SEM = structural equation modeling

SRMR = standardized root mean square residual

TFEQ-R18 = Three-Factor Eating Questionnaire-R18

TLI = Tucker-Lewis index

TPB = Theory of Planned Behaviors

WBIS = Weight Bias Internalization Scale

WRSS = weight-related self-stigma

Chapter 1 Introduction

Over the past few decades, overweight or obesity (hereafter overweight and obesity indicate the same meaning of having excess weight) has become a global public health issue. When the general public considers weight issues, they often focus on the physiological and physical health aspect (Stewart, 2018). However, there are a number of psychosocial variables that are linked to obesity and how people manage their weight. One important variable is weight stigma. Stigma is the "spoiled social identity," indicating social disapproval (Bos et al., 2013; Goffman, 1963). Weight stigma, which refers to the devaluation and discrimination based on body weight, is one of the most pervasive stigmas in society (Tomiyama et al., 2018). Weight stigma is prevalent, including in employment settings and even clinical settings (Puhl et al., 2021; Tomiyama et al., 2018). Some perspectives regarded weight stigma as a way to remind people to control weight, and it could be used as an approach to promote public health (Callahan, 2013a, 2013b). However, many other researchers raised concerns that weight stigma caused adverse health outcomes and subsequently exacerbated the weight problem in a vicious cycle (Major et al., 2018; Tomiyama, 2014). Nevertheless, there is a lack of empirical data to examine whether weight stigma would lead to perpetual problems in health and well-being. This thesis theorizes that weight stigma, psychological distress, weight management behaviors, and weight changes are linked, and a vicious cycle exists among these variables.

This thesis contains several studies to examine the following objectives:

1. To examine how weight-related self-stigma is associated with physical activity.
2. To examine how weight-related self-stigma is associated with eating behaviors.
3. To examine the interplay between perceived weight stigma, weight-related self-stigma, psychological distress, physical activity, and eating behaviors in a longitudinal study

4. To examine the bidirectional relationship between weight-related self-stigma and weight change in a longitudinal study.

Chapter 2 Literature Review

2.1. Overweight and Obesity as a Health Concern in Young Adults

The issue of overweight and obesity is a significant global health concern. Research covering 188 countries revealed that more than one-third of adults were overweight or obese (Ng et al., 2014). According to the findings of the latest Population Health Survey carried out by the Government between 2020 and 2022, 32.6% of Hong Kong's adult population were categorized as obese, with an additional 22.0% classified as overweight. (Centre for Health Protection, Department of Health, 2023b). This represents a noteworthy increase in the prevalence of overweight and obesity compared to 2004, when the obesity rate stood at 21.0% and the overweight rate was 17.8% among Hong Kong's adult residents. (Centre for Health Protection, Department of Health & Department of Community Medicine, University of Hong Kong, 2005). These statistics reveal a significant public health challenge related to overweight and obesity among Hong Kong's adult population. Studies indicated that individuals who are obese or overweight have a higher chance of developing cardiovascular disease and have a lower quality of life (Reilly et al., 2003; P. C. Wong et al., 2019). Being overweight in young adulthood was associated with increased blood pressure and mortality in middle age (Carslake et al., 2016; Xie et al., 2016). Young adulthood is an important stage for people to consolidate their self-concept and to develop health maintenance behavior and a healthy lifestyle. Primary health care often seeks to raise awareness among young adults about the importance of weight management behaviors that tackle weight-related health issues.

2.2. Behavioral Weight Management

There are two major approaches to behavioral weight management - physical activity and eating. A review suggested that interventions targeting physical activity and diet were effective for the short-term, however, weight gain usually occurred in long-term follow-up (Turk et al., 2009). For instance, participants in lifestyle modification programs, i.e., modified diet and physical activity, usually show successful weight loss. Regrettably, participants regained approximately one-third of their lost weight within one year, and fifty percent of the participants returned to their baseline weight after five years (Wadden et al., 2004). When compared to older adults, young adults maintained their weight loss for a shorter period (LaRose et al., 2013). Furthermore, better appearance and social relationships were the motivations for young adults to lose weight (LaRose et al., 2013). Stewart (2018) indicated that weight management behaviors based on these motivations were difficult to sustain. Indeed, the appearance and social concerns of young adults imply the problem of weight stigma. Hence, investigation from the psychosocial perspective is valuable for weight-related health (Stewart, 2018).

2.2.1. *Physical Activity*

Physical activity is an essential behavioral factor in healthy weight management (World Health Organization, 2020a). For adults, the World Health Organization (WHO) recommends at least 150 min of moderately intense aerobic physical activity per week to maintain health, including a healthier body mass (World Health Organization, 2011). Moreover, low levels of physical activity lead to weight gain (Y.-C. Lin et al., 2019). About 30% of people worldwide do not get adequate physical activity, and this incidence is higher in high-income countries (Guthold et al., 2018). A significant portion of Hong Kong's adult population falls short in meeting recommended physical activity levels. According to a survey, 34% of adults in Hong Kong reported that they had seldom or never exercised over the past six months. (Hong Kong Institute of Asia-Pacific Studies at CUHK, 2016). According to the Government's latest Population Health Survey 2020-22, a quarter of adults did not meet the recommended physical activity level (Centre for Health Protection, Department of Health, 2023a). Furthermore, another study conducted in 2021 showed that more than 70% of Hong Kong young adults (aged from 18 to 29) participated in physical activity less than 2.5 hours per week, which is an inadequate level (Hung et al., 2024). In addition, a survey indicated that only 16.79% of individuals in the obesity group had active physical activity, while those in the non-overweight group had 29.01% (M. Chen et al., 2022). Taken together, addressing the problem of insufficient physical activity is essential for the people in Hong Kong to improve their weight management.

2.2.2. *Eating*

Eating is another crucial behavioral factor in healthy weight management (World Health Organization, 2020a). According to the World Health Organization, healthy eating consists of eating enough fruit and vegetables (at least 400 g per day), low intake of fats (less than 30% per day), sugars (less than 10% per day), and salt (less than 5 g per day) (World Health Organization, 2020b). Eating unhealthy foods, such as foods that are energy–dense or high–fat, leads to weight gain (Wu et al., 2019). Moreover, eating disinhibition positively associated with weight gain and reduced weight loss effort (Bryant et al., 2010, 2012). As for the diet, Imamura et al. (2015) found that although the diet quality was improved worldwide, the increment of unhealthy eating behaviors was more than the healthy behaviors. Similar phenomena can be observed in Hong Kong. For example, nearly 40% of Hong Kong people do not have daily fruit consumption, and 46.5% eat processed meat (which has high amount of salt) weekly (Centre for Health Protection, Department of Health, 2017). A survey indicated that 16.09% of individuals in obesity group had unhealthy high-fat food consumption, while non-overweight had 8.09% only (M. Chen et al., 2022). Eating behaviors (EB), conceptualized as the behaviors of cognitive restraint, emotional eating, and uncontrolled eating (Halali et al., 2020), are linked to weight gain and diminished efforts in weight loss (Bryant et al., 2019; Halali et al., 2020). Particularly, concerns have been raised regarding eating behaviors in Hong Kong young adults (Cheng et al., 2018; Sheffield et al., 2005). For example, a study revealed that emotional eating was prevalent among 14.8% of female and 4.5% of male university students in Hong Kong (Sze et al., 2021). Furthermore, 26.5% of Hong Kong young adults had the tendency to have eating behaviors (C. Y. Chan & Chiu, 2022).

It is crucial to address challenges in eating behaviors in better weight management.

2.3. Weight Stigma and its Consequences

Stigma originally refers to the physical signs or taboos imprinted on the skin of immoral people, such as criminals or slaves (Goffman, 1963). Today, stigma is used to describe the "spoiled social identity" indicating social disapproval (Bos et al., 2013; Goffman, 1963). When people are stigmatized, it means the public is holding a negative stereotype or prejudice on them due to their specific conditions, e.g. race, sexual orientation, mental illness, HIV/AIDS, and weight. Pryor and Reeder (2011) suggested that public stigma is the core of stigmatization. *Perceived stigma* results from the direct experience or observation of discrimination and negative judgment. When people react negatively to someone who has stigmatized conditions, the target is aware of those devaluations or disapproval. In other words, stigmatized individuals realize that others always treat them badly because of their specific conditions. Apart from that, stigmatized individuals internalized the stigma to become *self-stigma*, which was revealed in a longitudinal study on mental illness stigma (Vogel et al., 2013). Self-stigma is a kind of self-devaluation, in which individuals believe they are not worthy and they expect others should treat them negatively.

Weight stigma refers to the devaluation and discrimination based on body weight, causing individuals who are overweight and obese to face a high risk of stigma (Puhl & Heuer, 2009). Weight stigma is pervasive and widely acceptable in society, even in healthcare settings (Tomiyama et al., 2018). Puhl et al. (2020) indicated concern about young adults experiencing weight stigma. It is alarming to find that more than half of Asian American young adults reported their past experiences of weight stigma (Puhl et al., 2020). People may develop weight stigma due to the cultural preference for thinness and the negative representation of overweight and obesity in media, such as TV shows and fitness advertisements (Frederick et al., 2016). The weight issue is usually regarded as controllable by oneself, and they are solely responsible for it. Thus, weight-stigmatized individuals usually are viewed as lazy, self-indulgent, or lack of self-control. Meanwhile, society and some scholars argued that weight stigma could serve as social pressure and motivation (Callahan, 2013a, 2013b). They believed public health could be achieved by imposing stigma, the public awareness would rise, and people would exert effort to manage weight. However, studies on the effects of weight stigma supported the opposite (Major et al., 2018; Pearl & Puhl, 2018). Instead of promoting health, weight stigma causes detrimental consequences on both physical and mental health, as discussed in the following sections.

2.3.1. *Weight Stigma's Relationship with Physical and Mental Health*

Weight stigma is commonly regarded as having a negative impact on health and weight management, but the evidence is not consistent (Pearl et al., 2021). Perceived stigma was associated with mood disorders (Hatzenbuehler et al., 2009). Exposure to video clips from television and movies, which had scenarios of weight bias and teasing, such as laziness and clumsy, was associated with increased calorie-dense snack intake and a higher level of negative emotion in participants who were overweight (Schvey et al., 2011). Further, Schvey et al. (2014) found that people had greater cortisol reactivity following videos with weight bias and teasing, which could be due to stress induced by videos. The cortisol plays a role in motivating food consumption (Adam & Epel, 2007). Moreover, negative and direct life experiences or attitudes can lead individuals to develop weight-related self-stigma, which refers to the internalization of these biases that foster self-devaluation (Durso & Latner, 2008). Weight-related self-stigma was associated with more psychological distress, eating disturbance, and physical activity avoidance (Durso & Latner, 2008; Fan et al., 2023; Mensinger & Meadows, 2017; O'Brien et al., 2016). However, a review study indicated that while most studies found a negative relationship between weight stigma and physical activity level, one study found the opposite (Pearl et al., 2021). Furthermore, Lee et al. (2021) reported that weight stigma was not associated with lower levels of physical activity. On the other hand, findings from studies on the relationship between self-stigma and psychological distress were also inconsistent. For instance, O'Brien et al. (2016) found that self-stigma was associated with psychological distress and emotional eating. However, another study found that self-stigma was not associated with anxiety in adolescents who are overweight (C.-Y. Lin et al., 2019). Thus, there is a need to further examine how weight stigma is linked to weight management behaviors and psychological distress.

2.3.2. *Weight Stigma and Weight Management: A Vicious Cycle*

From the above discussion, it is possible that weight stigma creates a vicious cycle of stigma and health. Some models have been proposed to indicate this risk. Tomiyama (2014) proposed a cyclic obesity/weight-based stigma (COBWEBS) model, which illustrates a vicious cycle of weight stigma and weight gain based on a physiological pathway. In the COBWEBS model, weight stigma is the first step and a source of stress. The stress brought about by weight stigma, then, induces cortisol secretion and maladaptive eating behavior. Consequently, people who are overweight or obese are highly likely to gain more weight or at least hinder their weight loss efforts. However, weight gain is not the conclusion of the process. It may, in turn, reinforce the weight stigma, and another round of this vicious cycle could occur, i.e. a positive feedback loop (Tomiyama, 2014).

Using a macro perspective, the model of weight stigma presented by Major et al. (2018) illustrated how socioeconomic and healthcare factors influence weight stigma and health. For example, discrimination can lead to social isolation, poorer healthcare management from providers, and lower socioeconomic status due to limited opportunities. The model also includes an individual's perspective, such as physiological stress reactivity and psychological and behavioral perspectives. For example, stigma-induced stress could lead to comfort eating and stigma avoidance behaviors. It also indicated that the possibility of stigma leads to more weight gain and, therefore, more adverse effects.

As people, including overweight and obese individuals, usually consider weight to be controllable by oneself, one would be blamed for weight problems (Puhl & Heuer, 2009). For example, people may think that a person is overweight because he/she did not control his/her diet or participate in physical activity. However, the idea of a vicious cycle can let people realize that weight problems are not merely due to the individual's motivation and behavior, but also the impact of weight stigma. Thus, it can be a model for people to better understand individuals who are overweight or obese and stop blaming or teasing them.

2.3.3. *Literature Gap in the Vicious Cycle Model of Weight Stigma*

The two models mentioned above provide insights for people to understand the crucial problem of weight stigma. However, the claim of being a vicious cycle in both models needs empirical evidence to support it. Currently, these models have been proposed by gathering results from different studies. Using the physiological pathway in the COBWEBS model as an example, studies have supported that weight stigma induces stress and cortisol secretion (Himmelstein et al., 2015; Schvey et al., 2014). The relationship among cortisol, eating, and weight gain proposed in the COBWEBS model is also supported in another study (Adam & Epel, 2007). Nevertheless, no empirical studies evaluate the entire COBWEBS model to support its claim of a vicious cycle. For example, the effect of weight gain on the level of stigma is unclear. Thus, the cycle is yet to be fully confirmed.

Moreover, although the model proposed by Major et al. (2018) seems comprehensive, it is a model that included almost every possible variable to introduce the entire potential picture to people. Therefore, it is difficult to investigate all pathways at a time, and each single cyclic pathway should be investigated first.

On the other hand, although findings from different studies indicated relationships between weight stigma and adverse health outcomes, more evidence is needed to explain how stigma leads to those outcomes. For example, as mentioned above, there was an argument that weight stigma could motivate people to lose weight. However, evidence indicated weight stigma was associated with poor weight management behaviors, e.g. inappropriate eating behaviors and avoidance behaviors (Mensinger & Meadows, 2017; O'Brien et al., 2016). However, apart from the behavioral outcomes, it is still meaningful to investigate whether weight stigma influences people's willingness to perform such behaviors.

It is also necessary to examine both self-stigma and perceived stigma in weight management. Some individuals may have perceived stigma but not self-stigma, while others may have both. In a qualitative study, individuals who were overweight or obese who internalized the weight bias reported more eating behaviors and higher perceived weight stigma compared to those who did not internalize the bias (Puhl et al., 2007). There are a few studies that examine the relationship between perceived stigma and self-stigma, and how they impact on health outcomes (Major et al., 2018).

The COBWEBS model proposed by Tomiyama (2014) suggested the importance of examining how weight gain impacts stigma, specifically whether weight gain maintains or exacerbates weight stigma. It is also not known if weight gain contributes to the level of weight-stigma as a feedback loop. The main study of this thesis is a longitudinal study that assesses the relationship between weight gain and the level of weight and whether a feedback loop (vicious cycle) exists between weight stigma, weight management, and physical and mental health. The potential significance of this study is to provide a better understanding of the interplay between weight gain, weight stigma, weight management behaviors, and psychological health. By identifying the potential factors and relationships, findings could lead to more effective approaches in both clinical practice and public health policy, hopefully aiming to break the vicious cycle, if any, that currently undermines weight management efforts and overall well-being.

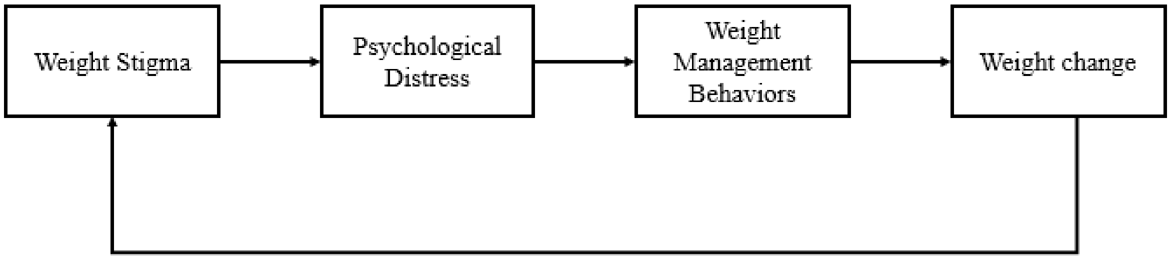
2.4. Objectives

Based on the reviewed literature, this study proposes a cyclic model of weight stigma (Figure 1). This thesis focused on psychological and behavioral perspectives, which included weight stigma, psychological distress, weight management behaviors, and weight changes. The proposed model would become the foundation of the study and be elaborated throughout the study period. In the beginning, the researcher would like to conduct multiple studies to understand different parts of the relationships in the model (Figure 1). Based on these studies, some literature gaps could be studied. Accordingly, the proposed model could be expanded or modified based on the results. Finally, this thesis aims to investigate the elaborated cyclic model through a longitudinal study.

In Chapter 3, the first study examined the association between weight-related self-stigma and physical activity (Objective 1) with the incorporation of a health behavior model (i.e., Theory of Planned Behavior; TPB). In Chapter 4, the second study examined the association between weight-related self-stigma and eating behaviors (Objective 2) with the incorporation of TPB. After the researcher ensured the several relationships in the model, a longitudinal approach was used in Chapter 5 to investigate the association between weight stigma, psychological distress, eating behaviors, physical activity, weight changes, and other additional variables based on the results from the previous two studies (Objective 3). Further, the bidirectional relationship between weight stigma and weight change was examined in the same longitudinal study (Objective 4).

Figure 1

The Proposed Model of Weight Stigma Cycle



Note. This is a model illustrating the weight stigma vicious cycle. First, weight stigma would induce psychological distress. Then, psychological distress would affect weight management behaviors, physical activity and eating. The poor management would lead to weight gain, and finally, the stigma would be intensified due to the weight gain.

Chapter 3 Psychosocial Variables Related to Weight-Related Self-Stigma in Physical Activity Across Weight Status

3.1. Background

This study aimed to investigate if potential factors, which are not mentioned in the Proposed Model of the Weight Stigma Cycle, are related to weight management behaviors. The Theory of Planned Behavior (TPB) was considered and used to incorporate with weight-related self-stigma (WRSS) to explain the physical activity of young adults in Hong Kong. As mentioned, individuals who are overweight may have different feelings and perceptions regarding their self-concept and body image, compared to those who are not overweight (Carr & Friedman, 2005; Mustillo et al., 2012). Thus, this study examined the model fit of a TPB theory, which proposed how weight-related self-stigma is linked to physical activity (i.e., Objective 1), and if this model applies to people with different weight statuses (non-overweight vs. overweight). The findings of this study have been published in the International Journal of Environmental Research and Public Health (https://doi.org/10.3390/ijerph17010064).

3.1.1. *The TPB and Physical Activity*

The TPB provides a framework for understanding and predicting specific behaviors (Ajzen, 1991), such as help-seeking, medication adherence, physical activity, and food intake (Beville et al., 2014; Guillaumie et al., 2010; C.-Y. Lin et al., 2016, 2017). The TPB consists of five important constructs: attitudes, subjective norms, perceived behavioral control, behavioral intentions, and behavior. An attitude represents how a person values and appraises the specific behavior and its outcomes. A subjective norm refers to perceived social pressure or approval/disapproval regarding the behavior within one's social context. Perceived behavioral control is defined as an individual's perception of their ability or control to be able to perform a specific behavior. Behavioral intention reflects the motivational and planning process, including when and how the behavior will be carried out (Ajzen, 1991).

According to Ajzen (1991), TPB suggests that attitude, subjective norm, and perceived behavioral control together determine behavioral intention, and the actual behavior is determined by behavioral intention and perceived behavioral control. Though TPB is used extensively in a broad range of studies to measure physical activity, the research outcomes are not always consistent. For example, a study with Canadian adolescents found that TPB accounted for physical activity behavior (Plotnikoff et al., 2011). In contrast, another study on U.S. women in a weight-loss treatment found that physical activity level was not associated with the TPB constructs of perceived behavioral control and intention (Gardner & Hausenblas, 2004). Furthermore, TPB factors, except subjective norm for males, successfully predicted engagement in leisure-time physical activity (Beville et al., 2014). Other evidence showed that TPB factors better explained the variance of behaviors based on volition (e.g., dancing) as opposed to activities that required daily trainings (e.g., running, swimming, and team sports) (Scott et al., 2010).

3.1.2. ***The TPB and WRSS***

The TPB has been widely used as a generic model in theorizing health behavior, but was criticized for not being able to account for specific factors that may impact on some health behavior (Ajzen, 2015; Conner & Armitage, 1998). Thus, there were suggestions to incorporate of additional potentially relevant factors to expand the model's explanatory power was suggested (Ajzen, 2015; Conner & Armitage, 1998). In studying weight management, for example, the TPB did not account for the potential effect of WRSS on physical activity. Research indicates that weight stigma can contribute to adverse health outcomes. Major et al. (2012) have shown that weight-based stigma can heighten stress and diminish self-control among individuals who experience stigma. Additionally, WRSS may impact perceived behavioral control, as it is linked to negative self-concept (the perception about oneself, such as traits and abilities) (Tomiyama et al., 2018). For instance, a study found that girls with obesity exhibited poorer self-perceptions of their capability and behavioral conduct compared to their non-overweight peers (Mustillo et al., 2012). Furthermore, the self-concept of girls who were previously overweight failed to recover, likely due to the lingering effects of self-stigma (Mustillo et al., 2012). Another study revealed that individuals with obesity frequently reported diminished self-concept when they faced weight-based stigmatization (Carr & Friedman, 2005). Consequently, WRSS may potentially influence perceived behavioral control, though there is currently no direct empirical evidence supporting this relationship. Moreover, the stress and psychological burden induced by experiencing weight stigma may subsequently decrease an individual's levels of physical activity (Cheng et al., 2018; Mouchacca et al., 2013). Accordingly, this thesis proposed incorporating WRSS as a potential influential factor into the TPB model in order to create an extended TPB framework for more comprehensively examining weight-related behaviors and outcomes.

3.2. Methods

3.2.1. *Participants and Procedures*

Through convenience sampling, participants from The Hong Kong Polytechnic University were recruited. Among 450 university students who were invited, 325 of them completed the study. In the final 20 minutes of a lecture, the study information was described to the students. Students were invited to complete a series of questionnaires in Google Form via a QR code provided. Ethical approval was obtained from the Ethics Review Board in the university before data collection (HSEARS20171212002). In the Google Form, electronic inform consent was requested before the part of the questionnaires. After participants select “agree” in the Google Form, it directs participants to the part of the questionnaire.

The participants provided their current height and weight, which were used to classify them as either non-overweight or overweight based on their body mass index (BMI). According to the Asian BMI cut-off defined by the World Health Organization, participants with a BMI between 18.5 and 22.9 kg/m^2 were categorized as non-overweight, while those with a BMI of 23 kg/m^2 or higher were considered overweight (World Health Organization, 2000). The study included participants aged 18 to 30 years old who were proficient in Traditional Chinese and consented to take part. Individuals were excluded if they self-reported having a neurological condition, functional impairment, or any psychotic disorder or intellectual disability that would make it difficult to complete the online surveys.

3.2.2. *Measures*

3.2.2.1. Physical Activity

The Chinese version of International Physical Activity Questionnaire (IPAQ) was utilized in this study (Macfarlane et al., 2007). The IPAQ is a self-reported measure that evaluates the level of physical activity undertaken by participants over the past week (Craig et al., 2003). A sample item is "During the last seven days, on how many days did you do vigorous physical activities?" (Craig et al., 2003). The responses on the questionnaire were then converted into the metabolic equivalent of task (MET) values, which correspond to the time spent on different intensity levels of physical activity (MET = 3.3 for walking, 4 for moderate physical activity, 8 for vigorous physical activity) (Craig et al., 2003). For instance, if a participant reported walking for 40 minutes each day, their physical activity level would be calculated as 3.3 × 40 minutes × 7 days = 924 METs. A higher MET value indicates a greater level of physical activity. The IPAQ has demonstrated satisfactory test-retest reliability, with an intraclass correlation coefficient of 0.79 (Macfarlane et al., 2007).

3.2.2.2. TPB Measures

3.2.2.2.1. Attitude towards physical activity

The study utilized an 8-item semantic differential scale to assess attitudes towards physical activity (C.-Y. Lin et al., 2016). Participants rated the statement "For me to exercise at least 30 minutes, three days per week is ____" on a 7-point scale using bipolar adjective pairs. A higher score reflected a more favorable attitude towards the target behavior, i.e., physical activity (C.-Y. Lin et al., 2016). The internal consistency of this attitude measure was excellent in the current study, with a Cronbach's alpha of 0.90.

3.2.2.2.2. Subjective Norm towards physical activity

The study utilized three 7-point items to measure subjective norms regarding physical activity. An example item was "People who are important to me would approve of me [exercising/exercising at least 30 minutes, at least three days per week]." Higher scores on this scale reflected stronger perceived social norms to engage in physical activity. The internal consistency of the subjective norm measure was satisfactory in the current study, with a Cronbach's alpha of 0.82.

3.2.2.2.3. Perceived Behavioral Control Towards Physical Activity

The study utilized a 4-item scale with 7-point response options to assess perceived behavioral control towards physical activity (Latimer & Martin Ginis, 2005). A sample item was "How much personal control do you feel you have over whether you [exercise/exercise at least 30 minutes, at least three days per week] in the next week?" Higher scores on this measure indicated greater levels of perceived behavioral control. The internal consistency of the perceived behavioral control scale in the current study was excellent, with a Cronbach's alpha of 0.95.

3.2.2.2.4. Behavioral Intention towards physical activity

The study employed a 3-item, 7-point scale to evaluate participants' behavioral intentions for physical activity (Kothe et al., 2012). For instance, a sample item was "I plan to [exercise at least 30 minutes, at least three days per week] from now on." Higher scores on this measure reflected greater levels of behavioral intention. The internal consistency of this intention towards physical activity scale was excellent, with a Cronbach's alpha of 0.97.

3.2.2.3. Weight-Related Self-Stigma

The Weight Bias Internalization Scale (WBIS) was utilized to assess participants' WRSS (Durso & Latner, 2008), and it was later modified to a version appropriate for individuals with any type of weight status, including non-overweight and overweight (Pearl & Puhl, 2014). This 11-item measure employed a 5-point rating scale, where higher scores reflected greater internalization of weight-related stigma. The Chinese version of the WBIS, which also adapted its item descriptions appropriate for any type of weight status, has demonstrated satisfactory psychometric properties in both individuals who are overweight and non-overweight (Pakpour et al., 2019). The internal consistency of the WBIS in the current study was excellent, with a Cronbach's alpha of 0.91.

3.2.3. *Data Analysis*

Considering that the model comprises six observed variables (attitude, subjective norm, perceived behavioral control, behavioral intention, WRSS, physical activity) and requires the estimation of eight path coefficients, the model would have 13 degrees of freedom, based on the formula: ½ × number of parameters × (number of parameters + 1) − free parameters. (Bollen, 1989). The necessary sample size to achieve adequate statistical power was estimated to be approximately 216 participants, given the parameters of 13 degrees of freedom, a Type I error of 0.05, a desired power of 0.8, a null root mean square error of approximation of 0.08, and an alternative root mean square error of approximation of 0. (Preacher & Coffman, 2006). Therefore, the sample size of 325 participants in the current study was adequate to ensure sufficient statistical power for the analysis.

Pearson's correlation was performed to examine the relationships among the TPB factors, WRSS, and physical activity. Furthermore, structural equation modeling (SEM) with multiple group analyses was conducted to assess the fit of the proposed physical activity model and to examine the invariance of path coefficients between the groups of overweight and non-overweight.

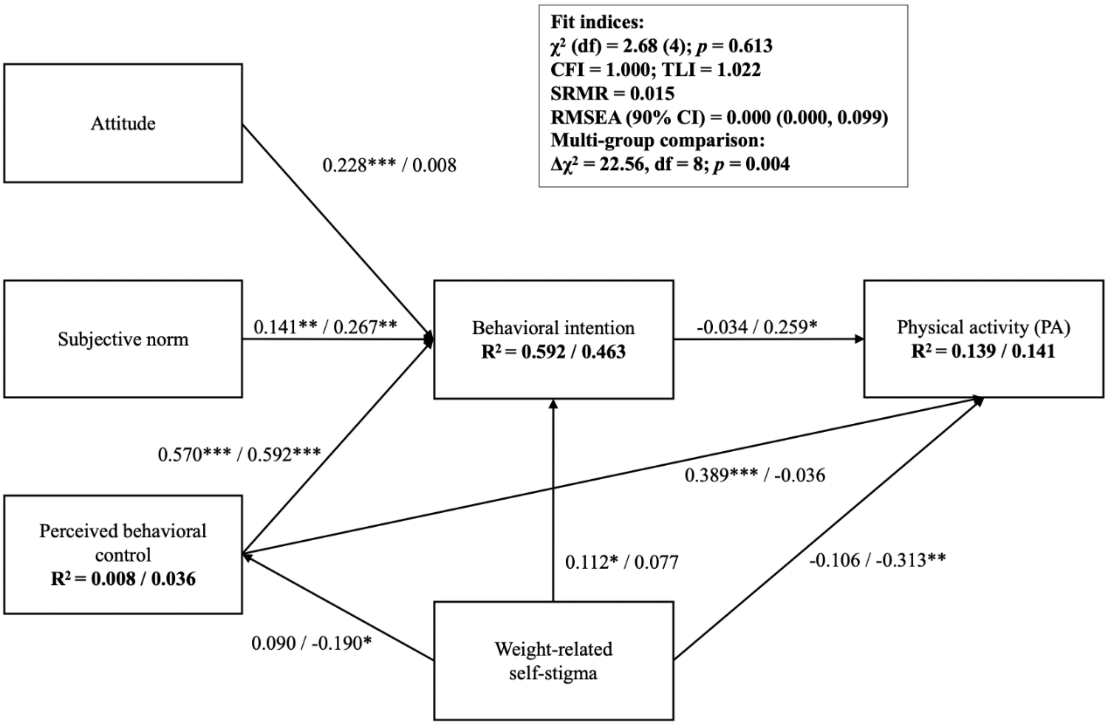
The study employed maximum likelihood estimation to analyze the hypothesized model and to handle any missing data. The proposed model, illustrated in Figure 2, treated all factors as observed variables, with summated scores used to represent each component of the extended TPB framework. The fitness of the multiple-group SEM was evaluated using various fit indices, including the comparative fit index (CFI), Tucker-Lewis index (TLI), root mean square error of approximation (RMSEA), and standardized root mean square residual (SRMR). Additionally, the chi-square test was utilized to determine the overall model fit. Models demonstrating a nonsignificant chi-square statistic, along with CFI and TLI values exceeding 0.9, and RMSEA and SRMR values below 0.08, were considered to have acceptable fit, indicating that the data supported the proposed model (Hu & Bentler, 1998).

After verified the fitness of the physical activity model was supported, the researcher performed the χ^2 difference test to examine path invariance across the two groups. A non-significant χ^2 difference test result indicated that the path coefficients were invariant across the two groups. Initially, the researcher constrained all path coefficients to be equal between the two groups, and then evaluated whether the model with these constrained paths differed significantly from the unconstrained model. If the two models did not exhibit a significant difference, it would support the invariance of the paths across all the model parameters. Conversely, if a significant difference was found, the researcher would have proceeded to assess the invariance of each path coefficient.

All the analyses were conducted using SPSS 25.0 software (IBM Corp., Armonk, NY, USA), except for the SEM analyses, which were performed using the R software (R Foundation for Statistical Computing, Vienna, Austria) with the latent variable analysis (lavaan) package (Rosseel, 2012).

Figure 2

The Theory of Planned Behavior Model Incorporated Weight-Related Self-Stigma on Physical Activity with the Results of Multiple Group Analysis



Note. PA = physical activity; CFI = comparative fit index; TLI = Tucker-Lewis 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 the overweight group after the slash. Likewise, R-squared are presented for the two groups. A lower value on physical activity indicates less physical activity engagement. * $p < 0.05$. ** $p < 0.01$. *** $p < 0.001$. From "Psychosocial variables related to weight-related self-stigma in physical activity among young adults across weight status." International Journal of Environmental Research and Public Health, 17(1), p.5. https://doi.org/10.3390/ijerph17010064

3.3. Results

The demographics and instrument scores for all participants are summarized in Table 1. Briefly, the sample had a mean age of 21.6 (standard deviation [*SD*] = 2.95) and a mean BMI of 22.39 (*SD* = 4.03), with more than half of the participants being female (61.2%). Additionally, Table 2 presents the correlations among the TPB factors, WRSS, and physical activity.

Table 1

Demographic Information Among Participants

	Participants (*N* = 325)
Gender, *n* (%)	
Male	126 (38.8%)
Female	199 (61.2%)
Age (years), *M* (*SD*)	21.6 (2.95)
Body Mass Index, *M* (*SD*)	22.39 (4.03)
Weight status, *n* (%)	
Non-overweight	221 (68%)
Overweight	104 (32%)
International Physical Activity Questionnaire, *M* (*SD*)	2008.17 (2144.41)
Weight Bias Internalization Scale, *M* (*SD*)	28.92 (9.58)
Theory of Planned Behavior factors, *M* (*SD*)	
Attitude toward PA	82.69 (13.94)
Subjective norm toward PA	47.28 (26.17)
Perceived behavioral control toward PA	59.28 (27.00)
Behavioral intention toward PA	62.21 (27.29)

Note. PA = physical activity. From "Psychosocial variables related to weight-related self-stigma in physical activity among young adults across weight status." International Journal of Environmental Research and Public Health, 17(1), p.6. https://doi.org/10.3390/ijerph17010064

Table 2

Correlation Matrix Among Theory of Planned Behavior Factors, Weight-Related Self-Stigma, and Physical Activity

	r				
Variables	2.	3.	4.	5.	6.
1. PA	0.20 ***	−0.02	0.30 ***	0.22 ***	−0.13 *
2. Attitude toward PA	--	0.13 *	0.50 ***	0.46 ***	−0.08
3. Subjective norm toward PA		--	0.20 ***	0.34 ***	0.31 ***
4. PBC-PA			--	0.68 ***	0.05
5. Intention toward PA				--	0.15 **
6. Weight-related self-stigma					--

Note. PA = physical activity; PBC = perceived behavioral control toward physical activity. * $p < 0.05$. ** $p < 0.01$. *** $p < 0.001$. From "Psychosocial variables related to weight-related self-stigma in physical activity among young adults across weight status." International Journal of Environmental Research and Public Health, 17(1), p.6. https://doi.org/10.3390/ijerph17010064

3.3.1. *Model Fit of the Physical Activity Model*

The proposed physical activity model (Figure 2) demonstrated excellent model fit, as evidenced by the non-significant chi-square statistic (χ^2 = 2.68 [4], p = 0.613), a CFI of 1.000, a TLI of 1.022, a SRMR of 0.015, and a RMSEA of 0.000. Although the CFI = 1 and RMSEA = 0, it happens when the degree of freedom is greater than the value of χ^2 according to their equations (Kenny & McCoach, 2003). Furthermore, as the model had a non-zero χ^2 and SRMR, the model is not a perfect fit.

The path coefficient significance differed between the non-overweight and overweight groups. For the non-overweight group, attitude, subjective norm, perceived behavioral control, and WRSS were significantly associated with behavioral intention, while only perceived behavioral control was significantly associated with actual physical activity. Attitude, subjective norm, perceived behavioral control, and WRSS collectively accounted for 59.2% of the variance in behavioral intention, and WRSS, perceived behavioral control, and behavioral intention together explained 13.9% of the variance in physical activity. In the overweight group, only subjective norm and perceived behavioral control were significantly associated with behavioral intention, and WRSS was negatively associated with physical activity, while behavioral intention was positively associated with physical activity. Additionally, WRSS was negatively associated with PBC. Attitude, subjective norm, perceived behavioral control, and WRSS accounted for 46.3% of the variance in behavioral intention. Furthermore, 14.1% of the variance in physical activity was explained by WRSS, perceived behavioral control, and behavioral intention. Additionally, WRSS explained 3.6% of the variance in perceived behavioral control.

3.3.2. χ^2 Difference Test

The χ^2 difference test indicated a significant discrepancy between the constrained and unconstrained physical activity models ($\Delta\chi^2 = 22.56$, $df = 8$; $p = 0.004$; Table 3). Further path invariance analyses were conducted by constraining one path at a time and comparing the results to the unconstrained model. These tests revealed that the relationships between perceived behavioral control and physical activity ($\Delta\chi^2 = 9.21$, $df = 1$; $p = 0.002$), between attitude and intention ($\Delta\chi^2 = 4.91$, $df = 1$; $p = 0.027$), and between WRSS and perceived behavioral control ($\Delta\chi^2 = 5.57$, $df = 1$; $p = 0.018$) were significantly different across the overweight and non-overweight groups (Table 3).

Table 3

Path Invariance of Physical Activity Model Across Weight Groups (Non-overweight vs. Overweight)

Model	χ^2	*df*	$\Delta\chi^2$	Δdf	*p*
Unconstrained model	2.68	4	--	--	--
All path coefficients constrained	25.23	12	22.56	8	0.004
Path coefficient constrained: Att → Int	7.59	5	4.91	1	0.027
Path coefficient constrained: SN → Int	4.46	5	1.78	1	0.182
Path coefficient constrained: PBC → Int	3.22	5	0.54	1	0.464
Path coefficient constrained: PBC → PA	11.89	5	9.21	1	0.002
Path coefficient constrained: Int → PA	5.98	5	3.30	1	0.069
Path coefficient constrained: WRSS → PBC	8.25	5	5.57	1	0.018
Path coefficient constrained: WRSS → Int	2.69	5	0.01	1	0.930
Path coefficient constrained: WRSS → PA	6.18	5	3.50	1	0.061

Note. Att = attitude; Int = intention; SN = subjective norm; PBC = perceived behavioral control; PA = physical activity; WRSS = weight-related self-stigma.

Unconstrained model is that path coefficients are freely estimated across weight groups.

Constrained path coefficient is that it constrained to be equal across weight groups.

3.4. Discussion

To achieve Objective 1 of this thesis, the study presented in this chapter investigated physical activity, a weight management behavior, by incorporating the TPB and WRSS into a model (Figure 2). The proposed physical activity model exhibited excellent model fit. However, the relationships within the model differed between the overweight and non-overweight groups, and the path coefficients were not invariant across the groups. Specifically, the associations of perceived behavioral control with physical activity, attitude with behavioral intention, and WRSS with perceived behavioral control were significantly different between the two weight status groups.

In the physical activity model, attitude was significantly associated with behavioral intention for the overweight group but not for the non-overweight group. Additionally, PBC was significantly associated with physical activity engagement for the non-overweight group, but not for the overweight group. These findings suggest that attitude and PBC may not be the key determinants of behavioral intention and physical activity participation for individuals with overweight status in the current sample. A potential explanation could be the perceived barriers faced by those who were overweight. Previous research has indicated that overweight individuals tend to be more concerned about body image and experience greater social anxiety, which can lead to unwillingness to engage in physical activity (Fernández et al., 2017). Similarly, prior studies have found that as individuals who are overweight face more criticism regarding physical activity due to their weight status, they report lower enjoyment and demonstrate avoidance of physical activity (Faith et al., 2002).

Regarding the relationship between perceived behavioral control and intention to engage in physical activity, external factors such as peer victimization may serve as barriers (Gray et al., 2008). Individuals with overweight or obesity status may perceive fewer opportunities and less support, and may feel unwelcomed by others, which could negatively impact their intention to be physically active (Gray et al., 2008). Prior research suggested that individuals who are overweight reported more barriers related to perceived physical activity competence compared to those of non-overweight (Deforche et al., 2006). Additionally, studies have found that adults who are overweight often lack confidence in their ability to perform physical activity (Rech et al., 2016). Consequently, social environmental factors may interfere with the associations between attitude, perceived behavioral control, and physical activity intention.

Moreover, the results of the current study also indicated that WRSS was significantly associated with perceived behavioral control, behavioral intention, and physical activity engagement. This aligns with prior research demonstrating a negative relationship between life stressors and perceived behavioral control (Louis et al., 2009). In the context of this study, WRSS can be viewed as a form of life stress; individuals experiencing self-stigma, particularly those who have faced self-devaluation from societal labels, may feel a diminished sense of competence and power (Durso & Latner, 2008; Tomiyama et al., 2018). These factors help explain the negative association between WRSS and perceived behavioral control, but only among the group of overweight. Additionally, WRSS was negatively associated with physical activity, potentially due to reduced self-esteem and self-efficacy (Corrigan et al., 2009). Those who internalize weight-related stigma may have lower motivation for weight management behaviors, a phenomenon known as the "why try" effect, which can undermine their initial behavioral intentions (Corrigan et al., 2009).

This study had several limitations. Firstly, the cross-sectional design limited the ability to establish causal relationships, highlighting the need for future longitudinal studies to validate the findings across the model. Secondly, the exclusive use of self-reported data may have led to social desirability bias, potentially affecting the accuracy of the results. Thirdly, the homogeneity of the sample, which included only university students, compromised the generalizability of the findings. Finally, the focus on young adults in this study may restrict the applicability of the results, as previous research indicates that older adults might have different perceptions of the controllability of stigmatized conditions and experience lower levels of stigma compared to younger individuals (Emlet et al., 2015; Krendl & Wolford, 2013).

This study explored the expanded TPB model for PA. The model was enriched by highlighting the important impact of WRSS, giving better insights into one of the weight management behaviors: PA. The next chapter investigated another weight management behavior: eating behaviors.

Chapter 4 Weight Stigma and Eating Behaviors in Young Adults Across Weight Status

The study was an extension of Chapter 3 to examine another weight management behavior, eating behaviors, in related to WRSS (i.e., Objective 2). It aimed to investigate whether adding weight-related self-stigma (WRSS) to the Theory of Planned Behavior (TPB) model of eating behaviors could explain the avoidance of maladaptive eating behaviors by young adults in Hong Kong. The findings of this study were published in the American Journal of Health Behavior (https://doi.org/10.5993/AJHB.48.3.6).

As mentioned in the beginning, eating is also critical for weight management (World Health Organization, 2020a). Callahan (2013a, 2013b) asserted weight stigma motivates people to maintain a healthy weight. Although the weight stigma was strong among weight loss treatment-seeking individuals, the weight stigma was associated with binge eating (Carels et al., 2010). Also, weight stigma was associated with increased calorie intake (Araiza & Wellman, 2017; Meadows & Higgs, 2019). It appears that weight stigma plays a negative role in terms of behavioral outcomes. Yet, the literature still knows little about the effect of weight stigma on avoiding eating behaviors that are maladaptive. From the results of Chapter 3, WRSS was associated with intention towards physical activity. Thus, an association between WRSS and the intention to avoid eating behaviors might possibly exist as well. The incorporation of WRSS in the TPB could provide additional knowledge on how weight stigma affects eating behaviors.

4.1. Background

4.1.1. *Eating Behaviors*

Eating behaviors are crucial components of effective weight management (World Health Organization, 2020a). Research has identified several eating behaviors that are deemed unfavorable or maladaptive, including emotional eating, uncontrolled eating, and cognitive dietary restraint (Bryant et al., 2019; Kamolthip et al., 2022). The tendency to consume food in response to emotional distress rather than physiological hunger is referred to as emotional eating. People with a stronger tendency toward emotional eating consumed more sweet energy-dense foods. This tendency was also associated with more non-sweet and energy-dense food consumption. However, it was not associated with vegetable or fruit intake (Konttinen et al., 2010). Uncontrolled eating is characterized by a diminished capacity to cease or regulate food intake. For example, people with a stronger tendency to uncontrolled eating were associated with increased food intake, including energy-dense foods (de Lauzon et al., 2004). Cognitive restraint involves the conscious restriction of food consumption. For instance, a study has shown that female participants possessing a higher cognitive restraint score reported a decreased energy intake compared to those with a lower cognitive restraint score (de Lauzon et al., 2004). Although cognitive restraint may not inherently be detrimental, an excessive or inflexible form of it can contribute to cycles of dietary restriction and subsequent overeating (de Lauzon et al., 2004). These patterns are linked to weight increases and diminished weight loss effort (Bryant et al., 2019; Kamolthip et al., 2022). Eating behaviors and its related problems have been highlighted as a growing concern in the Asian region (Ahorsu et al., 2020; I.-H. Chen et al., 2022; Huang et al., 2022; Kamolthip et al., 2022; C.-Y. Lin et al., 2021; Saffari et al., 2022). Specifically, studies have found that eating behaviors represent an issue among young adults in Hong Kong (Cheng et al., 2018; Sheffield et al., 2005). For instance, prior research has reported a 14.8% and 4.5% prevalence of emotional eating behaviors among female and male university students in Hong Kong respectively (Sze et al., 2021). It is necessary to further investigate the psychosocial mechanisms underlying eating behaviors.

4.1.2. *The TPB and Eating Behaviors*

The TPB has been widely applied to investigate various eating behaviors. For instance, researchers have used TPB to examine factors influencing dietary choices, such as fruit and vegetable consumption and adherence to low-fat diets (Guillaumie et al., 2010), avoidance of sugary snacks and beverages (Masalu & Åstrøm, 2001), and reduced intake of foods with additives (M.-F. Chen, 2017). Moreover, TPB has been employed to understand the intention to binge eat among female university students as well as motivation for recovery in anorexia nervosa (Dawson et al., 2015; Kane et al., 2015). These examples demonstrate the versatility of TPB in elucidating the psychosocial processes underlying diverse eating-related behaviors.

The majority of existing TPB research on eating behaviors has been conducted in Western countries, with a focus on dieting or healthy eating practices such as fruit and vegetable consumption (Guillaumie et al., 2010). These studies have primarily examined specific food choices, whereas eating behaviors, such as emotional eating and uncontrolled eating, extend beyond just food selection. Eating behaviors also encompass the quantity and frequency of food intake. The TPB framework could offer a valuable analytical approach for investigating factors influencing eating behaviors in East Asian contexts. This study thus applied the TPB model to specifically understand the underlying intentions behind the avoidance of these inappropriate eating behaviors among young adults in Hong Kong.

Existing research has largely focused on understanding and supporting individuals with eating behavior issues (Neumark-Sztainer et al., 2006). However, there is less investigation into the factors that influence people's attitudes, perceived behavioral control, subjective norms, and intentions to avoid such behaviors. Previous studies have applied the TPB to assess motivations for weight gain in anorexia nervosa and intentions to reduce binge eating among those with gastric banding surgery (Dawson et al., 2015; Wood & Ogden, 2014). Yet, few studies have examined the use of TPB in understanding the avoidance of inappropriate eating behaviors (i.e., to avoid performing eating behaviors, including cognitive restraint, emotional eating, and uncontrolled eating). Additionally, the relationship between cognitive restraint and outcomes is mixed, as it may facilitate weight regulation or contribute to increased food cravings and further weight gain (Bryant et al., 2019). Therefore, further investigation is warranted to determine whether TPB can provide additional insights into the factors influencing the avoidance of eating behaviors.

4.1.3. *The TPB and WRSS in Understanding Eating Behaviors*

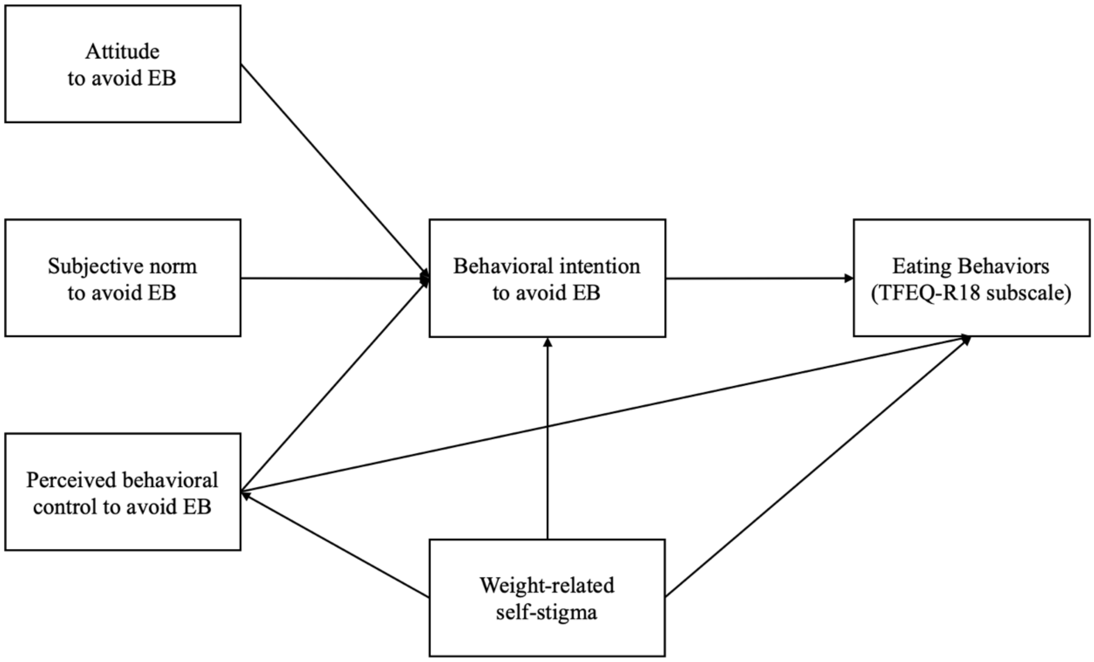
In addition to the factors proposed by the TPB, WRSS may also influence eating behaviors. Individuals who are overweight or obese often face a heightened risk of stigmatization from others due to their body weight (Puhl & Heuer, 2009). These individuals may develop WRSS, which involves the internalization of weight-related beliefs associated with self-devaluation. This internalization process is not merely a product of direct life experiences but can also emerge under the influence of cultural values and stigmatizing media content (Durso & Latner, 2008). Several studies have linked WRSS to poor health outcomes (Alimoradi et al., 2020; Huang et al., 2022; Kamolthip et al., 2021; Liu et al., 2022). Regarding its influence on eating behaviors, it has been found that WRSS was associated with emotional and uncontrolled eating (O'Brien et al., 2016). Furthermore, individuals who experienced higher levels of weight stigma were likely to engage in inappropriate eating behaviors, regardless of their weight. This indicates that stigma can affect both those who are overweight and those who are not (C.-Y. Lin et al., 2020). According to Major et al. (2012), concerns about weight stigma can increase stress and impair self-control in stigmatized individuals. Furthermore, those with WRSS tend to have a lower self-concept, suggesting it may be a risk factor for perceived behavioral control. For instance, a study (i.e., the finding from Chapter 3) found that WRSS was negatively associated with perceived behavioral control and the level of physical activity (Fung et al., 2020). Similarly, WRSS may also impact perceived behavioral control and intentions related to avoidance of eating behaviors. Moreover, individuals with self-stigma may be more prone to engage in uncontrolled eating, emotional eating, and cognitive restraint, potentially leading to further weight gain (Cheng et al., 2018; Tomiyama, 2014).

It has been suggested that the TPB should be expanded to encompass potentially related variables in specific scenarios (Ajzen, 2015; Conner & Armitage, 1998). This study sought to extend the TPB by incorporating WRSS as a potentially influential factor in eating behaviors. The rationale was that WRSS could interact with perceived behavioral control and behavioral intention, thereby impacting eating behaviors. This extended TPB model was proposed as potentially useful for healthcare providers in developing appropriate weight management interventions. The proposed conceptual model is shown in Figure 3. The primary objective of this research was to examine whether the extended TPB, which integrates WRSS with the traditional TPB constructs, could explain the avoidance of various eating behaviors among young adults in Hong Kong. Specifically, the researcher utilized three models to examine three types of eating behaviors: uncontrolled eating, emotional eating, and cognitive restraints (Kamolthip et al., 2022). Additionally, the researcher would also explore whether the extended TPB model could be used for two groups of participants, those who are overweight and those who are not.

This study hypothesized that (1) attitude, subjective norm, perceived behavioral control, and WRSS would be associated with the intention to avoid eating behaviors; (2) that perceived behavioral control and intention to avoid eating behaviors would be negatively associated with eating behaviors; (3) that WRSS would be negatively associated with perceived behavioral control and positively associated with eating behaviors; and (4) that there would be significant differences in the hypothesized relationships between participants of different weight statuses (i.e., overweight and non-overweight).

Figure 3

The Conceptual Model of the Theory of Planned Bahavior Model Incorporated Weight-Related Self-Stigma on Eating Behaviors Avoidance



Note. EB= Eating Behaviors. EB refers to the three types of eating behaviors assessed by the Three-Factor Eating Questionnaire-Revised 18-item version (TFEQ-R18): cognitive restraint, uncontrolled eating, and emotional eating. Higher scores on each subscale reflect greater levels of the respective eating behaviors. From "Weight stigma and eating behaviors in young adults across weight status." American Journal of Health Behavior, 48(3), p.630 (https://doi.org/10.5993/AJHB.48.3.6).

4.2. Methods

4.2.1. *Participants and Procedures*

Prior to commencing the data collection process, ethical approval was obtained from the university's Ethics Review Board (HSEARS20201120002). Participants were recruited to complete the questionnaires by scanning a QR code that directed them to the university's online survey platform. Before accessing the questionnaire, they were required to provide electronic informed consent by clicking the "Agree" icon, indicating their willingness to participate in the study after being informed about the study details and their rights as participants. Those who selected "Agree" were then directed to the questionnaire.

The inclusion criteria were: age between 18 and 30 years; proficiency in traditional Chinese; and a willingness to participate. Exclusion criteria consisted of self-reported neurological conditions, such as stroke, functional disabilities, including blindness, or any form of psychosis or intellectual disability that would prevent them from completing the online survey. Recruitment was carried out through the distribution of flyers and posters on the Hong Kong Polytechnic University campus between March and June 2021, resulting in a sample size of 348 young adults.

4.2.2. *Measures*

4.2.2.1. Background Information

Participant data on self-reported gender, age, height, and weight was collected. Participants were then categorized as either "non-overweight" or "overweight" based on their body mass index. The classification followed the Asian BMI cutoff specified by the World Health Organization, with a BMI below 23 kg/m^2 considered non-overweight and a BMI of 23 kg/m^2 or above considered as overweight. Additionally, a single yes-no question was included to assess whether the participants perceived their eating behaviors as being affected by the COVID-19 pandemic.

4.2.2.2. Eating Behaviors

The Three-Factor Eating Questionnaire-R18 (TFEQ-R18) assesses eating behaviors across three distinct dimensions: cognitive restraint, uncontrolled eating, and emotional eating. Six items on cognitive restraint evaluate the extent to which an individual consciously manages their weight by restricting food intake. Nine items on uncontrolled eating measure the degree to which an individual tends to consume more than usual, due to a loss of control over intake accompanied by subjective feelings of hunger. Three items on emotional eating examine whether a person eats in response to their inability to resist emotional cues. All items were scored on a 4-point Likert scale. Each subscale score was then converted to a scale ranging from 0 to 100. While there are no cutoff values for diagnostic purposes, higher scores indicate a stronger tendency towards the corresponding aspects of eating behaviors (de Lauzon et al., 2004). The TFEQ-R18 has demonstrated good internal consistency, ranging from 0.83-0.87 Cronbach's alpha (de Lauzon et al., 2004). The Chinese version of the TFEQ-R18 used in the current study has been applied to Asian populations in Hong Kong (Cheng et al., 2018). The internal reliability coefficients were 0.80 for cognitive restraint, 0.84 for uncontrolled eating, and 0.82 for emotional eating in the current study.

4.2.2.3. Weight-Related Self-Stigma

The Weight Bias Internalization Scale (WBIS) was used to evaluate participants' WRSS (Durso & Latner, 2008). This measure was subsequently adapted to be suitable for individuals across various weight statuses, including non-overweight and overweight populations (Pearl & Puhl, 2014). This 11-item measure employed a 5-point rating scale, where higher scores reflected greater internalization of weight-related stigma. Additionally, the Chinese version of the WBIS, which tailored its item descriptions to accommodate different weight statuses, has exhibited satisfactory psychometric properties among both overweight and non-overweight individuals. (Pakpour et al., 2019). In the current study, the internal consistency (Cronbach's α) of the WBIS was 0.91.

4.2.2.4. TPB Measures

Based on the guidance provided for constructing the TPB questionnaire (Fishbein & Ajzen, 2011), the researcher constructed a measure to assess the TPB factors to avoid eating behaviors, including attitudes, subjective norms, perceived behavioral control, and behavioral intentions. A pilot study was conducted with 15 male and 5 female participants to evaluate their understanding and responses to the questionnaire (N=20, mean age of 25.15 years (*SD* = 3.13). Feedback from the pilot sample indicated a consistent comprehension of what constitutes inappropriate eating behaviors, such as consuming unusually large quantities of food, eating in response to emotional cues, or intentionally restricting food intake, all of which can have detrimental health implications. Additionally, the researcher positioned the TFEQ-R18 prior to the TPB scale. This allowed participants to contextualize their responses to the attitude, perceived behavioral control, subjective norms, and intention items in relation to the eating behaviors described in the TFEQ-R18. This approach was confirmed to be effective based on feedback from the pilot study participants.

For the assessment of attitudes toward avoiding inappropriate eating behaviors, a scale with eight 7-point semantic differential items was employed (Cheng et al., 2018; Fishbein & Ajzen, 2011). The items utilized pairs of bipolar adjectives (e.g., good-bad, wise-foolish, correct-incorrect) with the stem "For me to avoid inappropriate eating behaviors is..." A higher score on this scale indicated a more favorable attitude. The internal consistency of the attitude measure was 0.92 in this study.

To evaluate subjective norms regarding the avoidance of inappropriate eating behaviors, three 7-point items were used (Cheng et al., 2018; Fishbein & Ajzen, 2011). A sample item was: "People who are important to me would think that I should avoid inappropriate eating behaviors every day". Higher scores on this scale suggested greater perceived social norms to avoid such behaviors. The internal consistency was 0.72 for the subjective norm measure in the current study.

Four 7-point items were employed to evaluate participants' perceived behavioral control toward avoiding inappropriate eating behaviors (Cheng et al., 2018; Fishbein & Ajzen, 2011). An example item was: "How much personal control do you feel you have over whether you avoid inappropriate eating behaviors in the next week?". Higher scores denoted greater levels of perceived behavioral control. The internal consistency of the perceived behavioral control measure was 0.86 in the current study.

Three 7-point items were used to assess the behavioral intention to avoid inappropriate eating behaviors (Cheng et al., 2018; Fishbein & Ajzen, 2011). For instance, one item stated: "I plan to from now on avoid inappropriate eating behaviors". Higher scores indicated stronger behavioral intention. The internal consistency of the intention measure was 0.95 in the current study.

4.2.3. *Data Analysis*

Pearson's correlation was used to investigate the associations among TPB factors, WRSS, and the three components of eating behaviors. Structural equation modeling, incorporating a multiple-group analysis, was conducted to evaluate the fit of the three proposed models and assess the path invariance across participants categorized as overweight and those who were not overweight. Furthermore, the models controlled for the potential influences of age, gender, and participants' perceptions of COVID-19's impact on their eating habits.

Structural equation modeling (SEM) was used, with all the factors entered as observed variables. For the behavioral components in the Theory of Planned Behavior, the researcher examined uncontrolled eating, emotional eating, and cognitive restraints separately, thereby testing three separate models (Figures 4 to 6). The maximum likelihood estimation was applied. The fitness of the proposed models was evaluated using several fit indices, including the comparative fit index (CFI), root mean square error of approximation (RMSEA), and standardized root mean square residual (SRMR). Additionally, the χ^2 test was employed to determine the overall fit of the models. Models that demonstrated a non-significant chi-square statistic, a CFI greater than 0.9, and RMSEA and SRMR values less than 0.08 were considered acceptable, indicating that the proposed models were supported by the data. After verified the fitness of the three models was supported, the researcher performed the χ^2 difference test to examine path invariance across the two groups. A non-significant χ^2 difference test result indicated that the path coefficients were invariant across the two groups. Initially, the researcher constrained all path coefficients to be equal between the two groups, and then evaluated whether the model with these constrained paths differed significantly from the unconstrained model. If the two models did not exhibit a significant difference, it would support the invariance of the paths across all the model parameters. Conversely, if a significant difference was found, the researcher would have proceeded to assess the invariance of each path coefficient.

All the analyses were conducted using SPSS 28.0 software (IBM Corp., Armonk, NY, USA), except for the SEM analyses, which were performed using the R software (R Foundation for Statistical Computing, Vienna, Austria) with the latent variable analysis (lavaan) package (Rosseel, 2012).

4.3. Results

The demographic data and instrument scores were presented in Table 4. The participants had a mean age of 22.97 years (*SD* = 3.37) and a mean BMI of 21.24 (*SD* = 3.64), with a predominance of female participants (63.5%). The mean score for emotional eating was 42.40 (*SD* = 25.0); for uncontrolled eating, it was 37.37 (*SD* = 17.9); and for cognitive restraint, it was 43.69 (*SD* = 19.2). Furthermore, a significant difference was found in cognitive restraint, $t(137.28) = -2.90$, $p = 0.004$, which showed that participants classified as overweight (*M* =

48.83, *SD* = 16.83) had a stronger tendency than those who were non-overweight (*M* = 42.26, *SD* = 19.62). A significant difference was also found in emotional eating, t(346) = −2.61, p = 0.009, with higher scores among participants who were overweight (*M* = 48.98, *SD* = 25.15) in comparison to those who were non-overweight (*M* = 40.56, *SD* = 24.72). No significant difference was found in uncontrolled eating between the two groups, t(346) = −1.89, p = 0.059.

The correlation matrix in Table 5 showed that WRSS was significantly associated with all TPB factors, except for behavioral intention, and that the TPB factors were significantly correlated with each other. Additionally, WRSS was significantly correlated with cognitive restraint, uncontrolled eating, and emotional eating. The subsequent paragraphs present the results of the SEMs.

Table 4

Demographic Information Among Participants

Variables	Participants (*N* = 348)
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)
Eating Behaviors	
Cognitive restraint, *M* (*SD*)	43.69 (19.2)
Uncontrolled eating, *M* (*SD*)	37.37 (17.9)
Emotional eating, *M* (*SD*)	42.40 (25.0)
Weight-related self-stigma, *M* (*SD*)	27.16 (8.48)
TPB factors toward avoiding eating behaviors	
Attitude, *M* (*SD*)	5.41 (1.27)
Subjective norm, *M* (*SD*)	4.45 (1.34)
Perceived behavioral control, *M* (*SD*)	5.17 (1.21)
Behavioral intention, M (*SD*)	4.74 (1.50)
Perceived impact of COVID-19 on eating	
Yes, *n* (%)	191 (54.9)
No, *n* (%)	157 (45.1)

Note. TPB = Theory of Planned Behavior. From "Weight stigma and eating behaviors in young adults across weight status." American Journal of Health Behavior, 48(3), p.633 (https://doi.org/10.5993/AJHB.48.3.6).

Table 5

Correlation Matrix Among Weight-Related Self-Stigma and the Theory of Planned Behavior Factors on Eating Behaviors

	r						
Variables	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							--

Note. EB = eating behaviors. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$. From "Weight stigma and eating behaviors in young adults across weight status." American Journal of Health Behavior, 48(3), p.633 (https://doi.org/10.5993/AJHB.48.3.6).

4.3.1. ***Model Fit of the Three Eating Behavior Models***

The cognitive restraint model (Figure 4) demonstrated excellent model fit, as evidenced by the following indices: CFI = 0.97, SRMR = 0.043, and RMSEA = 0.066. However, the association between perceived behavioral control and cognitive restraint was not significant across both study groups. Furthermore, in the overweight group, neither behavioral intention nor WRSS was linked to cognitive restraint. This suggests that the relationship between cognitive restraint, perceived control, and stigma-related factors may not be as robust or direct as in other conceptual models.

The uncontrolled eating model (Figure 5) had an excellent model fit with a nonsignificant chi-square (χ^2 [*df*] = 27.53 [20]; $p = 0.121$), a CFI of 0.98, an SRMR of 0.040, and an RMSEA of 0.047. For the non-overweight group, perceived behavioral control and WRSS were both significantly associated with behavioral intention and uncontrolled eating, while WRSS was negatively associated with perceived behavioral control. Conversely, for the overweight group, only subjective norm and perceived behavioral control were significantly associated with behavioral intention; WRSS was negatively related to perceived behavioral control; and perceived behavioral control was significantly associated with uncontrolled eating. This model highlights the distinct dynamics underlying uncontrolled eating behaviors between individuals who are overweight and those who are non-overweight, emphasizing the roles of WRSS and perceived control in these processes.

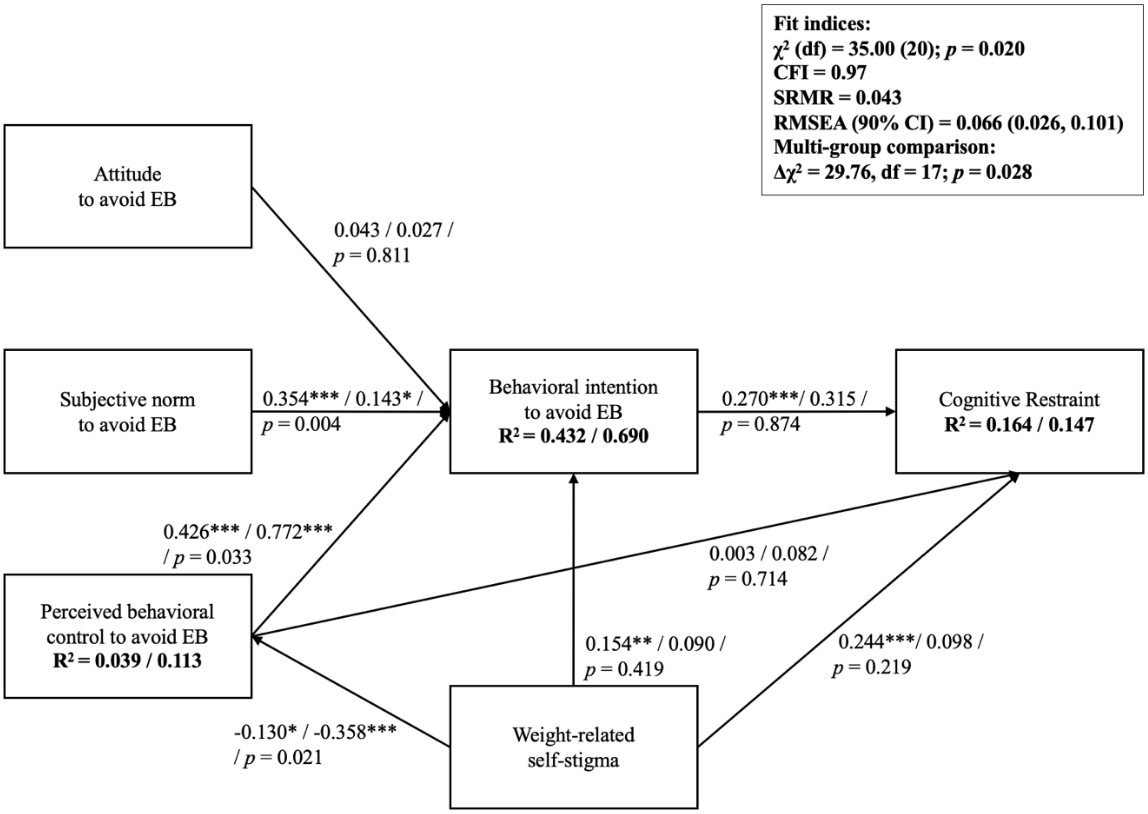
The emotional eating model (Figure 6) demonstrated excellent fit indices: CFI = 0.97, SRMR = 0.043, and RMSEA = 0.064. For the non-overweight group, subjective norm, perceived behavioral control, and WRSS were significantly associated with behavioral intention; perceived behavioral control and WRSS were significantly associated with emotional eating behaviors. Among the overweight group, only subjective norm and perceived behavioral control were significantly associated with behavioral intention; behavioral intention and perceived behavioral control were significantly associated with emotional eating. Furthermore, WRSS was negatively associated with perceived behavioral control. The model indicates that, although comparable factors contribute to emotional eating across weight groups, their specific interactions and effects vary, highlighting the complex nature underlying emotional eating behaviors.

4.3.2. χ^2 *Difference Test*

The χ^2 difference test results indicated significant differences between the constrained and unconstrained models for cognitive restraint ($\Delta\chi^2 = 29.76$, $df = 17$; $p = 0.028$), uncontrolled eating ($\Delta\chi^2 = 29.29$, $df = 17$; $p = 0.032$), and emotional eating ($\Delta\chi^2 = 29.76$, $df = 17$; $p = 0.028$). Additional path invariance analyses, each constraining a single path and comparing it to the unconstrained model, revealed that the relationships between perceived behavioral control and intention ($\Delta\chi^2 = 4.52$, $df = 1$; $p = 0.033$), subjective norm and intention ($\Delta\chi^2 = 8.47$, $df = 1$; $p = 0.004$), and WRSS and perceived behavioral control ($\Delta\chi^2 = 5.33$, $df = 1$; $p = 0.021$) differed significantly across weight groups. Specifically, the associations of perceived behavioral control with intention, as well as WRSS with perceived behavioral control, were notably stronger for the overweight group. Conversely, the relationship between subjective norms and intention was significantly stronger in the non-overweight group. See Figures 4 to 6 for details.

Figure 4

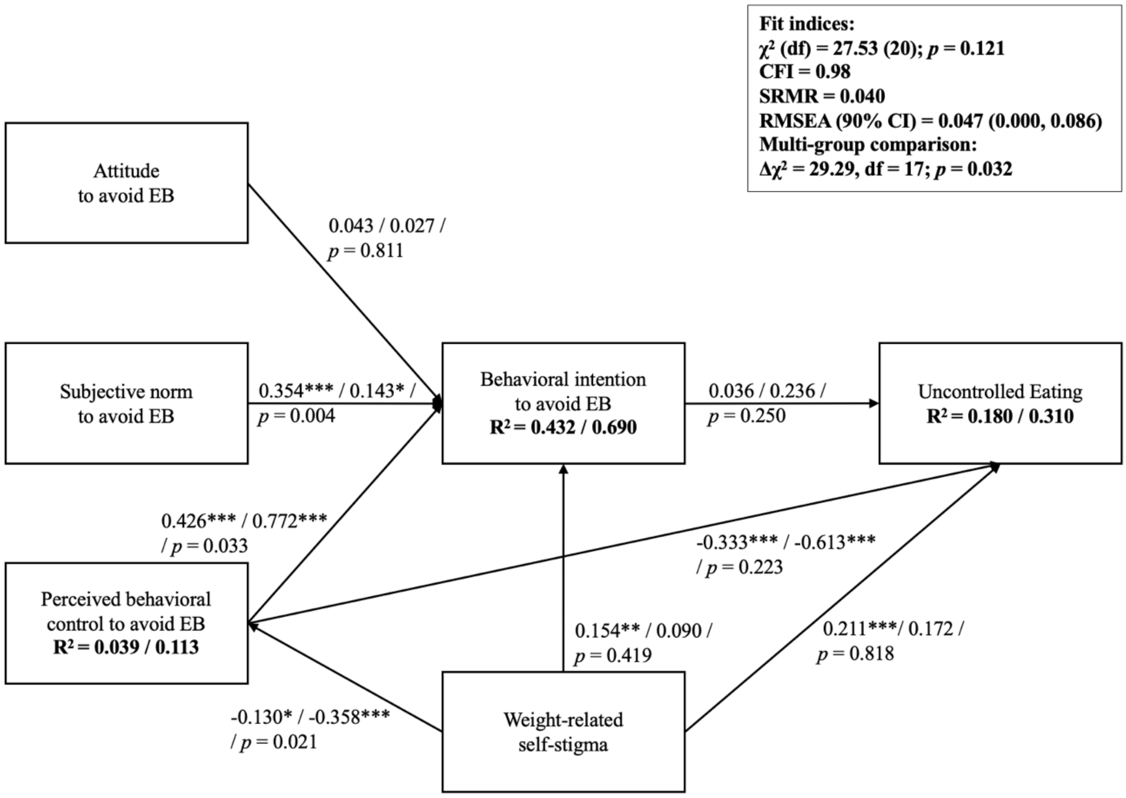
Multiple Group Analysis of the TPB Model Incorporated with WRSS on Cognitive Restraint



Note. TPB = Theory of Planned Behavior; WRSS = weight-related self-stigma; CFI = comparative fit index; SRMR = root mean square residual; RMSEA = root mean square error of approximation. The path coefficients for the non-overweight participants are shown before the slash, while those for the overweight participants are displayed after the slash. Additionally, the R-squared values for both groups are provided. The p-value beneath each set of path coefficients indicates the statistical significance of the differences between the two groups' path coefficients. * $p < 0.05$. ** $p < 0.01$. *** $p < 0.001$. From "Weight stigma and eating behaviors in young adults across weight status." American Journal of Health Behavior, 48(3), p.634 (https://doi.org/10.5993/AJHB.48.3.6).

Figure 5

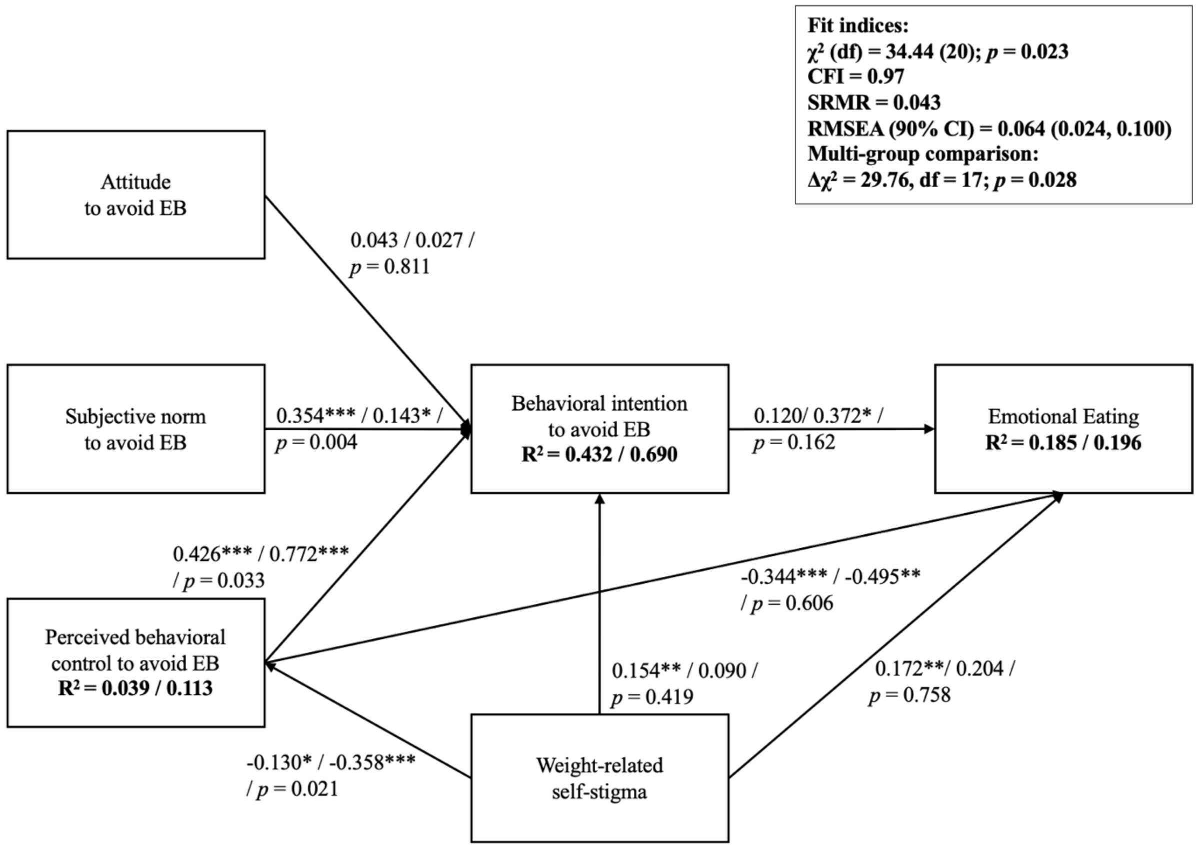
Multiple Group Analysis of the TPB Model Incorporated with WRSS on Uncontrolled Eating



Note. TPB = Theory of Planned Behavior; WRSS = weight-related self-stigma; CFI = comparative fit index; SRMR = root mean square residual; RMSEA = root mean square error of approximation. The path coefficients for the non-overweight participants are shown before the slash, while those for the overweight participants are displayed after the slash. Additionally, the R-squared values for both groups are provided. The p-value beneath each set of path coefficients indicates the statistical significance of the differences between the two groups' path coefficients. * $p < 0.05$. ** $p < 0.01$. *** $p < 0.001$. From "Weight stigma and eating behaviors in young adults across weight status." American Journal of Health Behavior, 48(3), p.634 (https://doi.org/10.5993/AJHB.48.3.6).

Figure 6

Multiple Group Analysis of the TPB Model Incorporated With WRSS on Emotional Eating



Note. TPB = Theory of Planned Behavior; WRSS = weight-related self-stigma; CFI = comparative fit index; SRMR = root mean square residual; RMSEA = root mean square error of approximation. The path coefficients for the non-overweight participants are shown before the slash, while those for the overweight participants are displayed after the slash. Additionally, the R-squared values for both groups are provided. The p-value beneath each set of path coefficients indicates the statistical significance of the differences between the two groups' path coefficients. * $p < 0.05$. ** $p < 0.01$. *** $p < 0.001$. From “Weight stigma and eating behaviors in young adults across weight status.” American Journal of Health Behavior, 48(3), p.635 (https://doi.org/10.5993/AJHB.48.3.6).

4.4. Discussion

To fulfill Objective 2 of this thesis, the TPB, combined with WRSS, was utilized to examine three types of eating behaviors: cognitive restraint, uncontrolled eating, and emotional eating. These models demonstrated an excellent fit. While the significance of the path coefficients varied among the models, the overall findings suggested that subjective norm, perceived behavioral control, and WRSS were positively associated with the intention to avoid eating behaviors. Furthermore, perceived behavioral control showed a negative association, whereas intention and WRSS showed positive associations with eating behaviors. Moreover, path invariance was not supported for certain path coefficients, such as the relationships between subjective norm and intention, perceived behavioral control and intention, and WRSS and perceived behavioral control. These findings imply that different models might be more applicable to different weight groups.

The study incorporated WRSS as an extension of the TPB model. This construct demonstrated significant associations with perceived behavioral control, behavioral intention, and eating behaviors. Notably, the relationship between perceived behavioral control and WRSS was significantly stronger for the overweight group compared to the non-overweight group. These findings align with my previous TPB-based study on physical activity (Chapter 3), which similarly found that WRSS was linked to perceived behavioral control within the overweight sample (Fung et al., 2020). The current study found that WRSS can lead to self-devaluation and diminish individuals' perceived behavioral control over eating behavior avoidance. Additionally, while weight-related stigma was linked to stronger intentions to avoid eating behaviors, it was also associated with eating behaviors increment at the time of data collection. This latter finding may be attributed to participants' recognition of their elevated eating behaviors and an attempt to address them. Existing research similarly suggests that weight stigma can contribute to inappropriate eating behaviors (Kamolthip et al., 2022; C.-Y.

Lin et al., 2020; O'Brien et al., 2016), and results of the current study further support this association.

The findings of this study suggest that while participants expressed an intention to regulate their eating behaviors, WRSS undermined their perceived ability to do so effectively. Prior research by Major et al. (2020) has similarly shown that weight stigma can heighten motivation to lose weight, yet simultaneously diminish perceived capability, leading to an increased likelihood of engaging in unhealthy weight-loss practices. That is, stigma may undermine self-control and perceived capability, making it challenging for individuals to restrain their eating impulses (Araiza & Wellman, 2017; Major et al., 2020). The findings suggest that weight stigma functions as a stressor, with experiences of weight-related stigma inducing psychological distress that may contribute to the adoption of emotional eating as a maladaptive coping strategy (Adam & Epel, 2007; Himmelstein et al., 2015, 2018). Additionally, the distress provoked by weight stigma appears to directly influence eating behaviors (Huang et al., 2022; O'Brien et al., 2016). Notably, the current study highlights the detrimental role of WRSS in inhibiting the perceived ability to avoid inappropriate eating behaviors. Researchers should be particularly attentive to the adverse impact of self-stigma on perceived behavioral control. Overall, this study provides valuable insights into eating behaviors and weight management, underscoring the need for healthcare practitioners to address both WRSS and perceived behavioral control, rather than solely focusing on modifying eating behaviors.

Contrary to the findings of several TPB studies (K. Chan et al., 2016; Dunn et al., 2011; Fan et al., 2021; Pickett et al., 2012), the SEM results in the present investigation revealed that attitude did not show a significant association with behavioral intention. Nevertheless, the correlation analysis indicated a positive relationship between them, which aligns with the fundamental premise of TPB. Similar patterns have been reported in previous research. For instance, studies on smoking cessation (H. Lee et al., 2006), healthy eating among university students (Plows et al., 2017), and weight loss programs have all found that attitude failed to predict intention (Gardner & Hausenblas, 2004). This suggests that the participants in the current study may not have been primarily motivated to avoid eating behaviors by their attitudes toward doing so. Instead, other factors, such as subjective norms and perceived behavioral control, appear to have played a more significant role in their intention.

Findings on the eating behaviors model from the current study aligned with previous research, demonstrating that subjective norm and perceived behavioral control were associated with behavioral intention (Lash et al., 2016; Leske et al., 2017; Nejad et al., 2004), and that higher levels of perceived behavioral control to avoid eating behaviors were negatively associated with the behaviors themselves. However, perceived behavioral control was not associated with cognitive restraint. One potential explanation is that cognitive restraint may necessitate additional knowledge or strategies beyond the participants' expectations. For instance, a study by Masterson et al. (2019) found that a high level of cognitive restraint was positively associated with health perception and faster decision-making compared to those with low cognitive restraint. Additionally, cognitive restraint could be counteracted by environmental distractions such as entertainment or social interaction (Bellisle & Dalix, 2001; Salvy et al., 2009).

Notably, the intention to avoid eating behaviors in this study did not translate to a reduction in eating behaviors. Specifically, the researcher did not observe a significant association between intention and uncontrolled eating (Figure 5); and surprisingly, the intention to avoid eating behaviors was found to be positively associated with increased engagement in eating behaviors (Figures 4 and 6). The discrepancy between intended and actual eating behaviors may be attributed to the "intention-behavior gap" phenomenon reported in prior research. Multiple studies have highlighted the existence of this gap in the context of eating behaviors (Monds et al., 2016; Mullan et al., 2014; Reichenberger et al., 2019). Research has indicated a lack of significant association between one's intentions and their actual food consumption frequency (Lash et al., 2016). Reichenberger et al. (2019) proposed that the discrepancy between intention and behavior may be attributed to individuals' tendency to overestimate their own capabilities due to optimistic thoughts. Additionally, they noted that people often underestimate the daily obstacles they face, and identified factors such as stress, emotions, and personal traits like disinhibition as potential barriers that can exacerbate this intention-behavior gap (Reichenberger et al., 2019). Accordingly, further examination of any underlying factors could provide valuable insights into this intention-behavior discrepancy. On the other hand, research has indicated that fluctuations in one's intention over time may be associated with subsequent engagement in unhealthy snacking (Inauen et al., 2016). Therefore, the variability in the strength of intentions over time may represent an additional factor contributing to the well-documented discrepancy between intentions and actual behaviors. Moreover, these issues may be associated with WRSS, as individuals experiencing self-stigma have demonstrated diminished self-control (Araiza & Wellman, 2017). The detrimental impact of WRSS has been explored in more detail in the previous paragraph.

This study has several limitations. First, the cross-sectional design prevents the determination of causal relationships. Longitudinal investigations would be needed to confirm the temporal association of the proposed models. Second, the convenience sampling of young adults from university may limit the representativeness and generalizability of the findings. Future research should explore more diverse populations and cultural contexts. Third, the sole reliance on self-reported data raises the possibility of social desirability bias, which could compromise the accuracy of the results.

Two cross-sectional studies presented in the preceding and this chapter have indicated the influence of WRSS on PBC. In Chapter 5, a longitudinal study was undertaken to assess their temporal relationships. Additionally, the relationships between PWS, WRSS, psychological distress, the two weight management behaviors, and BMI were also assessed.

Chapter 5 The Longitudinal Relationship Between Weight Stigma, Psychological Distress, and Weight Management Behaviors

5.1. Background

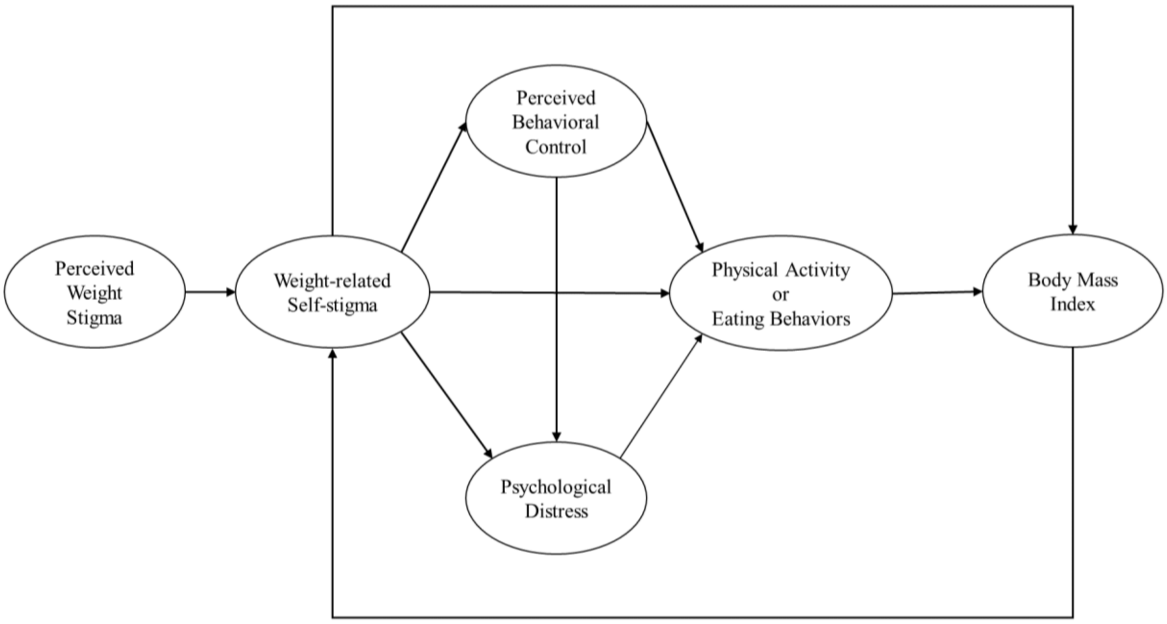
As shown in Chapters 3 and 4, the researcher conducted two cross-sectional studies to understand part of the relationships in my proposed model (Figure 1), that is, the relationship between weight stigma and weight management behaviors, and the researcher further identified an important variable, perceived behavioral control, interplay with the stigma and behaviors. The results from the studies above shed some light on the relationships (1) WRSS associated with perceived control, behavioral intention, and actual behavior on physical activity, and (2) WRSS associated with perceived control and behavioral intention on eating behaviors. In this Chapter, in order to achieve objectives 3 and 4, a longitudinal study was presented with a revised proposed model for this thesis based on the two completed studies and existing literature.

The findings in the previous two studies suggested that weight stigma might diminish perceived behavioral control on weight management behaviors. In addition, perceived weight stigma is another important variable that could be added to my model to have a better understanding of the whole process, from stigma formation to health-related behaviors. The perceived weight stigma refers to the experiences and perception of discrimination due to weight. Most importantly, it is considered a source of self-stigma (Tomiyama, 2019). The stage model of self-stigma on mental illness proposed by Corrigan and Rao (2012) could be applied to understand weight stigma. There are four stages included in their model, which are awareness, agreement, application, and harm. Awareness refers to people being aware of the negative beliefs, stereotypes, or stigmas that exist in public. Then, people may start to consider those thoughts as correct and apply them to themselves, which is the stage of agreement and application. After that, the application to themselves could harm them by reducing self-esteem or self-efficacy. As a result of these stages, a “why try effect” could be elicited from the formation of self-stigma (Corrigan & Rao, 2012). Namely, this harm from self-stigma might become a barrier to people's performance. Therefore, this study adopted this stage model to understand the weight stigma process. Specifically, the model includes perceived weight stigma to represent awareness, weight-related self-stigma as agreement and application, and perceived behavioral control to represent harm. Building upon this model, the researcher incorporated it with the model that was originally proposed in the literature review (Chapter 2), i.e., adding psychological distress, weight management behaviors (physical activity and eating behaviors), and BMI (Figure 7). The current study employed different analyses for this conceptual model to model the process from stigma formation to BMI change and the potential bidirectional relationship between weight-related self-stigma and BMI. Specifically, the parallel-process latent growth curve model (PP-LGCM) was used to investigate the process from stigma formation to BMI change, focusing on the growth trajectories and how these trajectories interact over time; a random intercept cross-lagged panel model (RI-CLPM) was used to examine how changes in WRSS and BMI within an individual can predict changes in each other across different time points.

In this study, a one-year longitudinal study was conducted. It is hypothesized that perceived stigma is associated with self-stigma; self-stigma is associated with perceived behavioral control, psychological distress, and physical activity/eating behaviors; perceived behavioral control is associated with psychological distress and physical activity/eating behaviors; psychological distress is associated with physical activity/eating behaviors; WRSS and physical activity/eating behaviors are associated with the BMI. Further, it is hypothesized that WRSS and BMI are associated with each other at subsequent time points.

Figure 7

The Expanded Conceptual Model of Weight Stigma Process



5.2. Methods

5.2.1. *Participants and Procedures*

This is a longitudinal study conducted from March 2021 to June 2022. Ethical approval was obtained from the university's Ethics Review Board (HSEARS20201120002). It investigated perceived weight stigma, weight-related self-stigma, perceived behavioral control, psychological distress, and physical activity among young adults. Participants were initially recruited from the Hong Kong Polytechnic University using snowball sampling, where current participants were asked to share research information with others. Subsequent waves of online surveys were sent to participants via email and text messages to their mobile phones. Data collection occurred every four months. The baseline survey was conducted between March and June 2021. Wave 2 occurred between July and October 2021, Wave 3 from November 2021 to

February 2022, and Wave 4 from March to June 2022. For example, if a participant enrolled in March 2021, subsequent waves occurred in July 2021, November 2021, and March 2022. If a participant enrolled in June 2021, subsequent waves occurred in October 2021, February 2022, and June 2022. To maintain participation in this longitudinal study, HK$50 incentives were given to participants who completed at least two of the waves; an additional HK$200 was given to those who completed all.

In the initial wave, 350 individuals consented to join the first wave study. The study included participants aged 18 to 30 years old who were proficient in Traditional Chinese and consented to take part. Individuals were excluded if they self-reported having a neurological condition, functional impairment, or any psychotic disorder or intellectual disability that would make it difficult to complete the online surveys. Two of them were excluded because their age did not meet the inclusion criteria; another three participants were excluded as they provided invalid responses on physical activity, such as the time reported exceeding 16 hours per day, reported no activity but provided time, or reported having activity but zero minutes (Craig et al., 2003; International Physical Activity Questionnaire, 2005). Therefore, 345 valid participants were recruited in the first wave. In the second wave, 251 of these participants (72.8% follow-up rate) engaged in the follow-up study. The third wave had 232 of the original 345 (67.2% follow-up rate) completed, and in the fourth wave, 234 participants (67.8% follow-up rate) completed. Participants were prompted to complete several questionnaires via a QR code on the university's online survey platform. Before they could access the survey questions, electronic informed consent was secured by having participants select an "agree" icon, which was shown after the study details and participants' rights were presented. After clicking "Agree," they were taken to the questionnaire.

5.2.2. *Measures*

5.2.2.1. Demographic Data

Participants were asked to provide their demographic data, such as age and gender. Height and weight provided were subsequently used to calculate the BMI. Furthermore, with the consideration of the COVID-19 impacts on PA and eating, such as decreased level of PA, increased total food intake, and dietary change (C. Y. Chan & Chiu, 2022; Chew & Lopez, 2021; Wang et al., 2021), participants were asked whether they think COVID-19 impacted their level of PA and eating (i.e., more, same, or less) in the past months to serve as a covariate in the analysis (see 5.2.3. Data analysis).

5.2.2.2. Perceived Weight Stigma (PWS)

The Perceived Weight Stigma Scale (PWSS) is a self-report measure that evaluates the perceived experiences of weight-based stigmatization. It consists of ten dichotomous items, where a score of 0 denotes the absence and 1 denotes the presence of perceived stigmatized situation. An example item is " People treat you less politely than others because of your weight status." The total scores are calculated by summing all item responses, with higher scores indicating greater PWS. The Chinese version of the PWSS demonstrated adequate internal consistency, with a Cronbach's alpha of 0.84 (C.-Y. Lin et al., 2020). Additionally, the psychometric properties of the scale were further validated through confirmatory factor analysis, which demonstrated a unidimensional factor structure with satisfactory fit indices in a sample of participants from Hong Kong (C.-Y. Lin et al., 2020). In the current study, Cronbach's α for the PWS ranged from 0.82 – 0.88 from Time 1 to 4.

5.2.2.3. Weight-Related Self-Stigma (WRSS)

The Weight Bias Internalization Scale (WBIS) was utilized to assess participants' WRSS (Durso & Latner, 2008). This measure was subsequently adapted to be suitable for individuals across various weight statuses, including non-overweight and overweight populations (Pearl & Puhl, 2014). This 11-item measure employed a 5-point rating scale, where higher scores reflected greater internalization of weight-related stigma. The Chinese version of the WBIS, which tailored its item descriptions to accommodate different weight statuses, has demonstrated satisfactory psychometric properties among both overweight and non-overweight individuals (Pakpour et al., 2019). As measured by Cronbach's α, the internal consistency for the WBIS ranged from 0.90 - 0.91 from Time 1 to 4 in this study, demonstrating excellent reliability in evaluating weight-related self-stigma. In addition, using the scores in Time 1, participants were categorized into low and high WRSS groups based on the suggested cutoff, i.e., the midpoint of the scale (Pearl et al., 2019).

5.2.2.4. Physical activity (PA)

The IPAQ used in Chapter 3 was also utilized in this study (Macfarlane et al., 2007). The IPAQ is a self-reported measure that evaluates the level of physical activity undertaken by participants over the past week (Craig et al., 2003). The IPAQ has demonstrated satisfactory test-retest reliability, with an intraclass correlation coefficient of 0.79 (Macfarlane et al., 2007).

5.2.2.5. Eating Behaviors

The TFEQ-R18 used in Chapter 4 was used again to assesses eating behaviors across three distinct dimensions: cognitive restraint, uncontrolled eating, and emotional eating. The total scale and subscale's reliability in Cronbach's alpha ranged from 0.76 to 0.88 from Time 1 to 4, denoting high internal consistency for TFEQ-R18.

5.2.2.6. Perceived Behavioral Control of Physical Activity (PBC-PA)

The perceived behavioral control of physical activity was the same in Chapter 3. The scale's reliability in Cronbach's alpha ranged from 0.83 to 0.84 from Time 1 to 4, denoting high internal consistency for PBC-PA.

5.2.2.7. Perceived Behavioral Control of Avoiding Eating Behaviors (PBC-EB)

The perceived behavioral control of physical activity was the same in Chapter 4. The scale's reliability in Cronbach's alpha ranged from 0.86 to 0.90 from Time 1 to 4, denoting high internal consistency for PBC-EB.

5.2.2.8. Psychological Distress

The Hospital Anxiety and Depression Scale (HADS) is a 14-item instrument developed to assess psychological distress, particularly anxiety and depression (Zigmond & Snaith, 1983). It comprises two subscales, each with seven items, and the cumulative scores indicate the level of distress, with higher scores reflecting greater psychological distress. The HADS has demonstrated satisfactory psychometric properties. A Chinese version of the HADS was utilized in this research to assess psychological distress among Chinese-speaking populations (Jiang et al., 2020). In the current study, Cronbach's α for the HADS ranged from 0.82 – 0.87 from Time 1 to 4.

5.2.3. *Data analysis*

Participant characteristics were analyzed using descriptive statistics. Scores of the questionnaires were calculated for the baseline and at each follow-up. Pearson correlations between PWS, WBIS, PBC-PA, PBC-EB, HADS, IPAQ, and TFEQ-R18 scores were computed across all four time points. Repeated measures analysis of covariance (RM-ANCOVA) was used to investigate whether there were significant differences in BMI, PWS, psychological distress, PA, three eating behaviors, PBC-PA, and PBC-EB, between low and high WRSS group, and between times, with the Greenhouse-Geisser corrections applied. The analysis included age and gender as covariates. Little's Missing Completed at Random (MCAR) test was used, and it was identified that the attrition did not have a pattern (Little, 1988): χ^2 (*df*) = 216.62 (197); $p = 0.161$ for the physical activity dataset; χ^2 (*df*) = 250.83 (234); $p = 0.215$ for the eating behaviors dataset.

To assess the longitudinal relationships between the variables, the parallel-process latent growth curve model (PP-LGCM) was used. The purpose of the analyses is to understand the trajectories between the variables over time. By fitting latent growth curves for each variable, initial status and growth rates (i.e., intercept and slope) could be estimated and the covariation between these processes can be examined.

5.2.3.1. PP-LGCM for Physical Activity

The model used four repeated measures of each variable to estimate the latent intercept (the estimated initial level) and latent slope (the estimated growth). Therefore, the model included latent intercepts and slopes for PWS, WRSS, PBC-PA, psychological distress, PA, and BMI (Figure 9). Specifically, the model estimated the effects of the latent intercept of PWS on the latent intercept of WRSS; the latent intercept of WRSS on the latent intercepts of PBC-PA, psychological distress, PA, and BMI; the latent intercept of PBC-PA on the latent intercepts of psychological distress and PA; the latent intercept of psychological distress on the latent intercept of PA; and the latent intercept of PA on the latent intercept on BMI. Similarly, the effects of the latent slope of PWS on the latent slope of WRSS; the latent slope of WRSS on the latent slopes of PBC-PA, psychological distress, PA, and BMI; the latent slope of PBC-PA on the latent slopes of psychological distress and PA; the latent slope of psychological distress on the latent slope of PA; and the latent slope of PA on the latent slope on BMI were estimated. In addition, age and gender were used as the time-invariant covariates, and the perceived impact of COVID-19 on PA in each wave was used as time-varying covariates for PA and PBC-PA in the model.

5.2.3.2. PP-LGCM for Avoiding Eating Behaviors

Another three models were proposed for the eating behaviors, i.e., cognitive restraints (Figure 10), emotional eating (Figure 11), and uncontrolled eating (Figure 12). Similarly, these models used four repeated measures of each variable to estimate the latent intercept and latent slope. The relationships in the models were similar to the PA model, whereas the PBC-PA was replaced with PBC-EB, and the PA was replaced with the three eating behaviors. Age and gender were used as the time-invariant covariates, and the perceived impact of COVID-19 on eating in each wave was used as time-varying covariates for eating behaviors and PBC-EB in the models.

5.2.3.3. RI-CLPM for the Temporal Association Between WRSS and BMI

Moreover, since there is speculation on whether WRSS and weight form a positive feedback loop, a random intercept cross-lagged panel model (RI-CLPM) was conducted to investigate if preceding WRSS was associated with subsequent measures of BMI, and preceding BMI associated with subsequent measures of WRSS. The model accessed the temporal associations between WRSS and BMI from Time 1 to Time 4 (Figure 13).

The following indices were used to examine whether the PP-LGCMs and RI-CLPM were supported: CFI and TLI greater than 0.9, SRMR less than 0.08, and RMSEA less than 0.10 (Browne & Cudeck, 1992; Hu & Bentler, 1999; Kenny et al., 2015). Descriptive statistics, Pearson's correlation of demographic data and questionnaire scores, RM-ANCOVA were analyzed using SPSS 29.0.2 (IBM Corp., Armonk, NY, USA). The PP-LGCM and RI-CLPM model was analyzed using R with the lavaan package (Rosseel, 2012). Maximum likelihood estimation with robust standard errors (MLR) was employed for the model, along with the use of full information maximum likelihood (FIML) imputation for missing data.

5.3. Results

5.3.1. *Descriptive Statistics*

At baseline, the participants' mean age was 22.94 years (*SD* = 3.33), and the BMI was 21.15 (*SD* = 3.22). There were 21.2% of participants who were overweight. Nearly two-thirds of the participants were females (*n* = 218; 63.2%). According to the WBIS score at Time 1, there were 101 participants categorized as high WRSS. Regarding the perceived impact of

COVID-19 on the level of PA, 62.6% of the participants reported performing less PA than before, 17.7% were performing more, and 19.7% reported the same. On the other hand, due to COVID-19, 28.4% of the participants reported they ate less than before, 26.4% were ate more, and 45.2% reported the same. For the follow-ups, ratios of male and female were similar at Time 2, Time 3, and Time 4, where the percentage of females were 63.6, 63.9, 65.0; the BMI at Time 2, Time 3, and Time 4 were M = 21.13, SD = 3.44; M = 21.32, SD = 3.34; and M = 21.16, SD = 3.25 respectively. The detailed information is presented in Table 6.

Table 6

Demographic Information and Descriptive Statistics of the Questionnaires of the Participants Across the Time

	Time 1 (***N*** **= 345)**	**Time 2** (***n*** **= 247-253)**	**Time 3** (***n*** **= 228-233)**	**Time 4** (***n*** **= 234-235)**
Gender, *n* (%)				
Male	127 (36.8)	92 (36.4)	84 (36.1)	82 (35.0)
Female	218 (63.2)	161 (63.6)	149 (63.9)	152 (65.0)
Age (years), *M* (*SD*)	22.94 (3.33)	23.07 (3.34)	23.45 (3.35)	23.87 (3.40)
Weight (kg), *M* (*SD*)	57.93 (11.61)	57.67 (11.61)	58.06 (11.68)	57.47 (11.35)
Body Mass Index, *M* (*SD*)	21.15 (3.22)	21.13 (3.44)	21.32 (3.34)	21.16 (3.25)
Weight group, *n* (%)				
Non-overweight	272 (78.8)	197 (77.9)	176 (75.9)	182 (77.8)
Overweight	73 (21.2)	56 (22.1)	56 (24.1)	52 (22.2)
Perceived Weight Stigma, *M* (*SD*)	1.24 (2.00)	1.29 (2.07)	1.13 (2.07)	1.06 (2.12)

Weight Bias Internalization Scale, *M* (*SD*)	27.07 (8.45)	26.84 (8.11)	26.60 (8.25)	26.64 (8.00)
Hospital Anxiety and Depression Scale (HADS), *M* (*SD*)	13.14 (6.03)	12.53 (5.94)	12.26 (6.52)	12.94 (6.74)
Perceived behavioral control toward PA, *M* (*SD*)	4.64 (1.31)	4.48 (1.26)	4.54 (1.21)	4.47 (1.21)
International Physical Activity Questionnaire, *M* (*SD*)	1955.49 (2442.70)	2495.21 (2600.13)	2250.01 (3137.30)	2205.66 (2882.06)
Perceived behavioral control toward avoiding EB, *M* (*SD*)	5.17 (1.21)	5.09 (1.28)	5.23 (1.13)	5.24 (1.23)
Three–Factor Eating Questionnaire–Revised 18–item version, *M* (*SD*)				
Cognitive restraint	43.67 (19.28)	44.02 (18.93)	44.37 (16.72)	43.40 (17.13)
Uncontrolled eating	37.21 (17.86)	35.76 (17.95)	34.83 (18.58)	33.54 (18.01)
Emotional eating	42.25 (25.07)	40.74 (24.11)	41.30 (25.46)	40.22 (24.61)
Perceived impact of COVID-19 on PA, *n* (%)				
More PA	61 (17.7)	44 (17.8)	22 (9.6)	37 (15.8)
Same	68 (19.7)	121 (49.0)	107 (46.9)	52 (22.2)

Less PA	216 (62.6)	82 (33.2)	99 (43.4)	145 (62.0)
Perceived impact of COVID-19 on Eating, *n* (%)				
More eating	91 (26.4)	36 (14.6)	44 (19.3)	67 (28.6)
Same	156 (45.2)	170 (68.8)	154 (67.5)	111 (47.4)
Less eating	98 (28.4)	41 (16.6)	30 (13.2)	56 (23.9)

Note. PA = physical activity; EB = eating behaviors.

Figures 7 and 8 show the correlation between variables. In general, both PWS and WRSS positively correlated with psychological distress; WRSS negatively correlated with both the PBC-PA and PBC-EB. PBC-PA was positively correlated with psychological distress and the level of physical activity. PBC-EB was negatively correlated with uncontrolled eating, and emotional eating, and positively correlated with cognitive restraint.

Table 7

Correlation Between Perceived Weight Stigma, Weight-Related Self-Stigma, Psychological Distress, Perceived Behavioral Control for Physical Activity, and Physical Activity

	r											
Variables	PWS1	PWS2	PWS3	PWS4	WRSS1	WRSS2	WRSS3	WRSS4	HADS1	HADS2	HADS3	HADS4
PWS1	--											
PWS2	0.53***	--										
PWS3	0.50***	0.73***	--									
PWS4	0.59***	0.70***	0.69***	--								
WRSS1	0.48***	0.36***	0.35***	0.39***	--							
WRSS2	0.44***	0.43***	0.43***	0.44***	0.80***	--						
WRSS3	0.44***	0.41***	0.46***	0.49***	0.78***	0.82***	--					
WRSS4	0.43***	0.44***	0.43***	0.50***	0.76***	0.79***	0.82***	--				
HADS1	0.33***	0.34***	0.34***	0.36***	0.28***	0.25***	0.37***	0.37***	--			
HADS2	0.29***	0.39***	0.34***	0.36***	0.24***	0.27***	0.36***	0.35***	0.68***	--		
HADS3	0.26***	0.37***	0.39***	0.39***	0.31***	0.32***	0.47***	0.41***	0.70***	0.76***	--	

HADS4	0.31***	0.34***	0.34***	0.40***	0.23***	0.19**	0.31***	0.36***	0.69***	0.72***	0.77***	--
PBC-PA1	-0.01	-0.09	-0.04	-0.02	-0.17**	-0.15*	-0.10	-0.12	-0.20***	-0.21***	-0.17**	-0.07
PBC-PA2	-0.05	-0.12	-0.11	-0.13	-0.18**	-0.18**	-0.17*	-0.14*	-0.25***	-0.22***	-0.21**	-0.13
PBC-PA3	-0.03	-0.06	-0.09	-0.14*	-0.24***	-0.25***	-0.23***	-0.20**	-0.20**	-0.17**	-0.23***	-0.15*
PBC-PA4	0.001	-0.19**	-0.19**	-0.16*	-0.17*	-0.21**	-0.20**	-0.18**	-0.24***	-0.26***	-0.23***	-0.25***
PA1	0.17**	0.06	0.03	0.07	0.05	0.003	0.06	0.03	-0.05	-0.04	0.02	0.05
PA2	0.07	0.09	-0.02	-0.08	0.03	-0.01	0.03	-0.05	-0.09	-0.09	-0.09	-0.11
PA3	0.02	0.04	-0.09	-0.09	0.05	-0.01	0.03	-0.02	0.004	-0.05	-0.08	-0.03
PA4	-0.03	0.12	0.06	-0.04	0.02	-0.02	0.02	0.01	-0.01	-0.05	0.03	-0.06

Cont'd

	r							
Variables	PBC-PA1	PBC-PA2	PBC-PA3	PBC-PA4	PA1	PA2	PA3	PA4
PBC-PA1	--							
PBC-PA2	0.63***	--						
PBC-PA3	0.63***	0.61***	--					

PBC-PA4	0.50***	0.62***	0.66***	--				
PA1	0.33***	0.34***	0.29***	0.20**	--			
PA2	0.13*	0.13*	0.16*	0.09	0.39***	--		
PA3	0.25***	0.23***	0.31***	0.26***	0.30***	0.36***	--	
PA4	0.08	0.11	0.08	0.16*	0.26***	0.52***	0.28***	--

Note. PWS = perceived weight stigma; WRSS = weight-related self-stigma; HADS = psychological distress; PA = physical activity; PBC-PA = perceived behavioral control for physical activity. The numbers (1 to 4) that follow the variable name indicate the variable at Time 1 to 4. * $p < 0.05$. ** $p < 0.01$. *** $p < 0.001$.

Table 8

Correlation Between Perceived Weight Stigma, Weight-Related Self-Stigma, Psychological Distress, Perceived Behavioral Control for Avoiding Eating Behaviors, and The Three Eating Behaviors

	r											
Variables	PWS1	PWS2	PWS3	PWS4	WRSS1	WRSS2	WRSS3	WRSS4	HADS1	HADS2	HADS3	HADS4
PBC-EB1	-0.16**	-0.06	-0.11	-0.16*	-0.25***	-0.17**	-0.29***	-0.29***	-0.27***	-0.21***	-0.25***	-0.32***
PBC-EB2	-0.07	-0.13*	-0.04	-0.12	-0.26***	-0.23***	-0.26***	-0.26***	-0.23***	-0.25***	-0.21**	-0.23***
PBC-EB3	-0.07	-0.12	-0.12	-0.18**	-0.26***	-0.22**	-0.28***	-0.25***	-0.17**	-0.18**	-0.24***	-0.27***
PBC-EB4	-0.13*	-0.15*	-0.15*	-0.25***	-0.26***	-0.19**	-0.27***	-0.31***	-0.29***	-0.27***	-0.24***	-0.34***
CR1	0.17**	0.06	0.02	0.007	0.27***	0.19**	0.20**	0.16*	0.06	-0.02	0.02	0.03
CR2	0.07	0.14*	0.09	0.06	0.22***	0.28***	0.23***	0.18**	-0.07	-0.003	0.03	-0.008
CR3	0.05	0.06	0.02	-0.04	0.20**	0.17*	0.21**	0.14*	-0.03	-0.02	-0.009	-0.05
CR4	0.02	0.02	0.02	0.02	0.23***	0.26***	0.22**	0.25***	0.02	0.02	0.08	0.06
UE1	0.21***	0.16*	0.20**	0.17*	0.30***	0.24***	0.29***	0.28***	0.25***	0.26***	0.25***	0.32***
UE2	0.26***	0.23***	0.23***	0.28***	0.30***	0.31***	0.38***	0.34***	0.24***	0.30***	0.25***	0.27***
UE3	0.28***	0.20**	0.21**	0.26***	0.39***	0.34***	0.43***	0.39***	0.24***	0.25***	0.30***	0.31***

UE4	0.25***	0.14*	0.18**	0.19**	0.38***	0.34***	0.40***	0.42***	0.25***	0.26***	0.25***	0.34***
EE1	0.21***	0.19**	0.26***	0.16*	0.31***	0.28***	0.29***	0.28***	0.19***	0.15*	0.19**	0.22***
EE2	0.21***	0.20**	0.20**	0.20**	0.25***	0.32***	0.28***	0.27***	0.15*	0.20**	0.19**	0.14*
EE3	0.17*	0.18**	0.20**	0.17*	0.41***	0.34***	0.39***	0.36***	0.15*	0.11	0.21**	0.16*
EE4	0.17*	0.17*	0.23***	0.16*	0.26***	0.27***	0.32***	0.33***	0.21**	0.15*	0.20**	0.28***

Cont'd

	r							
Variables	PBC-EB1	PBC-EB2	PBC-EB3	PBC-EB4	CR1	CR2	CR3	CR4
PBC-EB1	--							
PBC-EB2	0.54***	--						
PBC-EB3	0.53***	0.57***	--					
PBC-EB4	0.58***	0.62***	0.62***	--				
CR1	0.12*	0.10	0.03	0.12	--			
CR2	0.19**	0.16*	0.03	0.20**	0.76***	--		
CR3	0.17**	0.19**	0.08	0.14*	0.72***	0.73***	--	

CR4	0.07	0.11	0.009	0.10	0.64***	0.70***	0.69***	--
UE1	-0.38***	-0.27***	-0.34***	-0.42***	0.006	-0.06	0.002	0.05
UE2	-0.30***	-0.28***	-0.29***	-0.37***	0.03	-0.006	-0.02	-0.04
UE3	-0.40***	-0.31***	-0.45***	-0.40***	0.001	-0.01	-0.002	-0.01
UE4	-0.37***	-0.32***	-0.36***	-0.44***	0.05	-0.002	0.03	0.09
EE1	-0.32***	-0.21**	-0.30***	-0.36***	0.03	-0.06	-0.07	0.02
EE2	-0.26***	-0.21***	-0.25***	-0.27***	0.08	0.04	0.01	-0.05
EE3	-0.33***	-0.20**	-0.34***	-0.28***	0.07	0.03	0.05	0.04
EE4	-0.30***	-0.21**	-0.22**	-0.39***	0.03	-0.01	-0.02	0.11

Cont'd

	r							
Variables	UE1	UE2	UE3	UE4	EE1	EE2	EE3	EE4
CR1								
CR2								
CR3								

CR4								
UE1	--							
UE2	0.71***	--						
UE3	0.71***	0.76***	--					
UE4	0.71***	0.73***	0.77***	--				
EE1	0.60***	0.50***	0.51***	0.58***	--			
EE2	0.48***	0.67***	0.55***	0.51***	0.68***	--		
EE3	0.46***	0.54***	0.68***	0.54***	0.69***	0.70***	--	
EE4	0.40***	0.44***	0.47***	0.66***	0.68***	0.60***	0.68***	--

Note. PWS = perceived weight stigma; WRSS = weight-related self-stigma; HADS = psychological distress; PBC-EB = perceived behavioral control for avoiding eating behaviors; CR = cognitive restraint; UE = uncontrolled eating; EE = emotional eating. The numbers (1 to 4) that follow the variable name indicate the variable at Time 1 to 4. * $p < 0.05$. ** $p < 0.01$. *** $p < 0.001$.

5.3.2. *Differences between Low and High WRSS groups*

The results from the RM-ANCOVA were presented in Figure 8 and Table 9. The main effect of time was not significant on all variables, indicating that variables including BMI, PWS, psychological distress, PBC-PA, PBC-EB, PA, cognitive restraint, emotional eating, and uncontrolled eating did not change significantly across the four time points.

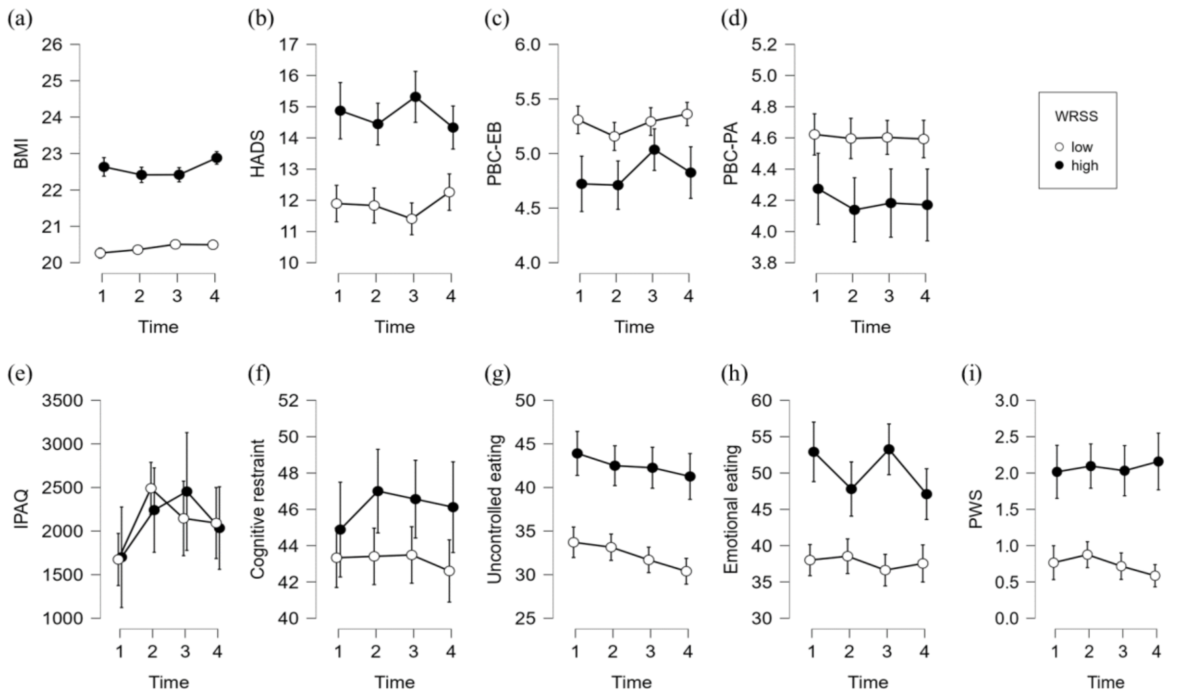
The main effect of the WRSS group was significant on BMI, $F(1, 204) = 31.58$, $p < 0.001$; PWS, $F(1, 204) = 29.48$, $p < 0.001$; psychological distress, $F(1, 204) = 13.55$, $p < 0.001$; PBC-PA, $F(1, 204) = 5.51$, $p = 0.020$; PBC-EB, $F(1, 204)=10.09$, $p = 0.002$; emotional eating, $F(1, 204)=12.84$, $p < 0.001$; and uncontrolled eating, $F(1, 204) = 17.09$, $p < 0.001$.

Emotional eating showed a significant interaction between the WRSS group and time, $F(2.90, 590.77) = 3.04$, $p = 0.030$. This interaction suggests that the change in emotional eating over time differed between the low and high WRSS groups. However, post hoc analysis with the Bonferroni adjustment revealed no significant difference between any pair of the time points.

The results suggest that while the studied variables were stable over time, BMI, PWS, psychological distress, uncontrolled eating, and emotional eating in the high WRSS group were consistently higher than the low WRSS group, and PBC-PA and PBC-EB were consistently lower than the low WRSS group.

Figure 8

Differences Between Low and High WRSS Groups over Time



Note. BMI = Body Mass Index; PWS = perceived weight stigma; WRSS = weight-related self-stigma; HADS = psychological distress; IPAQ = physical activity; PBC-PA = perceived behavioral control for physical activity; PBC-EB = perceived behavioral control for avoiding eating behaviors; CR = cognitive restraint; UE = uncontrolled eating; EE = emotional eating.

Table 9

Results of the RM-ANCOVA on the Studied Variables Between Low and High WRSS Groups

Parameter	**Factor**	***SS***	***df***	***MS***	***F***	***p***
BMI	Between-subjects [a]					
	WRSS	988.29	1	988.29	31.58	<0.001
	Gender	511.09	1	511.09	16.33	<0.001
	Age	416.77	1	416.77	13.32	<0.001
	Error	6384.12	204	31.30		
	Within-subjects					
	Time	2.00	2.62	0.76	1.15	0.325
	Time*WRSS	6.87	2.62	2.62	3.96	0.011
	Time*Gender	0.39	2.62	0.15	0.23	0.854
	Time*Age	1.90	2.62	0.72	1.09	0.347
	Error	354.02	535.39	0.66		
PWS	Between-subjects [a]					

	WRSS	299.79	1	299.79	29.48	<0.001
	Gender	0.12	1	0.12	0.01	0.915
	Age	37.40	1	37.40	3.68	0.057
	Error	2074.74	204	10.17		
	Within-subjects					
	Time	2.06	2.77	0.74	0.45	0.701
	Time*WRSS	4.11	2.77	1.48	0.90	0.434
	Time*Gender	1.73	2.77	0.63	0.38	0.752
	Time*Age	2.49	2.77	0.90	0.55	0.637
	Error	930.73	565.00	1.65		
HADS	Between-subjects [a]					
	WRSS	1652.42	1	1652.42	13.55	<0.001
	Gender	313.52	1	313.52	2.57	0.110
	Age	9.22	1	9.22	0.08	0.784
	Error	24883.87	204	121.98	24883.87	

	Within-subjects					
	Time	2.28	2.94	0.78	0.07	0.975
	Time*WRSS	73.89	2.94	25.15	2.23	0.085
	Time*Gender	26.71	2.94	9.09	0.80	0.489
	Time*Age	1.78	2.94	0.61	0.05	0.982
	Error	6769.10	599.29	11.30		
PA	Between-subjects [a]					
	WRSS	26208.34	1	26208.34	0.002	0.965
	Gender	2800994.34	1	2800994.34	0.21	0.651
	Age	27058851.23	1	27058851.23	1.99	0.160
	Error	2739547818.18	201	13629591.14		
	Within-subjects					
	Time	19153420.16	2.66	7196538.90	1.32	0.267
	Time*WRSS	6424896.08	2.66	2414034.37	0.44	0.698
	Time*Gender	10285419.22	2.66	3864553.64	0.71	0.529

	Time*Age	21151797.86	2.66	7947391.90	1.46	0.227
	Error	2905928467.89	534.96	5432080.58		
PBC-PA	Between-subjects [a]					
	WRSS	23.02	1	23.02	5.51	0.020
	Gender	20.07	1	20.07	4.80	0.030
	Age	8.72	1	8.72	2.08	0.150
	Error	852.94	204	4.18		
	Within-subjects					
	Time	0.75	2.88	0.26	0.40	0.743
	Time*WRSS	0.16	2.88	0.05	0.08	0.965
	Time*Gender	5.11	2.88	1.78	2.76	0.044
	Time*Age	1.29	2.88	0.45	0.70	0.549
	Error	378.47	586.79	0.64		

Cognitive restraint	Between-subjects [a]					
	WRSS	1212.88	1	1212.88	1.26	0.264
	Gender	485.49	1	485.49	0.50	0.479
	Age	63.55	1	63.55	0.07	0.798
	Error	196825.48	204	964.83		
	Within-subjects					
	Time	15.31	2.89	5.29	0.05	0.982
	Time*WRSS	126.23	2.89	43.64	0.44	0.718
	Time*Gender	92.11	2.89	31.84	0.32	0.803
	Time*Age	28.40	2.89	9.82	0.10	0.957
	Error	58569.86	590.14	99.25		
Emotional eating	Between-subjects [a]					
	WRSS	21568.66	1	21568.66	12.84	<0.001
	Gender	12640.89	1	12640.89	7.53	0.007

	Age	731.50	1	731.50	0.44	0.510
	Error	342667.64	204	1679.74		
	Within-subjects					
	Time	225.45	2.90	77.85	0.36	0.772
	Time*WRSS	1883.87	2.90	650.53	3.04	0.030
	Time*Gender	94.00	2.90	32.46	0.15	0.923
	Time*Age	352.75	2.90	121.81	0.57	0.629
	Error	126345.01	590.77	213.87		
Uncontrolled eating	Between-subjects [a]					
	WRSS	16739.90	1	16739.90	17.09	<0.001
	Gender	571.58	1	571.58	0.58	0.446
	Age	1770.13	1	1770.13	1.81	0.180
	Error	199844.63	204	979.63		
	Within-subjects					

	Time	105.09	2.92	36.01	0.38	0.760
	Time*WRSS	76.70	2.92	26.28	0.28	0.835
	Time*Gender	218.75	2.92	74.95	0.80	0.493
	Time*Age	100.31	2.92	34.37	0.37	0.772
	Error	55958.43	595.41	93.98		
PBC-EB	Between-subjects [a]					
	WRSS	37.72	1	37.72	10.09	0.002
	Gender	0.49	1	0.49	0.13	0.719
	Age	3.99	1	3.99	1.07	0.303
	Error	762.55	204	3.74		
	Within-subjects					
	Time	0.68	2.96	0.23	0.36	0.781
	Time*WRSS	2.70	2.96	0.91	1.42	0.237
	Time*Gender	0.03	2.96	0.01	0.02	0.996
	Time*Age	0.49	2.96	0.16	0.26	0.854

Error	388.49	603.37	0.64

Note. BMI = Body Mass Index; PWS = perceived weight stigma; WRSS = weight-related self-stigma; HADS = psychological distress; PA = physical activity; PBC-PA = perceived behavioral control for physical activity; PBC-EB = perceived behavioral control for avoiding eating behaviors. [a] Greenhouse-Geisser corrections applied.

5.3.3. *Model Fit of the PP-LGCM for PA*

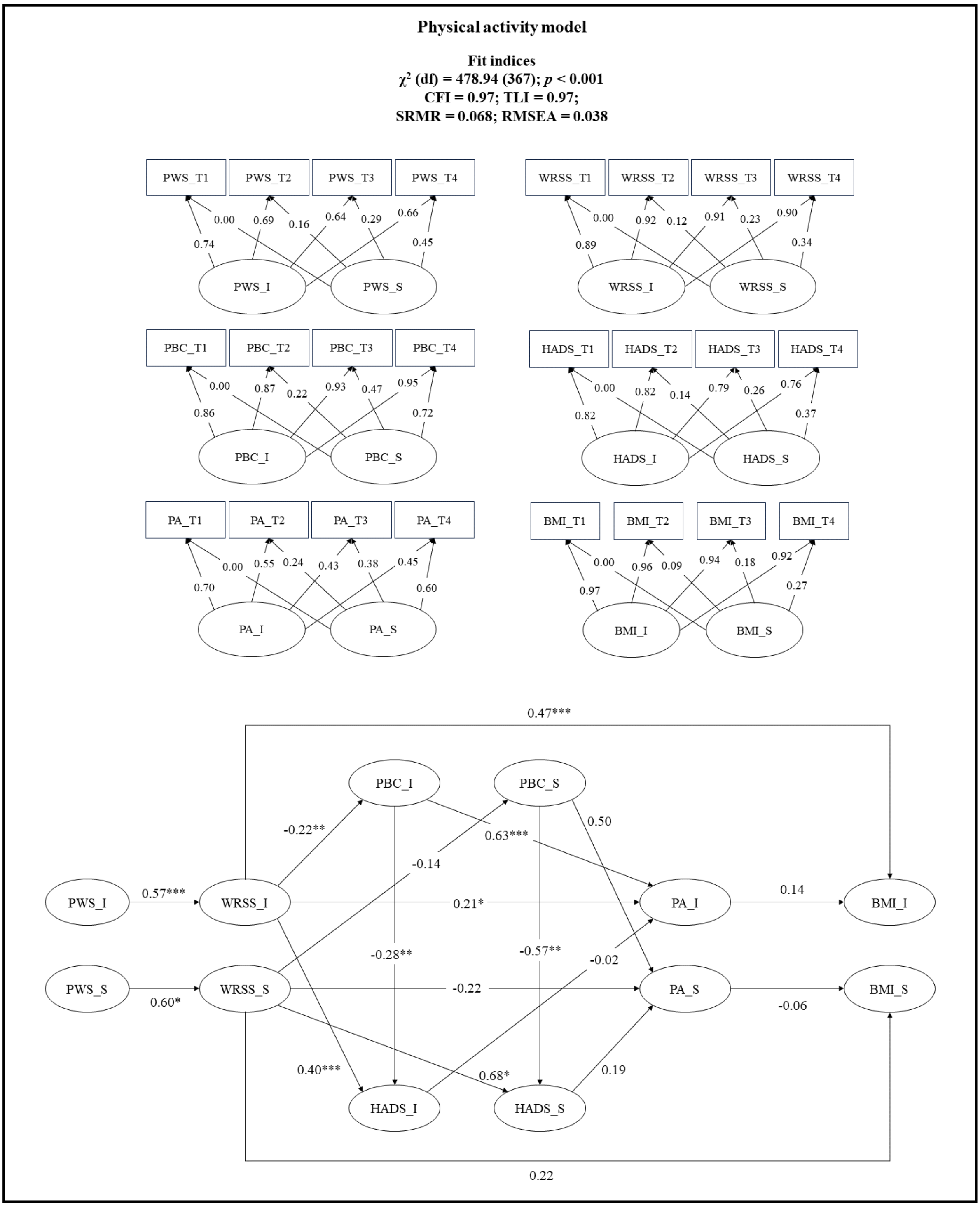
The parallel process latent growth curve model for the physical activity showed an acceptable fit to the data (Figure 9). The χ^2 was 478.94 (df = 367, $p < .001$), the RMSEA was 0.038, the CFI and TLI were 0.97, and the SRMR was 0.068, which indicated an acceptable fit.

For the path coefficients, the intercept (i.e., the initial level) of perceived stigma was significantly associated with the intercept of WRSS (standardized coefficient = 0.57; $p < 0.001$); the intercept of WRSS was significantly associated with the intercept of PBC-PA (standardized coefficient = -0.22; $p = 0.001$), psychological distress (standardized coefficient = 0.40; $p < 0.001$), PA (standardized coefficient = 0.21; $p = 0.040$), and BMI (standardized coefficient = 0.47; $p < 0.001$); the intercept of PBC-PA was significantly associated with the intercept of psychological distress (standardized coefficient = -0.28; $p = 0.001$), PA (standardized coefficient = 0.63; $p < 0.001$); the intercept of PA was not significantly associated with the intercept of BMI ($p = 0.122$).

Furthermore, the slope (i.e., the growth) of PWS was associated with the slope of the WRSS (standardized coefficient = 0.60; $p = 0.021$). The slope of WRSS (standardized coefficient = 0.68; $p = 0.005$) and the PBC-PA (standardized coefficient = -0.57; $p = 0.005$) were significantly associated with the slope of psychological distress. In other words, the temporal associations were only found in the relationship between PWS and WRSS, between WRSS and psychological distress, and between PBC-PA and psychological distress. There was no rate of change in any variables associated with the rate of change in BMI.

Figure 9

The PP-LGCM for Physical Activity



Note. BMI = Body Mass Index; PWS = perceived weight stigma; WRSS = weight-related self-stigma; HADS = psychological distress; PA = physical activity; PBC = perceived behavioral control for physical activity; T1 = Time 1; T2 = Time 2; T3 = Time; T4 = Time 4. The upper part of the figure illustrates each pair of the latent intercept (I) and latent slope (S) of the variables, the lower part illustrates the parallel process between latent variables. All path coefficients presented are standardized coefficients. * $p < 0.05$. ** $p < 0.01$. *** $p < 0.001$.

5.3.4. ***Model Fit of the PP-LGCM for the Three Eating Behaviors***

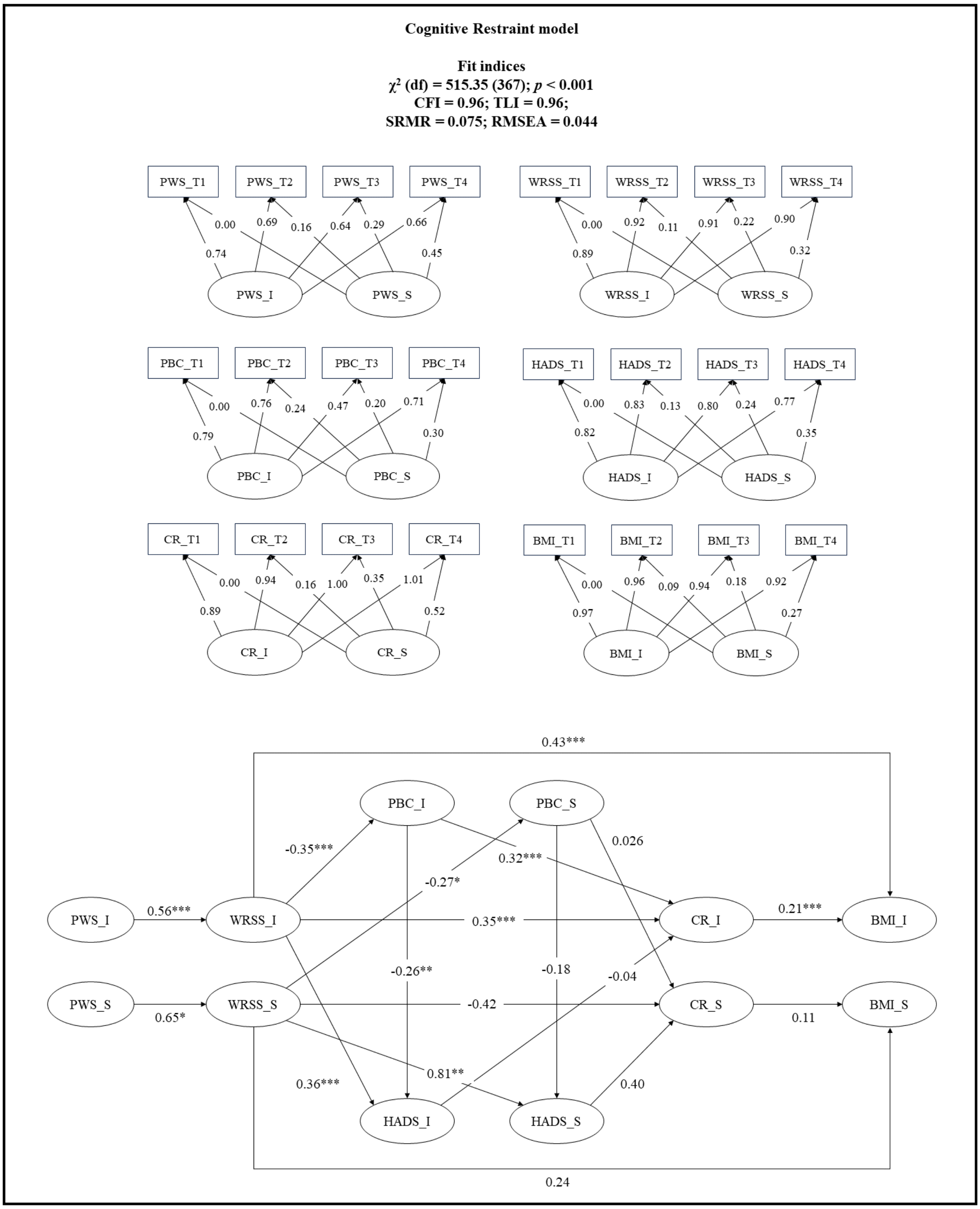
All of the three eating models (Figure 10, Figure 11, and Figure 12) had acceptable fit with the RMSEA ranged from 0.042 to 0.047, CFI ranged from 0.96 to 0.97, TLI ranged from 0.95 to 0.96, SRMR ranged from 0.075 to 0.076. However, a Heywood case occurred in the model of cognitive restraint where a standardized coefficient was greater than 1 in the latent intercept of cognitive restraint. Therefore, only the models of uncontrolled eating and emotional eating should be considered as supported.

For the path coefficients of uncontrolled eating model, the intercept of perceived stigma was significantly associated with the intercept of self-stigma (standardized coefficient = 0.58; $p < 0.001$); the intercept of self-stigma was significantly associated with the intercept of PBC (standardized coefficient = -0.35; $p < 0.001$), psychological distress (standardized coefficient = 0.39; $p < 0.001$), uncontrolled eating (standardized coefficient = 0.19; $p = 0.016$), and BMI (standardized coefficient = 0.51; $p < 0.001$); the intercept of PBC was significantly associated with the intercept of psychological distress (standardized coefficient = -0.25; $p = 0.010$) and uncontrolled eating (standardized coefficient = -0.39; $p < 0.001$). Furthermore, the growth rate of perceived stigma was significantly associated with the growth rate of self-stigma (standardized coefficient = 0.57; $p = 0.017$); the growth of self-stigma was significantly associated with the growth of psychological distress (standardized coefficient = 0.90; $p = 0.003$).

For the path coefficients of emotional eating model, the intercept of perceived stigma was significantly associated with the intercept of self-stigma (standardized coefficient = 0.57; $p < 0.001$); the intercept of self-stigma was significantly associated with the intercept of PBC (standardized coefficient = -0.34; $p < 0.001$), psychological distress (standardized coefficient = 0.37; $p < 0.001$), emotional eating (standardized coefficient = 0.23; $p = 0.005$), and BMI (standardized coefficient = 0.47; $p < 0.001$); the intercept of PBC was significantly associated with the intercept of psychological distress (standardized coefficient = -0.25; $p = 0.009$) and emotional eating (standardized coefficient = -0.36; $p < 0.001$). Furthermore, the growth of perceived stigma was significantly associated with the growth of self-stigma (standardized coefficient = 0.56; $p = 0.021$); the growth of self-stigma was significantly associated with the growth of psychological distress (standardized coefficient = 0.92; $p = 0.009$).

Figure 10

The PP-LGCM for Cognitive Restraint

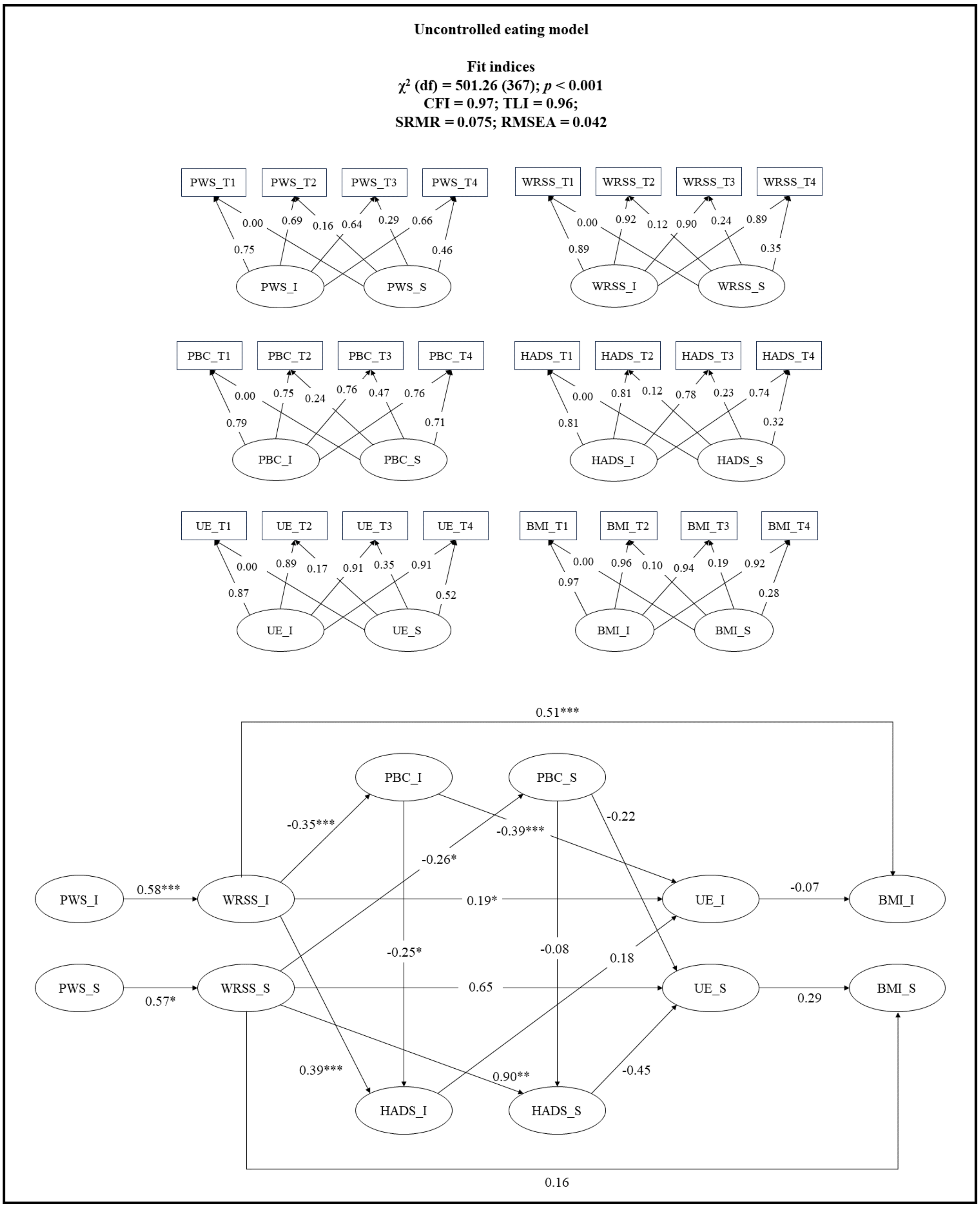


Note. BMI = Body Mass Index; PWS = perceived weight stigma; WRSS = weight-related self-stigma; HADS = psychological distress; PBC = perceived behavioral control for avoiding eating behaviors; CR = cognitive restraint; T1 = Time 1; T2 = Time 2; T3 = Time; T4 = Time

4. The upper part of the figure illustrates each pair of the latent intercept (I) and latent slope (S) of the variables, the lower part illustrates the parallel process between latent variables. All path coefficients presented are standardized coefficients. * $p < 0.05$. ** $p < 0.01$. *** $p < 0.001$.

Figure 11

The PP-LGCM for Uncontrolled Eating

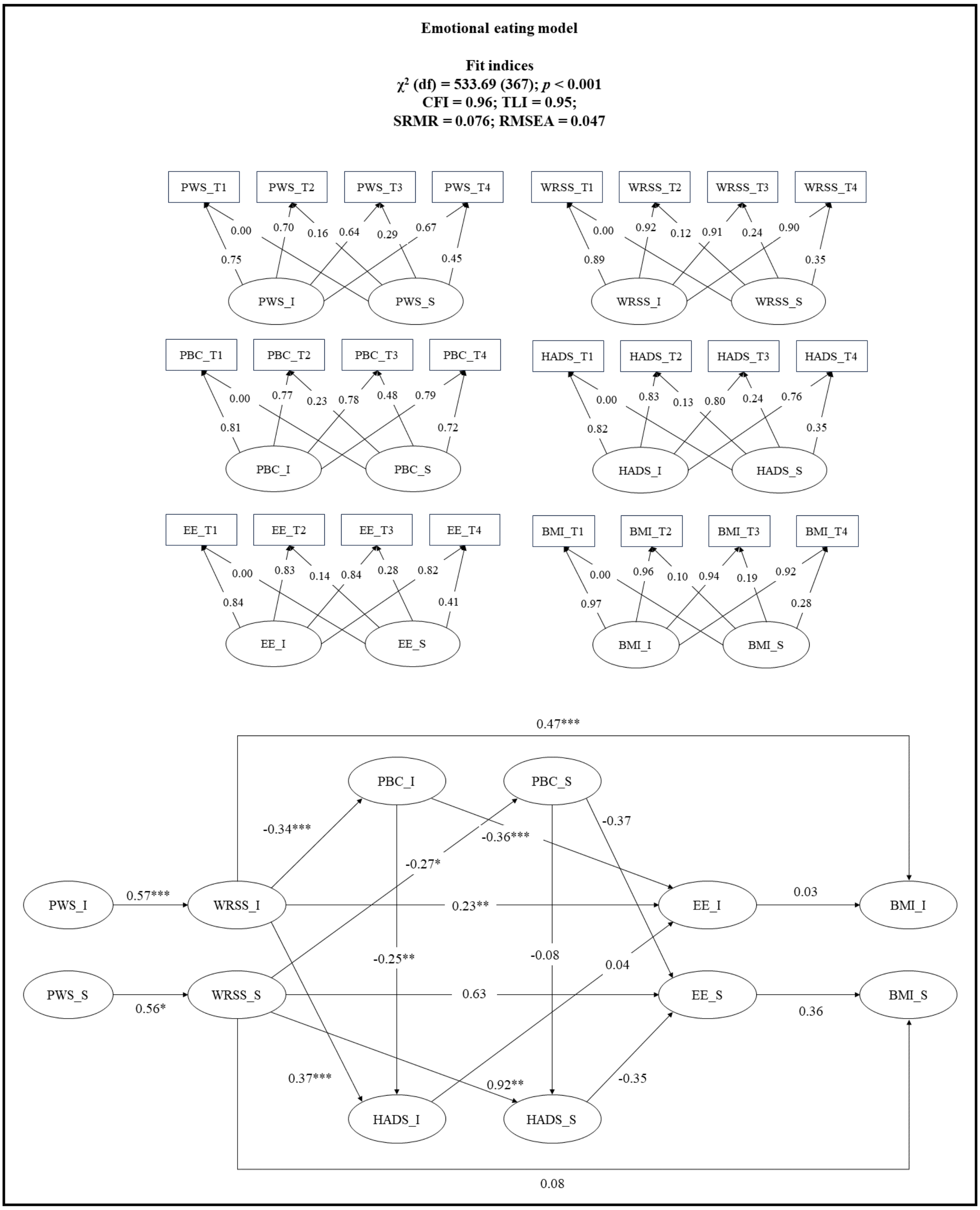


Note. BMI = Body Mass Index; PWS = perceived weight stigma; WRSS = weight-related self-stigma; HADS = psychological distress; PBC = perceived behavioral control for avoiding eating behaviors; UE = uncontrolled eating; T1 = Time 1; T2 = Time 2; T3 = Time; T4 = Time

4. The upper part of the figure illustrates each pair of the latent intercept (I) and latent slope (S) of the variables, the lower part illustrates the parallel process between latent variables. All path coefficients presented are standardized coefficients. * $p < 0.05$. ** $p < 0.01$. *** $p < 0.001$.

Figure 12

The PP-LGCM for Emotional Eating



Note. BMI = Body Mass Index; PWS = perceived weight stigma; WRSS = weight-related self-stigma; HADS = psychological distress; PBC = perceived behavioral control for avoiding eating behaviors; EE = emotional eating; T1 = Time 1; T2 = Time 2; T3 = Time; T4 = Time 4.

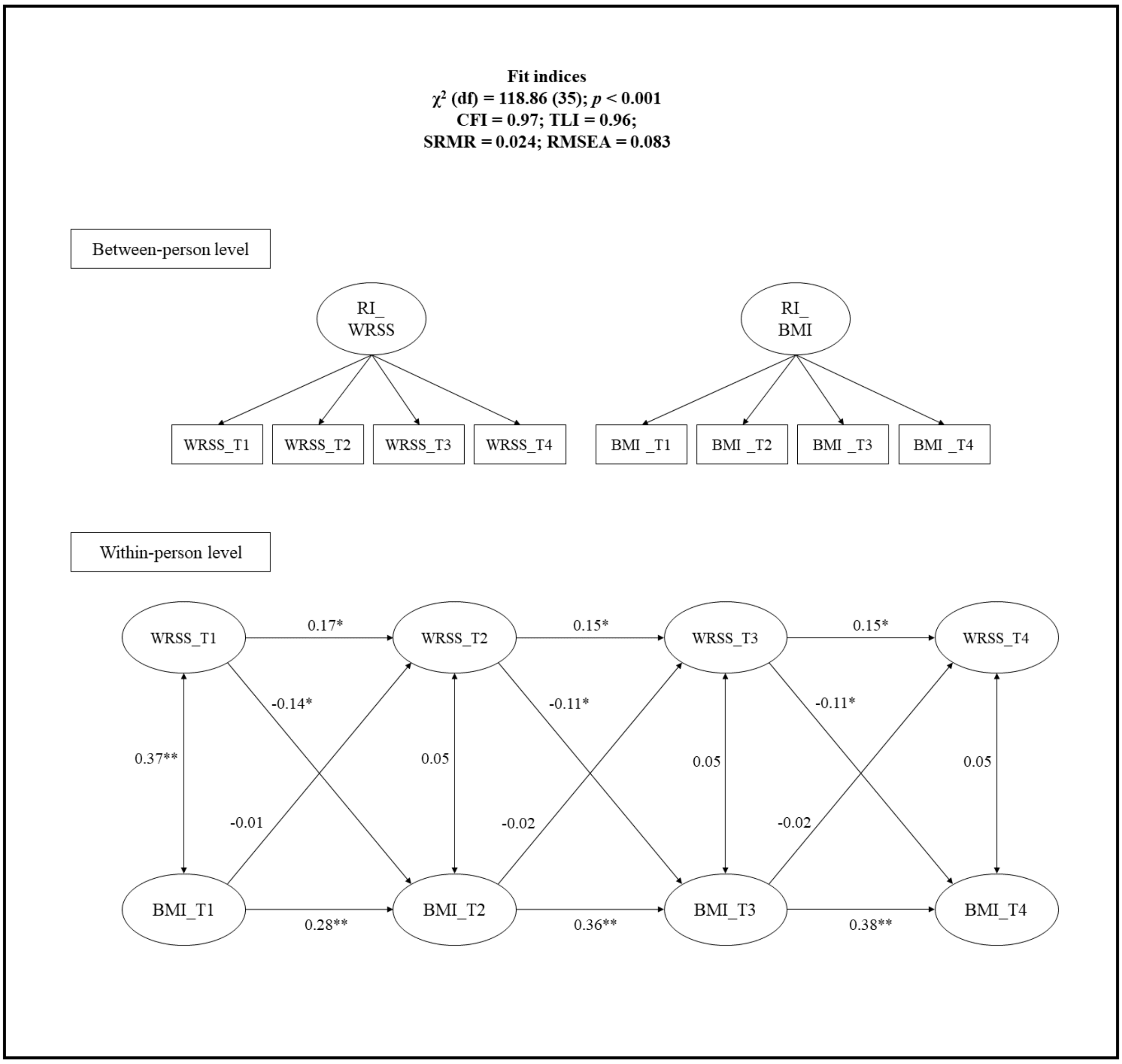
The upper part of the figure illustrates each pair of the latent intercept (I) and latent slope (S) of the variables, the lower part illustrates the parallel process between latent variables. All path coefficients presented are standardized coefficients. * $p < 0.05$. ** $p < 0.01$. *** $p < 0.001$.

5.3.5. *Model Fit of the RI-CLPM on the Relationship Between WRSS and BMI*

The proposed RI-CLPM (Figure 13) had acceptable fits (CFI = 0.97, TLI = 0.96, RMSEA = 0.083, and SRMR = 0.024). There were significant associations between preceding WRSS and subsequent BMI from Time 1 to Time 2 (standardized coefficient = -0.14; p = 0.032), Time 2 to Time 3 (standardized coefficient = -0.11; p = 0.032), and Time 3 to Time 4 (standardized coefficient = -0.11; p = 0.032). However, no significant associations were found between preceding BMI and subsequent WRSS, from Time 1 to Time 2 (standardized coefficient = -0.01; p = 0.806), Time 2 to Time 3 (standardized coefficient = -0.02; p = 0.806), and Time 3 to Time 4 (standardized coefficient = -0.02; p = 0.806). In other words, the model suggested that while higher WRSS contributed to a lower subsequent BMI, the BMI did not affect the subsequent WRSS.

Figure 13

The RI-CLPM on the Relationship Between WRSS and BMI



Note. WRSS = weight-related self-stigma; BMI = Body Mass Index; T1 = Time 1; T2 = Time 2; T3 = Time; T4 = Time 4. * $p < 0.05$. ** $p < 0.01$.

5.4. Discussion

The present study attempted to investigate the temporal associations between perceived stigma, self-stigma, PBC, psychological distress, PA, and BMI, by using the one-year longitudinal data collected (i.e., Objective 3 of this thesis). RM-ANCOVA suggested that there were no significant differences between time points. However, the high WRSS group consistently suffered from more significant issues with BMI, PWS, psychological distress, PBC for PA, PBC for avoiding eating behaviors, uncontrolled eating, and emotional eating. With the analysis of PP-LGCM, this study significantly identified most of the proposed relationships between the initial level of the variables; however, for the growth rate of the variables, only the relationships between perceived stigma, self-stigma, PBC, and psychological distress were found. In this regard, the study contributes to understanding the relationships between the changes in perceived stigma and self-stigma, between the changes in PBC (avoiding eating behavior) and self-stigma, and between the changes in self-stigma and psychological distress among young adults. Furthermore, to achieve Objective 4 of this thesis, RI-CLPM was performed. The results from RI-CLPM indicated that WRSS was negatively associated with future BMI, but BMI was not associated with future WRSS. In this regard, no feedback loop was found in the current study.

5.4.1. *Temporal Associations Between PWS and WRSS*

Regarding the temporal associations between perceived stigma and self-stigma, the results found in the current study are consistent with the existing literature. For instance, a three-month longitudinal study in Taiwan found that the changes in perceived weight stigma was associated with the changes in internalized weight stigma among university students (Y.-C. Lin et al., 2023). The significant association in the current one-year study from a Hong Kong adult sample continues to indicate that as people are aware they are being stigmatized, they are very likely to agree and turn their thoughts into their own, hence producing self-stigma (Corrigan & Rao, 2012; Puhl & Heuer, 2009). In other words, the results are consistent with the speculation that perceived stigma modifies people's point of view and justifies the discrimination (Major et al., 2018). This finding underscores the importance of addressing attitudes and stereotypes from society to prevent this internalization process.

5.4.2. *Temporal Associations Between WRSS and Psychological Distress*

Furthermore, there is also a significant longitudinal relationship between weight self-stigma and psychological distress, which includes depression and anxiety in the measure. Existing literature has suggested that people who experience weight self-stigma often suffer from psychological issues such as depression and anxiety (Huang et al., 2022). A meta-analysis indicated that there were not many longitudinal studies on weight self-stigma and psychological distress (Alimoradi et al., 2020). The current study adds further support to this relationship. This relationship can be explained by the fact that weight self-stigma leads to a negative self-perception and feelings of worthlessness, which may lead to or worsen mental health issues. However, future studies should investigate any factor that contributes to the non-significant temporal association between perceived behavioral control and psychological distress in this study.

5.4.3. *Temporal Associations Between WRSS and PBC*

Another significant longitudinal association is the relationship between weight self-stigma and perceived behavioral control. Results in the current study suggested that a higher weight self-stigma leads to a lower sense of being capable of controlling their behavior. This relationship is not only evident cross-sectionally but also longitudinally, where persistent weight self-stigma over time is associated with continued low perceived behavioral control. This relationship suggests that weight self-stigma influences one's confidence in making positive health-related behavioral changes. It is in accordance with a cross-sectional study in the US, where weight self-stigma was associated with self-efficacy in managing eating (Pearl et al., 2020). Furthermore, weight self-stigma can undermine self-control through the elevation of perceived threats and uncertainty (Duckworth et al., 2013). This impairment affects a range of different dimensions of self-control, such as attentional, behavioral, and emotional impulses. In particular, the perception of devaluation from self-stigma is uncontrollable, which might further worsen these effects, leading to a decrease in perceived behavioral control (Duckworth et al., 2013). Results of the current study further support this association where weight self-stigma is consistently linked to decreased perceived behavioral control. In addition, national research with a 20-year follow-up from the United States indicated that there were significant decreases in overall and general perceived control among young adults compared to middle age (Cerino et al., 2024). Further, the perceived daily control (i.e., dealing with specific daily life activities and stressors) suffered from more significant declines than the overall perceived control (Cerino et al., 2024). Therefore, along with my study results, evidence illustrates that there is a need to address the problem of declined perceived behavioral control caused by self-stigma among young adults. Future studies could investigate, for example, whether weight stigma reduction programs can help resume the perceived control of weight management behaviors.

5.4.4. *Insignificance of the Bidirectional Association Between WRSS and BMI*

Recently, some studies published within a year have also attempted to investigate the longitudinal relationship between weight stigma and weight changes, e.g., two observational studies (K. M. Lee et al., 2024; Y.-C. Lin et al., 2023) and one intervention study (Sheynblyum et al., 2024).

For instance, a study by Lin et al. (2023) focuses on college students in Taiwan, revealing a significant association between WRSS and BMI. Their longitudinal data showed that an increase in WRSS was associated with an increase in BMI, suggesting that stigma not only affects psychological well-being but also has a physiological impact. However, the authors also noted that one of the study’s limitations was the three-month study period, and they suggested that longitudinal effects should be examined over longer time frames in future studies (Y.-C. Lin et al., 2023). The current study with a 1-year time frame, instead, found the opposite result. The result from RI-CLPM suggested a negative association between WRSS and BMI in the subsequent measures. Namely, a higher level of WRSS results in a lower BMI, or a lower level of WRSS results in a higher BMI. This result challenges the commonly held belief that a higher level of weight stigma contributes to higher weight. The results of the current may not capture the full picture, as there could be other factors not examined that potentially influence or elucidate the negative association between weight-related stigma and weight changes. Future studies should explore the underlying factors that may have contributed to this situation.

Lee et al. (2024) investigate how weight stigma functions as a stressor, contributing to a cycle of adverse health outcomes. Their one-year longitudinal study involved 348 individuals with higher weight in the United States. The findings revealed that weight stigma was significantly associated with increased perceived stress and comfort eating behaviors. Although comfort eating did not predict weight changes over the subsequent four-month periods, they found that weight was associated with greater daily experience of weight stigma over the subsequent four-month periods (K. M. Lee et al., 2024). Consistent with their study, results from PP-LGCM in the current study did not find significant longitudinal relationships between eating behaviors (including emotional eating and uncontrolled eating) and BMI. This might be due to the fact that a one-year study with four time points is still not long enough to observe the weight changes. On the other hand, a significant association between weight and subsequent weight stigma, though it was a relatively weak association, was found by Lee et al. (2024). However, the current study failed to find a significant relationship, which may be due to the measure of different types of weight stigma. Lee et al. (2024) studied the daily experienced weight stigma, whereas my study measured WRSS, which is the internalization of stigma. Again, the time could be matters. It is possible that WRSS requires additional time for the process of internalization. Hence, the changes are difficult to detect in the current study time frame, suggesting the need for longer-term longitudinal research to better understand the relationship between weight stigma internalization and its consequences. On the other hand, it might also be possible that the level of WRSS might not increase further, indicating a static relationship.

Sheynblyum et al. (2024) examined the longitudinal effects of WRSS on physical activity and weight changes in a 72-week behavioral weight loss intervention. Their findings indicated that a greater reduction in WRSS was associated with greater weight loss in the future. Furthermore, they found that physical activity did not mediate the relationship between WRSS and weight changes (Sheynblyum et al., 2024), which is similar to the current study regarding the non-significant longitudinal relationship between physical activity and BMI. This suggested that other factors may influence the relationship between weight stigma, weight management behaviors, and weight changes. The lack of a significant relationship may also stem from various external influences, such as environmental and social factors that potentially exert a more substantial impact on individuals' motivation, social support, access to resources, and time allocation towards daily commitments, all of which could influence their willingness and opportunity to engage in physical activity (Herazo-Beltrán et al., 2017; Koh et al., 2022). The study by Sheynblyum et al. (2024) did not examine the relationship between weight change and subsequent weight stigma. Nevertheless, research on weight or stigma reduction programs appears to be a suitable approach for investigating this bidirectional relationship. Since both weight and stigma changes can be gradual, reduction programs might facilitate the study of these dynamics over time.

One of the potential factors that might have contributed to the insignificant results of the longitudinal relationships could be the local situation of COVID-19 in Hong Kong during the data collection period because of the changes in eating habits and physical activities (Wang et al., 2021). Notably, in that one year, Hong Kong had gone through the fourth to fifth wave (the most severe wave) of the epidemic (S.-C. Wong et al., 2022). Due to the situation, Hong

Kong has faced numerous rapid changes in terms of the seriousness of the epidemic, accompanied by preventive measures, including social distancing measures, quarantine, Vaccine Pass (limited access to public places), restricted dine-in service hours, closure of sports premises (indoor and outdoor venues) and fitness centers (The Government of the Hong Kong Special Administrative Region, 2021, 2022a, 2022b). Furthermore, the government implemented a timely and flexible approach, i.e., restricting or relaxing measures based on the situation of COVID-19, meaning that these preventive measures were frequently adjusted back and forth within a few months (The Government of the Hong Kong Special Administrative Region, 2022b, 2022c). Therefore, apart from the infection and quarantine, the closure of sports venues and the limited access based on the Vaccine Pass could significantly affect the level of PA and their PBC in that year and affect their habit or consistency in performing physical activity. Although the questionnaire asked for the perceived impact of COVID-19 on PA, it might not be that simple to use it to adjust for the changes. Similarly, since the dine-in service hours were restricted (The Government of the Hong Kong Special Administrative Region, 2022d), in addition to wearing masks and being concerned about being infected, it might reduce people's eating behaviors outside. Eating at home and/or eating alone during COVID-19 might also have an impact on the eating pattern (McCormack & Peng, 2024; Mensah & Tuomainen, 2024) and be associated with more maladaptive eating behaviors (Freizinger et al., 2022).

5.4.5. *Limitations*

There were some limitations in the current study. First, all measures of the variables were self-reported. The self-reported nature of the measures may lead to potential biases, such as recall bias in estimating physical activity duration and the influence of social desirability or approval in responding to questions about weight stigma and weight. Additionally, the study sample might not be generalized to the general young adults, as the snowball sampling was started from universities and potentially lacked diversity, such as occupations with different lifestyles. This study did not ask for participants' employment status, so the ratio of students to workers remains unclear. However, based on the school attendance rate from the Census and Statistics Department (2023), 55.8% of individuals aged 18 to 24 were attending school, while only 0.8% of those aged 25 or older were attending. Therefore, although this may not be entirely accurate, it can be roughly inferred that 64.9% were students and 35.1% were workers in my study according to their age. Furthermore, as discussed in the previous section, the study time frame of the current longitudinal study might still fall short when considering the stigma internalization and weight changes. Future studies should explore longitudinal effects over extended periods.

Chapter 6 General Discussion and Conclusion

The focus of this thesis was to investigate how weight stigma influences people's weight management behaviors. The objectives included (1) examine how weight-related self-stigma (WRSS) is associated with physical activity (PA), (2) examine how WRSS is associated with eating behaviors, (3) examine the interplay between perceived weight stigma (PWS), WRSS, psychological distress, perceived behavioral control, PA, and eating behaviors in a longitudinal study, and (4) examine the bidirectional relationship between WRSS and weight change in a longitudinal study. To achieve these objectives, three studies were conducted, including two cross-sectional studies and one longitudinal study. The first cross-sectional study (Chapter 3) corresponds to the first objective, which investigated whether WRSS can be added to the Theory of Planned Behavior (TPB) model as an extension and to understand how WRSS influences PA. The second cross-sectional study (Chapter 4) corresponds to the second objective, which investigated whether WRSS can be added to the TPB model as an extension and to understand how WRSS influences eating behaviors. The one-year longitudinal study (Chapter 5) corresponds to the third and fourth objectives, which investigated the process from stigma formation to body mass index (BMI) change, focusing on the growth trajectories and how these trajectories interact over time. The researcher also examined how changes in WRSS and BMI within an individual can predict changes in each other across different time points.

6.1. Key Findings From Chapter 3

Chapter 3 used an extended TPB model, which added WRSS to better understand the motivations behind PA in individuals with varying weight statuses. The study's methodology involved a survey of 325 university students, examining their PA levels, TPB factors (attitude, subjective norm, perceived behavioral control [PBC-PA], and behavioral intention), and levels of WRSS. The key findings indicate that WRSS significantly impacts PBC-PA, behavioral intentions, and, most importantly, PA engagement, especially among individuals who are overweight. The extended TPB model showed a good fit in the structural equation modeling (SEM). However, significant differences were noted between the overweight and non-overweight groups in the paths associated with these psychosocial variables to PA.

6.2. Key Findings From Chapter 4

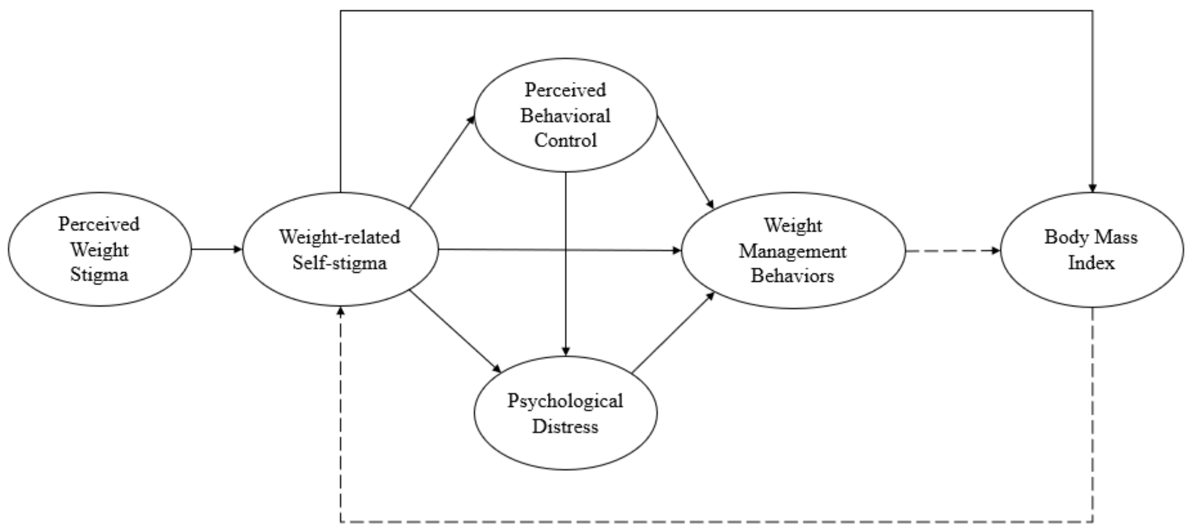
In a similar vein, the study in Chapter 4 used a TPB model extended by WRSS to understand better the motivations behind avoiding eating behaviors in individuals with varying weight statuses. The study recruited 348 adults aged 18-30 to assess their eating behaviors, WRSS, and TPB factors using validated questionnaires. Notably, the intention to avoid eating behaviors did not consistently lead to a reduction in such behaviors, and in some instances, it was associated with an increase, shedding light on the intention-behavior gap. Further, WRSS significantly reduced perceived behavioral control for avoiding eating behaviors (PBC-EB). The study also highlighted the significant role of WRSS, which, despite strengthening the intention to avoid eating behaviors, might increase uncontrolled eating and emotional eating due to the emotional impact of WRSS.

6.3. Key Findings From Chapter 5

As the two cross-sectional studies consistently found significant relationships between WRSS and perceived behavioral control, the PBC-PA and the PBC-EB were also adopted to the longitudinal models. In Chapter 5, the researcher presented the one-year longitudinal study on PWS, WRSS, PBC-PA, PBC-EB, psychological distress, and BMI. The initial sample size was 345 participants, and the study was able to retain 251 participants in Time 2, 232 participants of the original 345 in Time 3, and 234 participants of the original 345 in Time 4. The findings indicated that despite the stability of the examined variables over time, individuals in the high WRSS group consistently exhibited higher levels of BMI, PWS, psychological distress, uncontrolled eating, and emotional eating compared to the low WRSS group. In addition, the high WRSS group demonstrated consistently lower PBC-PA and PBC-EB relative to the low WRSS group. Results from the parallel-process latent growth curve models indicated that the temporal associations were limited to the relationships between PWS and WRSS, WRSS and psychological distress, PBC-PA and psychological distress, and WRSS and PBC-EB. Namely, the growth trajectories of the studied variables were not associated with the growth trajectories in BMI. On the other hand, results from the random intercept cross-lagged panel model showed that WRSS was negatively associated with subsequent BMI, but BMI was not associated with subsequent WRSS. Taken together, the conceptual model was revised (Figure 14). Specifically, this longitudinal study found no evidence that a change in weight management behaviors was related to a change in BMI; furthermore, BMI would neither increase nor decrease the level of WRSS at a later time.

Figure 14

The Revised Conceptual Model of Weight Stigma Process



Note. The solid lines represent significant temporal associations, while the dashed lines represent insignificant associations based on the findings of this thesis.

6.4. Implications and Significance

6.4.1. *Theoretical Consideration*

To the best of my knowledge, the longitudinal study in this thesis is not the first to investigate the temporal association between weight stigma and weight change, but it is one of the few that further examined the associations with perceived behavioral control, psychological distress, physical activity, and eating behaviors.

Studies in Chapters 3 and 4 of this thesis also successfully extended the TPB by adding WRSS to explain physical activity and eating behaviors. However, results from these studies also indicated that factors in TPB, such as behavioral intention, may not be capable of accounting for the two studied behaviors. Namely, the intention-behavior gap was found, which is consistent with existing literature (Conner & Norman, 2022). Instead, WRSS played a more influential role in explaining the two behaviors in this thesis. Further, the researcher decided to adopt only PBC in the conceptual model of the third study due to the observed relationship between WRSS and PBC. Moreover, the TPB might lack consideration of other influences, such as the emotional aspect. For instance, a recent study on purchasing organic food in biodegradable and compostable packaging suggested that the TPB, when extended with both positive and negative emotions, explained more variance in intention compared to the TPB used alone (Lombardi et al., 2024). Furthermore, using the rational-emotional model, which included both rational factors (e.g., cognitive benefits and concerns) and emotion, was even better in explaining the intention (Lombardi et al., 2024). On the other hand, traditional theories like the TPB are unable to take care of contemporary issues, e.g., misinformation from the internet. The spread of health misinformation online and through social media has been a major issue in recent years (Kbaier et al., 2024). Misinformation about diet is one example (Suarez-Lledo & Alvarez-Galvez, 2021). Incorrect information from the internet and social media can shape inappropriate attitudes and subjective norms about health behaviors, leading to potentially inaccurate predictions by the TPB. Therefore, the original TPB might not always be suitable for every study context. Yet, TPB provides a theoretical basis for consideration.

Researchers should be aware of the flexibility to expand it or adopt some of the factors from it to fit with their study context.

Although the current longitudinal study did not find a significant relationship between BMI and subsequent WRSS, one interesting situation was found, which is the negative relationship between WRSS and subsequent BMI. The direction of this relationship may indicate a new situation that could happen, yet the relationship between the two variables is still understudied and inconclusive. Implications from the findings mentioned above include a better understanding of weight management, which emphasizes the detrimental role of WRSS.

6.4.2. *Situation on Weight Stigma in Hong Kong*

Research studies on weight stigma or weight discrimination in Hong Kong are relatively few. A survey by the Hong Kong Obesity Society reported that people in Hong Kong generally hold negative views towards individuals with obesity (Hong Kong Obesity Society, 2022). Among 559 respondents, 67% considered individuals with obesity are lazy for exercising, 62% think they often binge eat, and over 50% feel they lack willpower (Hong Kong Obesity Society, 2022). The findings from this thesis provide a further understanding of Hong Kong's situation. For example, using results from Chapter 5, more than half of the participants (56.2%) reported at least one perceived weight stigma situation. Furthermore, 29.3% of the participants were in the high WRSS group, and results showed that they have worse conditions in terms of higher BMI, higher level of psychological distress, lower level of PBC, and higher tendency to uncontrolled eating and emotional eating. These results indicated notable concerns about weight stigma in Hong Kong that need to be addressed in several aspects, such as education for the public and stigma reduction programs.

6.4.3. *Social Interaction in Daily Life and the Digital Era*

In our daily lives, urging people to lose weight, criticizing their inaction, or even teasing them produces no advantage for them to perform weight management behaviors. Instead, there is a higher likelihood of imposing weight stigma, which, in turn, increases their WRSS and reduces their perceived behavioral control to engage in physical activity and avoid inappropriate eating behaviors. The results alerted the general public on how to communicate and interact with people who are overweight or obese. To better practice weight management, caring, and peer support are essential, rather than providing insensitive comments or attributing to the individual ability and willpower.

In recent decades, technological advancements have made the internet, along with social media, a significant platform for social interaction. Individuals can freely access a wealth of information and express their attitudes. Social media has influenced people's attitudes and perceptions of body and beauty standards (Holland & Tiggemann, 2016). Engagements on social media and interaction, such as comments and likes, significantly impact one's confidence level (Syaifussalam et al., 2024). Furthermore, frequent use of social media leads to body image dissatisfaction and experience of weight stigma (Fung et al., 2021; Malloy et al., 2024). Thus, the internet and social media could be turned into a battlefield for addressing the issue of weight stigma. People should consider ways to present an appropriate and fair manner towards the spectrum of weight status. For example, there was a hashtag movement (#bodypositivity) to promote a positive attitude toward diverse body images. On one hand, it raised public awareness; on the other hand, it also faced challenges as people used the hashtag in connection with weight loss and ideal images (Khonach & Kurz, 2024). Incorporating social media companies might help the situation of the distorted culture, e.g., how to refine algorithms to provide neutral content to the public appropriately.

6.4.4. *Public Health Policy and Education*

The findings could offer evidence to support policy reforms addressing weight stigma as a public health issue. To minimize potential stigmatization, public health campaigns could emphasize overall health and well-being rather than solely focusing on weight loss. Schools and public seminars should provide education not only on overweight and obesity but also on weight stigma to raise public awareness. Additional training or education on weight stigma for healthcare providers and educators could also be beneficial. For example, promoting the integration of stigma-reduction techniques and sensitivity training in medical education and continuing professional development programs. There were studies on mental illness stigma reduction in Hong Kong, e.g., a mental health course at university that changed attitudes towards mental illness (P. W. C. Wong et al., 2019). Similar education on weight stigma is worth developing and investigating.

6.4.5. *Clinical Practice and Interventions*

Gaining a deeper understanding of the connection between weight stigma and psychological distress can improve mental health services, leading to more compassionate and effective support for individuals dealing with issues related to being overweight, weight stigma, and associated psychological challenges. It is also suggested that weight management programs or interventions should address the detrimental effects of WRSS and focus on enhancing PBC-PA and PBC-EB in order to promote PA and reduce inappropriate eating behaviors. For instance, programs targeted at healthy behaviors, such as PA, should be tailored according to weight status, with particular attention to reducing WRSS and resuming PBC-PA to enhance PA engagement in overweight individuals.

Understanding how weight stigma can undermine traditional weight management strategies may lead to improved approaches that address both the physical and psychological aspects of weight concerns. The study also emphasizes the need for psychosocial approaches to weight management that address both the psychological and social barriers to physical activity and control eating behaviors, as people may suffer from psychological distress due to stigma, which hinders their efforts in interventions. For example, there has been a recent development in cognitive-behavioral intervention for WRSS (Pearl et al., 2023). Preliminary evidence from pilot studies suggests that the program can effectively reduce WRSS and improve psychological outcomes, though some effects may only last for a short period at the current stage, and its long-term effects are still being investigated (Pearl et al., 2023). Furthermore, a review article suggested that psychological interventions for WRSS were effective (D’Adamo et al., 2024). Effective interventions for WRSS consist of cognitive-behavioral modules aimed at WRSS for behavioral weight reduction treatment or acceptance and commitment strategies (D’Adamo et al., 2024). The content of such interventions could be periodically updated to incorporate the latest research findings. The insights obtained from this thesis, combined with existing literature, may contribute to the development of successful interventions aimed at reducing stigma and ultimately promoting health. In addition, future research could explore strategies to close the intention-behavior gap and assess the influence of social support on mitigating the impact of stigma.

On the other hand, digital interventions should be explored in consideration of the aforementioned influence from the internet and social media. For instance, Smith et al. (2023) developed a digital intervention by advertising on social media. It is a single session consisting of self-reflection, psychoeducation, and exercises to counter negative thoughts was presented online to promote body neutrality, with positive feedback from participants. Furthermore, the literature indicated digital health tools, such as mobile applications, were effective for weight loss (Ufholz & Werner, 2023). Research shows that people who utilize applications to record and monitor their meals, physical activity, and weight generally achieve greater weight loss than those who do not (Ufholz & Werner, 2023). In addition, it has been found that a web-based weight loss program is effective and can provide personalized feedback (Beleigoli et al., 2020). However, a study of a 12-week online weight loss program indicated that individuals experiencing high levels of weight stigma were more likely to drop out (Schram et al., 2024). Olson et al. (2021) discussed the situation of commercial applications for weight loss and weight-related behaviors, which may contain stigmatizing language that could have adverse effects. These findings showed that weight stigma is still a significant issue that must be tackled in the digital era, and research on managing weight and weight stigma online is currently insufficient.

6.5. Future Direction

Studies on weight stigma in the future could be designed with more extended time frames to observe stigma and weight changes. Objective measurement should also be used, such as measuring weight in research facilities instead of self-reported, using accelerometers to quantify PA levels (Trost & O'Neil, 2014), or using technologies to monitor food choices and detect eating actions (Rantala et al., 2022). On the psychological aspect, additional variables could be investigated to depict a more compressive picture to understand weight stigma. For instance, psychological resilience could be one of the variables that worth investigate in the context of weight stigma. Prior research has shown that greater psychological resilience is associated with reduced self-stigma and enhanced stigma resistance among individuals with mental health conditions (Post et al., 2021). Similarly, resilience has been found to mediate the relationship between stigma and social avoidance in infertility patients (Zhao et al., 2022). Therefore, resilience may serve a preventive role by mitigating the development of self-stigma and its subsequent issues, and fostering stigma resistance, which merits further investigation in the context of weight stigma.

6.6. Conclusion

Throughout this thesis, the studies conducted consistently highlighted the adverse effects of weight stigma, especially, WRSS on weight management. Using the proposed models, perceived behavioral control was the major variable that suffered from WRSS, and the diminished perceived behavioral control might hinder one's engagement in weight management behaviors such as PA and avoiding inappropriate eating behaviors. Furthermore, while people who were overweight showed significantly greater reduce in perceived behavioral control due to WRSS, attention should also be given to the fact that the significant relationship also exist in people who are non-overweight. Moreover, temporal associations between WRSS, perceived behavioral control, and psychological distress have been found. However, the study in this thesis was unable to offer further support regarding the potential feedback loop between weight stigma and weight change. Findings from this thesis suggest that additional research is still required to understand whether weight stigma could be affected by weight gain.

APPENDICES

Appendix A. The Ethical Approval Documents

THE HONG KONG POLYTECHNIC UNIVERSITY
香港理工大學

To	Lin Chung-Ying (Department of Rehabilitation Sciences)		
From	Man Wai Kwong, Chair, Departmental Research Committee		
Email	david.man@	Date	12-Dec-2017

Application for Ethical Review for Teaching/Research Involving Human Subjects

I write to inform you that approval has been given to your application for human subjects ethics review of the following project for a period from 30-Dec-2017 to 30-Nov-2020:

Project Title:	Understanding the Factors that Contribute to Obesity in Young Adults
Department:	Department of Rehabilitation Sciences
Principal Investigator:	Lin Chung-Ying
Project Start Date:	30-Dec-2017
Reference Number:	HSEARS20171212002

You will be held responsible for the ethical approval granted for the project and the ethical conduct of the personnel involved in the project. In the case of the Co-PI, if any, has also obtained ethical approval for the project, the Co-PI will also assume the responsibility in respect of the ethical approval (in relation to the areas of expertise of respective Co-PI in accordance with the stipulations given by the approving authority).

You are responsible for informing the Human Subjects Ethics Sub-committee in advance of any changes in the proposal or procedures which may affect the validity of this ethical approval.

Man Wai Kwong

Chair

Departmental Research Committee

THE HONG KONG POLYTECHNIC UNIVERSITY
香港理工大學

To	Siu Man Hong Andrew (Department of Rehabilitation Sciences)
From	Yee Kay Yan Benjamin, Delegate, Departmental Research Committee
Email	benjamin.yee@ Date 23-Nov-2020

Application for Ethical Review for Teaching/Research Involving Human Subjects

I write to inform you that approval has been given to your application for human subjects ethics review of the following project for a period from 01-Dec-2020 to 30-Nov-2022:

Project Title:	Modeling the effect of weight stigma on weight management behaviors and psychological distress among young adults: A prospective study
Department:	Department of Rehabilitation Sciences
Principal Investigator:	Siu Man Hong Andrew
Project Start Date:	01-Dec-2020
Reference Number:	HSEARS20201120002

You will be held responsible for the ethical approval granted for the project and the ethical conduct of the personnel involved in the project. In case the Co-PI, if any, has also obtained ethical approval for the project, the Co-PI will also assume the responsibility in respect of the ethical approval (in relation to the areas of expertise of respective Co-PI in accordance with the stipulations given by the approving authority).

You are responsible for informing the Human Subjects Ethics Sub-committee in advance of any changes in the proposal or procedures which may affect the validity of this ethical approval.

Yee Kay Yan Benjamin

Delegate

Departmental Research Committee (on behalf of Human Subjects Ethics Sub-Committee)

Appendix B. Chinese version of the Weight Bias Internalization Scale (WBIS)

以下是一些句子形容你對自己的感受。如果你非常同意該句子請選 5 ，如果你同意句子便選 4，對句子沒有特別感受請選 3，不同意便選 2，非常不同意的話請你選 1 。

	句子				
1	我的體重讓我覺得自己與其他人一樣能幹。				
	1 非常不同意	2 不同意	3 中立	4 同意	5 非常同意
2	因為我的體重，我比別人欠缺吸引力。				
	1 非常不同意	2 不同意	3 中立	4 同意	5 非常同意
3	我會因別人的想法而對我的體重感到不安。				
	1 非常不同意	2 不同意	3 中立	4 同意	5 非常同意
4	我希望能大幅改變自己的體重。				
	1 非常不同意	2 不同意	3 中立	4 同意	5 非常同意
5	每當我想到自己的體重時，我會感到心情不好。				
	1 非常不同意	2 不同意	3 中立	4 同意	5 非常同意
6	我討厭我的體重。				
	1 非常不同意	2 不同意	3 中立	4 同意	5 非常同意
7	我主要用體重去判斷我作為一個人的價值。				
	1 非常不同意	2 不同意	3 中立	4 同意	5 非常同意
8	因為我的體重，我不認為我值得擁有真正美滿的社交生活。				
	1 非常不同意	2 不同意	3 中立	4 同意	5 非常同意
9	我能接受現在的體重。				
	1 非常不同意	2 不同意	3 中立	4 同意	5 非常同意
10	因為我的體重，我不能感受到真正的自我。				
	1 非常不同意	2 不同意	3 中立	4 同意	5 非常同意
11	因為我的體重，我不認為會有吸引力的人想和我交朋友。				
	1 非常不同意	2 不同意	3 中立	4 同意	5 非常同意

Appendix C. Chinese version of Perceived Weight Stigma Scale (PWSS)

以下是一些句子形容你與他人的相處情況。如果該句子描述的情況曾發生請回答「是」，如果從未發生請回答「否」。你曾否**因自己的體重**而有以下的經歷和感受?

	句子	
1	人們似乎認為你比不上他們。	是 / 否
2	人們似乎認為你不聰明。	是 / 否
3	人們似乎害怕你。	是 / 否
4	相比他人，你受到較不禮貌的對待。.	是 / 否
5	相比他人，你受到較少的尊重 。	是 / 否
6	在商店或餐廳時受到較差的服務。	是 / 否
7	人們似乎認為你不誠實。	是 / 否
8	別人用令你不開心的說法去稱呼你。	是 / 否
9	別人令你感到害怕或麻煩。	是 / 否
10	你在社交場合不受別人喜愛（例如：學校）。	是 / 否

Appendix D. Theory of Planned Behavior measures for physical activity in Chinese

Attitude

1. 我認為每週運動三天，每次最少三十分鐘是... 不愉快 - 愉快
2. 我認為每週運動三天，每次最少三十分鐘是... 不好的 - 好的
3. 我認為每週運動三天，每次最少三十分鐘是... 有害 - 有益
4. 我認為每週運動三天，每次最少三十分鐘是... 愚蠢 - 明智
5. 我認為每週運動三天，每次最少三十分鐘是... 不正確 - 正確
6. 我認為每週運動三天，每次最少三十分鐘是... 不享受 - 享受
7. 我認為每週運動三天，每次最少三十分鐘是... 不令人滿足的 - 令人滿足的
8. 我認為每週運動三天，每次最少三十分鐘是... 沒有用處 - 有用處

Subjective norm

1. 對我重要的人會鼓勵我每週運動三天，每次最少三十分鐘
2. 在社會的壓力下我必須每週運動三天，每次最少三十分鐘
3. 我被期望每週運動三天，每次最少三十分鐘

Perceived behavioral control

如果你需要在下週開始運動三天，每次最少三十分鐘......

1. 你認為你有自我控制能力。
2. 你認為成功與否完全取決於自己。
3. 你認為你有很大的信心。
4. 你在很大程度上認為自己有能力做到。

Behavioral intention

1. 我計劃由現在開始每星期運動三次，每次最少三十分鐘
2. 我會嘗試由現在開始每星期運動三次，每次最少三十分鐘
3. 我有意由現在開始每星期運動三次，每次最少三十分鐘

Appendix E. Theory of Planned Behavior measures for avoiding eating behaviors in Chinese.

Attitude

1. 我認為避免 飲食失調 是... 不愉快 - 愉快
2. 我認為避免 飲食失調 是... 不好的 - 好的
3. 我認為避免 飲食失調 是... 有害 - 有益
4. 我認為避免 飲食失調 是... 愚蠢 - 明智
5. 我認為避免 飲食失調 是... 不正確 - 正確
6. 我認為避免 飲食失調 是... 不享受 - 享受
7. 我認為避免 飲食失調 是... 不令人滿足的 - 令人滿足的
8. 我認為避免 飲食失調 是... 沒有用處 - 有用處

Subjective norm

1. 對我重要的人會鼓勵我避免飲食失調
3. 在社會的壓力下我必須避免飲食失調
5. 我被期望每天避免飲食失調

Perceived behavioral control

如果你需要在下週避免飲食失調......

1. 你認為你有自我控制能力。
2. 你認為成功與否完全取決於自己。
3. 你認為你有很大的信心。
4. 你在很大程度上認為自己有能力做到。

Behavioral intention

1. 我計畫由現在開始避免飲食失調
2. 我會嘗試由現在開始避免飲食失調
3. 我有意由現在開始避免飲食失調

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