Body Image 40 (2022) 110–115

Contents lists available at ScienceDirect

Body Image

journal homepage: www.journals.elsevier.com/body-image

Is the relationship between BMI and body appreciation explained by body dissatisfaction and body image inflexibility among older adults? A study among older Chinese men and women

Hengyue Zhang[a,1], Jianwen Song[a,1], Yiqing Zhao[a], Anna Brytek-Matera[b,2], Jinbo He[a,*,2]

[a] School of Humanities and Social Science, The Chinese University of Hong Kong, Shenzhen, China
[b] Institute of Psychology, University of Wroclaw, Wroclaw, Poland

ARTICLE INFO

Article history:
Received 18 June 2021
Received in revised form 19 November 2021
Accepted 26 November 2021
Available online 13 December 2021

Keywords:
Body mass index
Body appreciation
Body dissatisfaction
Body image inflexibility
Older adults

ABSTRACT

A number of previous studies reported a link between body mass index (BMI) and body appreciation; however, many of these studies were conducted in Western countries and addressed younger samples. Older adults, especially in East Asia, remain insufficiently examined. Therefore, the objective of this study was to examine the relationship between BMI and body appreciation and to explore two potential mediators, body dissatisfaction and body image inflexibility, as proposed in a previous meta-analysis. A community-based cross-sectional study was performed among 313 older Chinese men and women (M = 67.90, SD = 7.94). Mediation tests were conducted to examine the roles of body dissatisfaction and body image inflexibility in the relationship between BMI and body appreciation. BMI correlated significantly with body appreciation, body dissatisfaction, and body image inflexibility among older women but did not correlate with body appreciation among older men. Body dissatisfaction and body image inflexibility emerged as significant mediators in the relationship between BMI and body appreciation among older Chinese women. Reducing body dissatisfaction and body image inflexibility may be potential targets for helping older women with high BMI to promote their body appreciation.

1. Introduction

As a global public health concern, obesity has been prevalent worldwide, and the prevalence of overweight and obesity has doubled since 1980 (GBD Obesity Collaborators, 2017). In 2015, nearly one-third of the world's population was classified as overweight or obese (Seidell & Halberstadt, 2015). The obesity rate has accelerated at all ages and in all sexes across regions and countries, especially in older adults (Chooi et al., 2019). In China, a nationally representative cross-sectional study suggested that the prevalence of overweight and obesity among adults were 28.1% and 5.2%, respectively (Zhang et al., 2020). In addition, a recent study using the China Health and Retirement Longitudinal Study suggested that the overall prevalence of obesity in middle-aged and older adults in China was 11.53% (Ding et al., 2020).

Overweight and obesity, which are usually represented by a high body mass index (BMI) for adults, are closely related to negative mental and physical health consequences (Shekar & Popkin, 2020; Williams, Mesidor, Winters, Dubbert & Wyatt, 2015) and poor quality of life (Geirsdóttir & Bell, 2021; Lohmann, Goodwin, Chlebowski, Pan, Stambolic & Dowling, 2016; Villareal, Apovian, Kushner & Klein, 2005). One research area that continues to receive more research attention is the negative impacts of overweight and obesity on body image. Ample evidence has shown that overweight or obese individuals are more likely to be dissatisfied with their bodies (e.g., body dissatisfaction; Weinberger, Kersting, Riedel-Heller & Luck-Sikorski, 2016), which has also been confirmed in older adults from Western societies (Kilpela et al., 2021; Mangweth-Matzek et al., 2006; Webster & Tiggemann, 2003). Nevertheless, it should be noted that there are genetic and socioeconomic differences between Asian and Western populations (Ramachandran & Snehalatha, 2010), leading to different impacts of weight status on individual health (Ball, Crawford, Jeffery & Brug, 2010). In other words, prior findings from Western societies about the negative impacts of overweight and obesity on body image might be different in Asia. For example, a previous study showed that the relationship

* Corresponding author.
E-mail addresses: hejinbo@cuhk.edu.cn, anlfhe@gmail.com (J. He).
[1] The two authors contributed equally to the current work.
[2] Anna Brytek-Matera and Jinbo He are the last co-authors.

https://doi.org/10.1016/j.bodyim.2021.11.006
1740-1445/

between BMI and body dissatisfaction significantly differed by ethnicity and sex (Yates et al., 2004). Thus, considering that there has been limited research conducted in Asia about the association between weight status and body image in older adults, more research on this topic is warranted.

Moreover, body image is a multifaceted construct including both negative body image (e.g., body dissatisfaction) and positive body image (e.g., body appreciation) (Grogan, 2017). Extensive research has shown an association between negative body image (e.g., body dissatisfaction) and both mental and physical health in older adults (e.g., Kilpela et al., 2021). Consistent with research findings of a significant relationship between body weight and body dissatisfaction, a recent meta-analysis (He, Sun, Lin & Fan, 2020) found that body weight, as usually represented by body mass index (BMI), had significant negative relations to body appreciation, with a small effect size among men (an adjusted pooled r = −0.11, 95% CI [−0.16, −0.06]) but a close-to-medium effect size (r = −0.27, 95% CI [−0.30, −0.24]) among women. It is worth noting that most studies selected by He et al. (2020) were conducted among adolescent or young adult populations from Western counties. In other words, there is still little research available about whether and how BMI is related to body appreciation in older adults, especially those from Asia.

In addition, He et al. (2020) proposed two potentially important mediators that might help explain the relationship between BMI and body appreciation: body dissatisfaction and body image inflexibility. Body dissatisfaction is defined as a person's negative thoughts and feelings about his or her body (Grogan, 2017). Numerous studies have shown that body dissatisfaction is positively related to body weight, with overweight individuals more likely to be dissatisfied with their bodies (Weinberger et al., 2016). In addition, a study among older women aged 50–86 years showed that higher BMI was significantly associated with higher body dissatisfaction (Kilpela et al., 2021). Although body dissatisfaction is not the inverse of body appreciation (Tylka & Wood-Barcalow, 2015), body dissatisfaction is closely and negatively linked to body appreciation, as revealed in prior research (Andrew et al., 2015; Quittkat, Hartmann, Dusing, Buhlmann & Vocks, 2019). Furthermore, it appears that body dissatisfaction is present across adults' lifespans (Kilpela, Becker, Wesley & Stewart, 2015; Kilpela et al., 2021; Runfola et al., 2013) but does not change significantly during the aging process, especially for women (Tiggemann, 2004). For example, Webster and Tiggemann (2003) found that there was no significant difference in body dissatisfaction across three age groups of women: younger (20–34 years), middle-aged (35–49 years), and older (50–65 years). Because body appreciation has been proposed to be a protective factor against body dissatisfaction (Andrew et al., 2015; Halliwell, 2013), it is vital to explore the potential connections between BMI and body appreciation among older adults further.

Body image flexibility is the ability to accept negative thoughts, feelings, and sensations regarding one's body (Sandoz, Wilson, Merwin & Kate Kellum, 2013; Wu, Niu, Ni, Shao & Luo, 2019), while body image inflexibility is described as the unwillingness to experience negative appearance-related thoughts and emotions (Mancuso, 2016). Many studies have shown that body image (in)flexibility could be a self-regulatory mechanism of body image (Perey & Koenigstorfer, 2020; Webb et al., 2014). Through meta-analysis, Linardon, Anderson, Messer, Rodgers, and Fuller-Tyszkiewicz (2021) showed that body image flexibility was closely connected to various psychological correlates, including body image concerns (e.g., body dissatisfaction, r = −0.67) and body appreciation (r = 0.54). Previous mediation studies proposed that body dissatisfaction could predict body image (in)flexibility (Ferreira, Trindade, & Martinho, 2016; He, Cai, Chen, Lu, & Fan, 2021; Tang, Cooper, Wang, Song, & He, 2021; Webb, 2015). For example, Ferreira et al. (2016) found that body image inflexibility partly explained the link from body dissatisfaction to the adoption of inflexible eating rules. In addition, it has been suggested that body image (in)flexibility plays a mediating role in the relationship between body dissatisfaction and body appreciation (Mancuso, 2016; Perey & Koenigstorfer, 2020; Webb, 2015). Perey and Koenigstorfer (2020) showed that body image (in)flexibility mediated the relationship between appearance comparisons and body appreciation. Furthermore, in a sample of undergraduate women, the relationship between body dissatisfaction and body appreciation was found to be mediated by body image (in)flexibility (Webb, 2015).

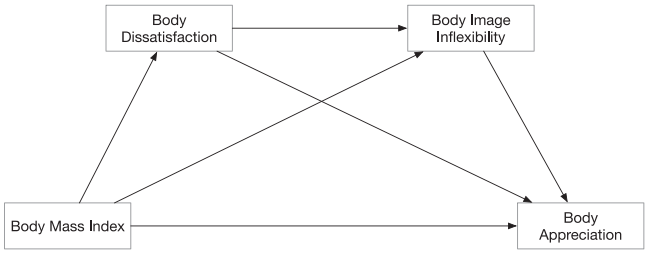

Fig. 1. Conceptual model.

Overall, to fill the research gap shown above, the aim of the current study is to explore whether, to what extent, and how BMI is related to body appreciation among older Chinese men and women. Two hypotheses were proposed based on the previous meta-analysis (He et al., 2020): (1) BMI is negatively related to body appreciation in older adults, with a larger correlation in older women than older men; (2) BMI is linked to body appreciation through the mediating role of body dissatisfaction and body image inflexibility among older adults (see Fig. 1).

2. Method

2.1. Participants and procedure

The data in the current study were from a project about body image and eating behaviors of older Chinese adults, which was approved by the Institutional Review Board of the Chinese University of Hong Kong, Shenzhen (No. 1-PSY-H). Details on the data collection and the sample characteristics were also described in two previous publications using the same sample (He, Zhao, Zhang & Lin, 2021; Zhao, Song, Brytek-Matera, Zhang & He, 2021). Specifically, data collection started in November 2019 and finished in early 2020, prior to COVID-19, and the participants were from three Chinese cities, namely Shenzhen, Guangzhou, and Qiqihar. Participants were at least 50 years old based on the criteria for older adulthood among Chinese people (Li et al., 2009). The participants were recruited through convenience sampling by going to senior community centers and snowball sampling by asking the participants to recommend other potential participants. Once a participant agreed to participate, informed consent was provided in the forms of both written and oral statements (in case some participants might have trouble reading). Researchers also asked each participant if he or she needed assistance, such as reading and explaining items during the study. To assist the participants, researchers read the survey aloud, explained each item to the participant, and then marked the feedback on the survey.

The total sample was composed of 313 older Chinese adults (151 men, 48.2%). Participant ages ranged from 51 to 92 years old (M = 67.90, SD = 7.94), and their self-reported BMI ranged from 13.67 to 36.75 kg/m^2 (M = 22.70, SD = 3.36). Based on the BMI thresholds for Chinese adults (Zhou, 2002), 10.5% were considered underweight (BMI < 18.5), 57.8% were healthy weight (18.5 ≤ BMI < 24), 26.2% were overweight (24 ≤ BMI < 28), and 5.4% were obese (28 ≤ BMI). Of the 313 participants, 187 (59.7%; mean age = 67.88, SD = 7.36) completed the survey using paper and pencil independently; the rest (mean age

Table 1
Percentages of descriptive information and mean (SD) of main research measures.

Variables	Men (n = 151)	Women (n = 162)	Total (n = 313)
	Percentage (n)/Mean (SD)	Percentage (n)/Mean (SD)	Percentage (n)/ Mean (SD)
1. Ethnicity			
Han	85.4% (129)	68.5% (111)	76.7% (240)
Minority	14.6% (22)	31.5% (51)	23.3% (73)
2. Urban/rural residence			
Urban	79.5% (120)	70.8% (114)	75% (234)
Rural	20.5% (31)	29.2% (47)	25% (78)
3. Marital status			
In a relationship	87.4% (132)	70.2% (113)	78.5% (245)
Not in a relationship	12.6% (19)	29.8% (48)	21.5% (67)
4. Education status			
Elementary or lower	9.9% (15)	14.2% (23)	12.1% (38)
Middle School	19.2% (29)	27.2% (44)	23.3% (73)
High School	53.6% (81)	41.4% (67)	47.3% (148)
Bachelor	14.6% (22)	17.3% (28)	16% (50)
Master or above	2.6% (4)		1.3% (4)
5. Survey completion method			
Self-report	56.3% (85)	63.0% (102)	59.7% (187)
Interview	43.7% (66)	37.0% (60)	40.3% (126)
6. Age	68.38(7.71)	67.46(8.15)	67.90(7.95)
7. BMI	23.13(3.35)	22.23(3.33)	22.70(3.36)
8. Body dissatisfaction	22.05(10.52)	23.49(12.20)	22.79(11.42)
9. Body image inflexibility	9.82(5.33)	10.13(5.70)	9.98(5.51)
10. Body appreciation	40.32(8.13)	39.14(9.28)	39.71(8.75)

= 67.94, *SD* = 8.77) completed the survey with the help of researchers in the form of interviews. Additional demographic information, including education level, marital status, urban/rural residence, and ethnicity, is presented in Table 1.

2.2. Measures

2.2.1. Body dissatisfaction

The nine-item body dissatisfaction subscale from the Eating Disorder Inventory-3 (EDI-BD) was used to assess body dissatisfaction (Garner, 2004). Items are rated on a 6-point Likert scale ranging from 1 "*Never*" to 6 "*Always*," with higher total scores implying higher levels of body dissatisfaction. The eight-factor structure and good psychometric properties of the EDI-3 (Garner, 2004) have been confirmed in clinical and non-clinical Chinese populations (Tseng, Yao, Hu, Chen & Fang, 2014). In the present study, the Cronbach's α for the EDI-BD was.95.

2.2.2. Body image inflexibility

The short-form Body Image Acceptance and Action Questionnaire (BI-AAQ) was used to assess body image inflexibility (Sandoz et al., 2013). The short-form BI-AAQ contains five items rated on a 7-point scale ranging from 1 "*Never true*" to 7 "*Always true*," with higher total scores implying higher levels of body image inflexibility (Basarkod et al., 2018). The Chinese version of the BI-AAQ-5 was validated by (He, Cai, Chen, Lu, & Fan, 2021)with good psychometric properties, and the one-factor structure was consistent with the original scale. In the present study, the Cronbach's α for the BI-AAQ-5 was.90.

2.2.3. Body appreciation

The Body Appreciation Scale-2 (BAS-2) was used to assess body appreciation (Tylka & Kroon Van Diest, 2013). The Chinese version of the BAS-2 was translated and validated by Swami et al. (2016). The BAS-2 contains ten items rated on a 5-point scale, ranging from 1 "*Never*" to 5 "*Always*." Swami et al. (2016) showed that the Chinese version of the BAS-2 had a one-factor structure, good internal consistency and convergent validity and was invariant across sexes. In the present study, the Cronbach's α for the BAS-2 was.92.

2.3. Statistical analysis

Statistical analyses were conducted with IBM SPSS version 26. The missing rate for each item was less than or equal to 0.6%, which was lower than the recommended cut-off value (5%) suggested by Schafer (1999). Thus, no data imputation was performed for the missing data in the present study. All the variables were standardized before data analysis, and nominal variables were dummy coded.

Because studies suggest that the relationship between BMI and body appreciation among men was curvilinear rather than linear, as found among women (Atari, 2016; He et al., 2020; Swami & Ng, 2015; Swami et al., 2016), the pattern in the relationship between BMI and body appreciation might differ by sex. Therefore, we decided to conduct data analyses separately within each sex. Pearson's bivariate correlation was used to examine the correlations between the study variables. According to Cohen (1992a), the cut-offs for small, medium, and large effect sizes of correlation coefficient are $r = 0.10$, $r = 0.30$, and $r = 0.50$, respectively. The mediation model was analyzed by Hayes's PROCESS macro (Hayes, 2017). The significance of the indirect effect was decided based on its 95% confidence interval (CI) as estimated using the bootstrap method (10,000 samples). The demographics that were significantly associated with the study variables would be controlled throughout the statistical analyses. In addition, based on power analyses (Faul, Erdfelder, Buchner & Lang, 2009), the sample sizes of 151 men and 162 women were adequate to detect small to medium effect sizes with an alpha = 0.05 and a power = 0.80.

3. Results

3.1. Descriptive and correlation analysis

The demographic information of the sample is shown in Table 1. The mean scores and standard deviations in body dissatisfaction, body image inflexibility, and body appreciation were 22.79 (*SD* = 11.42), 9.98 (*SD* = 5.51), and 39.71 (*SD* = 8.75), respectively (see Table 1).

Associations between the demographic variables and the four study variables (i.e., BMI, body dissatisfaction, body image inflexibility, and body appreciation) can be found in Table 2. Specifically, men of an older age had significantly lower body image inflexibility ($r = -0.23$, $p = .005$) but higher body appreciation ($r = 0.21$, $p = .011$). Men in rural areas had higher body appreciation than those in urban areas ($r = 0.18$, $p = .032$). In addition, men completed the survey by themselves reported less body dissatisfaction ($r = -0.37$, $p < .001$), body image inflexibility ($r = -0.35$, $p < .001$), yet higher body appreciation ($r = 0.42$, $p < .001$). Women with older ages also had significantly lower body image inflexibility ($r = -0.21$, $p = .009$). Compared with women of Han ethnicity, women of ethnic minorities reported lower body dissatisfaction ($r = -0.21$, $p = .007$) and lower body image inflexibility ($r = -0.17$, $p = .034$). Moreover, women in a relationship reported higher body image inflexibility ($r = 0.21$, $p = .008$) but lower body appreciation ($r = -0.18$, $p = .026$). Women with higher education levels reported higher body appreciation ($r = 0.17$, $p = .032$). Lastly, women who completed the survey without help reported lower body dissatisfaction ($r = -0.30$, $p < .001$) but higher body appreciation ($r = 0.19$, $p = .018$).

Regarding the results of the correlation analyses for men, men with high BMI reported significantly higher body dissatisfaction

Table 2
Bivariate correlations between BMI and other variables ($N = 313$).

Variables	1	2	3	4	5	6	7	8	9	10
1. Ethnicity[a]		.36***	.17*	-.12	.33***	-.07	-.12	-.21**	-.17*	.07
2. Urban/rural residence[b]	.12		.22**	-.22**	.10	-.12	.19*	-.05	.01	-.1
3. Marital status[c]	.01	.1		.04	.14	.08	.04	.10	.21**	-.18*
4. Education status[d]	.13	-.07	-.07		.06	-.08	-.16*	-.08	-.06	.17*
5. Survey completion method[e]	-.29***	.05	.53	.02		-.04	-.12	-.30***	-.10	.19*
6. Age	.01	-.04	.20*	-.20*	.05		-.12	-.12	-.21**	.11
7. BMI	-.12	-.08	.13	.00	-.21	.14		.42***	.30***	-.28***
8. Body dissatisfaction	-.12	-.06	-.07	.06	-.37***	.06	.43***		.68***	-.49***
9. Body image inflexibility	-.09	-.01	-.15	.12	-.35***	-.23**	.18*	.54***		-.48***
10. Body appreciation	.42***	.09	.18*	.13	-.10	.21*	-.07	-.37***	-.52***	

Notes: Men's correlations are on the bottom diagonal, and women's correlations are on the top diagonal.
[a] Ethnicity was coded as 1 = '*Han*', and 2 = '*Minority*'.
[b] Residence was coded as 1 = '*Urban*', and 2 = '*Rural*'.
[c] Marital status was coded as 1 = '*In a relationship*, and 2 = '*Not in a relationship*'.
[d] Education status was coded as 1 = 'Elementary or lower', 2 = 'Middle School', 3 = 'High School', 4 = 'Bachelor', and 5 = 'Master or above'.
[e] Survey completion methods was coded as 1 = '*Interview*', and 2 = '*self-report*'.
* $p < .05$.
** $p < .01$.
*** $p < .001$.

($r = 0.43$, $p < .001$) and body image inflexibility ($r = 0.18$, $p = .032$). However, no significant correlation was found between BMI and body appreciation among men ($r = -0.07$, $p = .376$). Considering that previous studies suggested that there might be a non-linear relationship between BMI and body appreciation among men (Atari, 2016; He et al., 2020; Swami & Ng, 2015; Swami et al., 2016), and thus the relationship between BMI-squared and body appreciation was also tested. However, there was no significant correlation between BMI-squared and body appreciation ($r = -0.11$, $p = .191$). Men with higher body dissatisfaction scored significantly higher in body image inflexibility ($r = 0.54$, $p < .001$) and lower in body appreciation ($r = -0.37$, $p < .001$). Furthermore, men with higher body image inflexibility reported lower body appreciation ($r = -0.52$, $p < .001$).

For women, women with higher BMI had higher body dissatisfaction ($r = 0.42$, $p < .001$) and body image inflexibility ($r = 0.30$, $p < .001$) and lower body appreciation ($r = -0.28$, $p < .001$). Women with higher body dissatisfaction had significantly higher body image inflexibility ($r = 0.68$, $p < .001$) but lower body appreciation ($r = -0.49$, $p < .001$). Furthermore, women with higher body image inflexibility reported lower body appreciation ($r = -0.48$, $p < .001$).

3.2. Mediation analysis

Given that the correlation between BMI and body appreciation among older men was not significant, a mediation analysis was conducted for older women only (see Fig. 2). After controlling for the demographics (i.e., age, ethnicity, residence, marital status, and education level) and survey completion method that were significantly related to one or more study variables, the mediation analysis showed that body dissatisfaction and body image inflexibility fully mediated the relationship between BMI and body appreciation (R^2 =.32). Specifically, as shown in Table 3, the indirect effect from BMI on body appreciation via body dissatisfaction (Path 1) was statistically significant, with an indirect effect of −0.09, 95% CI [−0.20, −0.01]. Although the indirect effect of BMI on body appreciation via body image inflexibility (Path 2)

Table 3
Pathways of direct and indirect effects for women ($N = 162$).

	Point estimates	SE	Bootstrapping 95%CI	
			Lower	Upper
Direct effect	-0.048	.080	-0.207	.110
Path 1				
BMI ↓ Body Dissatisfaction ↓ Body Appreciation	-0.091	.048	-0.195	-0.008
Path 2				
BMI ↓ Body Image Inflexibility ↓ Body Appreciation	.000	.021	-0.044	.043
Path 3				
BMI ↓ Body Dissatisfaction ↓ Body Image Inflexibility ↓ Body Appreciation	-0.063	.030	-0.129	-0.013
Total effect	-0.202	.082	-0.364	-0.041

Note: *SE* = standard error; *CI* = confidence interval.

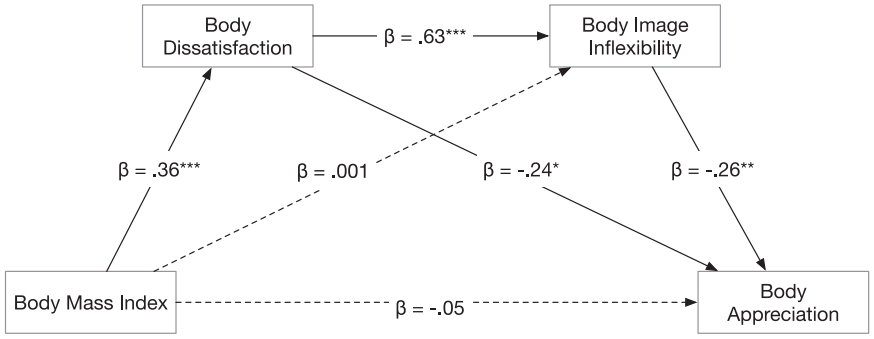

Fig. 2. Regression models of the mediation analysis for women (R^2 = 0.32). Note: * p < .05, ** p < .01, *** $p < .001$.

was not statistically significant, the indirect path from BMI to body dissatisfaction through both body dissatisfaction and body image inflexibility (Path 3) was significant, with an indirect effect of − 0.06, 95% CI [− 0.13, − 0.01].

4. Discussion

The current study explored the relationship between BMI and body appreciation among older Chinese men and women and tested the potential mediators of body dissatisfaction and body image inflexibility as proposed in He et al. (2020). The results showed that the association between BMI and body appreciation was significant among older women (a close to medium effect size) but not older men (a small effect size). The mediation analysis suggests that body dissatisfaction and body image inflexibility played fully mediating roles in the relationship between BMI and body appreciation among older women.

Even though we hypothesized a significant relationship between BMI and body appreciation among both older Chinese men and women, the analyses only revealed a significant correlation for women, which is partly consistent with the previous meta-analysis (He et al., 2020). Specifically, for men, the relationship between BMI and body appreciation was significant and had a small effect size ($r = 0.11$) in He et al.'s (2020) meta-analysis but was not significant in the current study ($r = 0.07$). However, given that He et al.'s (2020) results were based on a large combined sample which has a high statistical power to detect small effects (Cohn & Becker, 2003), differences in strengths of the relation between the two studies appear to be trivial and due to sample size differences (Cohen, 1992b). However, the trivial correlation between BMI and body appreciation in the current study suggests that body appreciation in older Chinese men might be less likely to be affected by their weight status.

Consistent with He et al. (2020), the correlation between BMI and body appreciation was found to be significant for women, with a close to medium effect size, indicating that the relationship between BMI and body appreciation is not limited to adolescent girls or young women (He et al., 2020) but also applies to older women in China. The gender differences in ideal bodies (Grogan, 2017) may help explain the different results of the relationship between older men and older women, because women tend to idealize a thin body type, whereas men prefer a muscular body type (Rodgers, Ganchou, Franko & Chabrol, 2012). A thin body is directly linked to a low BMI, whereas a muscular body is not (He et al., 2020). Considering that the pursuit of muscularity might affect the association between BMI and body satisfaction among men (Austin et al., 2009), men with high BMI resulting from muscles may report high body appreciation, while men with high BMI due to body fat may have low body appreciation.

Furthermore, for older women, body dissatisfaction and body image inflexibility played vital mediating roles in the relationship between BMI and body appreciation, which may have clear clinical implications. Specifically, future interventions may focus on body dissatisfaction and body inflexibility to help older women with high BMI build up a healthy body image. For example, a brief 3-week period of self-compassion meditation has proven to be an effective approach to mitigating body dissatisfaction in women aged 18–60 years old (Albertson et al., 2015); Berman et al. (2016) used the Acceptance and Commitment Therapy (ACT) intervention for women with obesity and depression, and the results showed significant improvements in a variety of outcomes, including body image inflexibility. Moreover, Duarte et al. (2017) used a low-intensity 4-week intervention characterized by compassion, mindfulness, and acceptance for women with binge-eating disorder, and the results demonstrated significant improvements in eating disorder symptoms (e.g., shape and weight concerns) and body image inflexibility. Thus, interventions with components of compassion, mindfulness, and acceptance might be promising for boosting body appreciation among older women with high BMI.

The current study has several limitations that should be considered in future research. The primary limitation of our study was its' use of a cross-sectional study design. Therefore, it remains unknown whether there are causal relationships among the four study variables. Future researchers may use intervention experiments (Eberhardt, 2007) to explore this issue. For example, to check the causal nature of the mediation model, researchers may conduct interventions for older women with high BMI by focusing on reducing body weight, body dissatisfaction, and body image inflexibility to check whether there will be a significant improvement in body appreciation. Another limitation is related to our sample ages, which ranged from 51 to 92 years old. Some participants had difficulty completing the questionnaire independently due to their age and required assistance from researchers. Although the researchers only helped to read the questionnaire, this small intervention might make the subjects feel that their personal information was being disclosed, thus biasing their self-reporting. Lastly, the samples in the current study were older Chinese adults, so the findings cannot be generalized to young adults or older adults from other cultures.

In conclusion, the current study found that body dissatisfaction and body image inflexibility fully mediated the relationship between BMI and body appreciation among older Chinese women. In the context of China's rapidly aging population, our findings provide insight into the relationship between BMI and body appreciation among older adults.

Funding

This research received a grant from the Chinese University of Hong Kong, Shenzhen for Undergraduate Research Award (URA).

CRediT authorship contribution statement

Hengyue Zhang: Investigation, Writing – original draft. **Jianwen Song:** Formal analysis, Writing – review & editing. **Yiqing Zhao:** Investigation, Writing – review & editing. **Anna Brytek-Matera:** Writing – review & editing. **Jinbo He:** Conceptualization, Supervision, Writing – review & editing. All authors approved the final version of the manuscript for submission.

Conflict of interest statement

Nothing declared.

Author statement

Ethical approval was obtained from the institutional review board at Chinese University of Hong Kong, Shenzhen. All procedures performed in this study involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. Moreover, the work has not been published previously or under consideration for publication elsewhere. All authors have reviewed and approved this submission. All the authors declare that they have no conflict of interest.

References

Albertson, E. R., Neff, K. D., & Dill-Shackleford, K. E. (2015). Self-compassion and body dissatisfaction in women: A randomized controlled trial of a brief meditation intervention. *Mindfulness, 6*(3), 444–454. https://doi.org/10.1007/s12671-014-0277-3

Andrew, R., Tiggemann, M., & Clark, L. (2015). The protective role of body appreciation against media-induced body dissatisfaction. *Body Image, 15*, 98–104. https://doi.org/10.1016/j.bodyim.2015.07.005

Atari, M. (2016). Factor structure and psychometric properties of the Body Appreciation Scale-2 in Iran. *Body Image, 18*, 1–4. https://doi.org/10.1016/j.bodyim.2016.04.006

Austin, S. B., Haines, J., & Veugelers, P. J. (2009). Body satisfaction and body weight: Gender differences and sociodemographic determinants. *Bmc Public Health, 9*(1), 313. https://doi.org/10.1186/1471-2458-9-313

Ball, K., Crawford, D., Jeffery, R., & Brug, J. (2010). The role of socio-cultural factors in the obesity epidemic. In *Obesity epidemiology: From aetiology to public health* (Vol. 2, pp. 105–118).

Basarkod, G., Sahdra, B., & Ciarrochi, J. (2018). Body image-acceptance and action questionnaire-5: An abbreviation using genetic algorithms. *Behavior Therapy, 49*(3), 388–402. https://doi.org/10.1016/j.beth.2017.09.006

Berman, M. I., Morton, S. N., & Hegel, M. T. (2016). Uncontrolled pilot study of an Acceptance and Commitment Therapy and Health at Every Size intervention for obese, depressed women: Accept Yourself!. *Psychotherapy, 53*(4), 462. https://doi.org/10.1037/pst0000083

Chooi, Y. C., Ding, C., & Magkos, F. (2019). The epidemiology of obesity. *Metabolism, 92*, 6–10. https://doi.org/10.1016/j.metabol.2018.09.005

Cohen, J. (1992a). A power primer. *Psychological Bulletin, 112*(1), 155–159. https://doi.org/10.1037//0033-2909.112.1.155

Cohen, J. (1992b). Statistical power analysis. *Current Directions in Psychological Science, 1*(3), 98–101.

Cohn, L. D., & Becker, B. J. (2003). How meta-analysis increases statistical power. *Psychological Methods, 8*(3), 243. https://doi.org/10.1037/1082-989X.8.3.243

Ding, L., Liang, Y., Tan, E. C., Hu, Y., Zhang, C., Liu, Y., ... Wang, R. (2020). Smoking, heavy drinking, physical inactivity, and obesity among middle-aged and older adults in China: Cross-sectional findings from the baseline survey of CHARLS 2011–2012. *Bmc Public Health, 20*(1), 1–9. https://doi.org/10.1186/s12889-020-08625-5

Duarte, C., Pinto-Gouveia, J., & Stubbs, R. J. (2017). Compassionate Attention and Regulation of Eating Behaviour: A pilot study of a brief low-intensity intervention for binge eating. *Clinical Psychology & Psychotherapy, 24*(6), O1437–O1447. https://doi.org/10.1002/cpp.2094

Eberhardt, F. (2007). *Causation and intervention* (Unpublished Doctoral dissertation). Carnegie Mellon University.

Faul, F., Erdfelder, E., Buchner, A., & Lang, A.-G. (2009). Statistical power analyses using G* Power 3.1: Tests for correlation and regression analyses. *Behavior Research Methods, 41*(4), 1149–1160. https://doi.org/10.3758/BRM.41.4.1149

Ferreira, C., Trindade, I. A., & Martinho, A. (2016). Explaining rigid dieting in normal-weight women: The key role of body image inflexibility. *Eating and Weight Disorders, 21*(1), 49–56. https://doi.org/10.1007/s40519-015-0188-x

Garner, D. M. (2004). *Eating disorder inventory-3 (EDI-3): Professional manual.* Psychological Assessment Resources.

GBD Obesity Collaborators (2017). Health effects of overweight and obesity in 195 countries over 25 years. *New England Journal of Medicine, 377*(1), 13–27. https://doi.org/10.1056/NEJMoa1614362

Geirsdóttir, Ó. G., & Bell, J. J. (2021). *Interdisciplinary nutritional management and care for older adults: An evidence-based practical guide for nurses.* Springer Nature. https://doi.org/10.1007/978-3-030-63892-4

Grogan, S. (2017). *Body image* (3rd ed). Routledge.

Halliwell, E. (2013). The impact of thin idealized media images on body satisfaction: Does body appreciation protect women from negative effects? *Body Image, 10*(4), 509–514. https://doi.org/10.1016/j.bodyim.2013.07.004

Hayes, A. F. (2017). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach.* Guilford Publications.

He, J., Cai, Z., Chen, X., Lu, T., & Fan, X. (2021H). Validation of the chinese version of the Body Image Acceptance and Action Questionnaire and the mediating role of body image flexibility in the relationship between body dissatisfaction and psychological distress. *Behavior Therapy, 52*(3), 539–551. https://doi.org/10.1016/j.beth.2020.07.003

He, J., Sun, S., Lin, Z., & Fan, X. (2020). The association between body appreciation and body mass index among males and females: A meta-analysis. *Body Image, 34*, 10–26. https://doi.org/10.1016/j.bodyim.2020.03.006

He, J., Zhao, Y., Zhang, H., & Lin, Z. (2021). Orthorexia nervosa is associated with positive body image and life satisfaction in Chinese elderly: Evidence for a positive psychology perspective. *International Journal of Eating Disorders, 54*(2), 212–221. https://doi.org/10.1002/eat.23400

Kilpela, L. S., Becker, C. B., Wesley, N., & Stewart, T. (2015). Body image in adult women: Moving beyond the younger years. *Advances in Eating Disorders: Theory, Research and Practice, 3*(2), 144–164. https://doi.org/10.1080/21662630.2015.1012728

Kilpela, L. S., Verzijl, C. L., & Becker, C. B. (2021). Body image in older women: A mediator of BMI and wellness behaviors. *Journal of Women & Aging, 33*(3), 298–311. https://doi.org/10.1080/08952841.2019.1692629

Li, Z., Sun, D., Cuj, H., Zhang, L., Lju, P., Yang, H., & Baj, J. (2009). Refractive error among the elderly in rural southern Harbin, China. *Ophthalmic Epidemiology, 16*(6), 388–394. https://doi.org/10.3109/09286580903312285

Linardon, J., Anderson, C., Messer, M., Rodgers, R. F., & Fuller-Tyszkiewicz, M. (2021). Body image flexibility and its correlates: A meta-analysis. *Body Image, 37*, 188–203. https://doi.org/10.1016/j.bodyim.2021.02.005

Lohmann, A. E., Goodwin, P. J., Chlebowski, R. T., Pan, K., Stambolic, V., & Dowling, R. J. (2016). Association of obesity-related metabolic disruptions with cancer risk and outcome. *Journal of Clinical Oncology, 34*(35), 4249–4255. https://doi.org/10.1200/JCO.2016.69.6187

Mancuso, S. G. (2016). Body image inflexibility mediates the relationship between body image evaluation and maladaptive body image coping strategies. *Body Image, 16*, 28–31. https://doi.org/10.1016/j.bodyim.2015.10.003

Mangweth-Matzek, B., Rupp, C. I., Hausmann, A., Assmayr, K., Mariacher, E., Kemmler, G., ... Biebl, W. (2006). Never too old for eating disorders or body dissatisfaction: A community study of elderly women. *International Journal of Eating Disorders, 39*(7), 583–586. https://doi.org/10.1002/eat.20327

Perey, I., & Koenigstorfer, J. (2020). Appearance comparisons and eating pathology: A moderated serial mediation analysis exploring body image flexibility and body appreciation as mediators and self-compassion as moderator. *Body Image, 35*, 255–264. https://doi.org/10.1016/j.bodyim.2020.09.008

Quittkat, H. L., Hartmann, A. S., Dusing, R., Buhlmann, U., & Vocks, S. (2019). Body dissatisfaction, importance of appearance, and body appreciation in men and women over the lifespan. *Frontiers in Psychiatry, 10*, 864. https://doi.org/10.3389/fpsyt.2019.00864

Ramachandran, A., & Snehalatha, C. (2010). Rising burden of obesity in Asia. *Journal of Obesity*, 2010. https://doi.org/10.1155/2010/868573

Rodgers, R. F., Ganchou, C., Franko, D. L., & Chabrol, H. (2012). Drive for muscularity and disordered eating among French adolescent boys: A sociocultural model. *Body Image, 9*(3), 318–323. https://doi.org/10.1016/j.bodyim.2012.03.002

Runfola, C. D., Von Holle, A., Trace, S. E., Brownley, K. A., Hofmeier, S. M., Gagne, D. A., & Bulik, C. M. (2013). Body dissatisfaction in women across the lifespan: Results of the UNC-SELF and Gender and Body Image (GABI) studies. *European Review of Eating Disorders, 21*(1), 52–59. https://doi.org/10.1002/erv.2201

Sandoz, E. K., Wilson, K. G., Merwin, R. M., & Kate Kellum, K. (2013). Assessment of body image flexibility: The Body Image-acceptance and action questionnaire. *Journal of Contextual Behavioral Science, 2*(1–2), 39–48. https://doi.org/10.1016/j.jcbs.2013.03.002

Schafer, J. L. (1999). Multiple imputation: A primer. *Statistical Methods in Medical Research, 8*(1), 3–15. https://doi.org/10.1177/096228029900800102

Seidell, J. C., & Halberstadt, J. (2015). The global burden of obesity and the challenges of prevention. *Annals of Nutrition and Metabolism, 66*(Suppl. 2), 7–12. https://doi.org/10.1159/000375143

Shekar, M., & Popkin, B. (2020). *Obesity: Health and economic consequences of an impending global challenge.* World Bank Publications.

Swami, V., & Ng, S. K. (2015). Factor structure and psychometric properties of the Body Appreciation Scale-2 in university students in Hong Kong. *Body Image, 15*, 68–71. https://doi.org/10.1016/j.bodyim.2015.06.004

Swami, V., Ng, S. K., & Barron, D. (2016). Translation and psychometric evaluation of a Standard Chinese version of the Body Appreciation Scale-2. *Body Image, 18*, 23–26. https://doi.org/10.1016/j.bodyim.2016.04.005

Tang, C., Cooper, M., Wang, S., Song, J., & He, J. (2021). The relationship between body weight and dietary restraint is explained by body dissatisfaction and body image inflexibility among young adults in China. *Eating and Weight Disorders, 26*(6), 1863–1870. https://doi.org/10.1007/s40519-020-01032-0

Tiggemann, M. (2004). Body image across the adult life span: Stability and change. *Body Image, 1*(1), 29–41. https://doi.org/10.1016/S1740-1445(03)00002-0

Tseng, M.-C. M., Yao, G., Hu, F.-C., Chen, K.-Y., & Fang, D. (2014). Psychometric properties of the Eating Disorder Inventory in clinical and nonclinical populations in Taiwan. *Assessment, 21*(1), 50–59.

Tylka, T. L., & Kroon Van Diest, A. M. (2013). The Intuitive Eating Scale-2: Item refinement and psychometric evaluation with college women and men. *Journal of Counseling Psychology, 60*(1), 137–153. https://doi.org/10.1037/a0030893

Tylka, T. L., & Wood-Barcalow, N. L. (2015). What is and what is not positive body image? Conceptual foundations and construct definition. *Body Image, 14*, 118–129. https://doi.org/10.1016/j.bodyim.2015.04.001

Villareal, D. T., Apovian, C. M., Kushner, R. F., & Klein, S. (2005). Obesity in older adults: Technical review and position statement of the American Society for Nutrition and NAASO, The Obesity Society. *The American Journal of Clinical Nutrition, 82*(5), 923–934. https://doi.org/10.1093/ajcn/82.5.923

Webb, J. B. (2015). Body image flexibility contributes to explaining the link between body dissatisfaction and body appreciation in White college-bound females. *Journal of Contextual Behavioral Science, 4*(3), 176–183. https://doi.org/10.1016/j.jcbs.2015.06.001

Webb, J. B., Butler-Ajibade, P., & Robinson, S. A. (2014). Considering an affect regulation framework for examining the association between body dissatisfaction and positive body image in Black older adolescent females: Does body mass index matter? *Body Image, 11*(4), 426–437. https://doi.org/10.1016/j.bodyim.2014.07.002

Webster, J., & Tiggemann, M. (2003). The relationship between women's body satisfaction and self-image across the life span: The role of cognitive control. *The Journal of Genetic Psychology, 164*(2), 241–252. https://doi.org/10.1080/00221320309597980

Weinberger, N. A., Kersting, A., Riedel-Heller, S. G., & Luck-Sikorski, C. (2016). Body dissatisfaction in individuals with obesity compared to normal-weight individuals: A systematic review and meta-analysis. *Obesity Facts, 9*(6), 424–441. https://doi.org/10.1159/000454837

Williams, E. P., Mesidor, M., Winters, K., Dubbert, P. M., & Wyatt, S. B. (2015). Overweight and obesity: Prevalence, consequences, and causes of a growing public health problem. *Current Obesity Reports, 4*(3), 363–370. https://doi.org/10.1007/s13679-015-0169-4

Wu, L., Niu, G., Ni, X., Shao, X., & Luo, Y. (2019). Body image flexibility moderates the association between photo-related activities on WeChat moments and the body dissatisfaction of female adolescents in China. *Current Psychology*. https://doi.org/10.1007/s12144-019-00553-x

Yates, A., Edman, J., & Aruguete, M. (2004). Ethnic differences in BMI and body/self-dissatisfaction among Whites, Asian subgroups, Pacific Islanders, and African-Americans. *Journal of Adolescent Health, 34*(4), 300–307. https://doi.org/10.1016/j.jadohealth.2003.07.014

Zhang, L., Wang, Z., Wang, X., Chen, Z., Shao, L., Tian, Y., ... Gao, R. (2020). Prevalence of overweight and obesity in China: Results from a cross-sectional study of 441 thousand adults, 2012–2015. *Obesity Research & Clinical Practice, 14*(2), 119–126. https://doi.org/10.1016/j.orcp.2020.02.005

Zhao, Y., Song, J., Brytek-Matera, A., Zhang, H., & He, J. (2021). The relationships between sleep and mental and physical health of Chinese elderly: Exploring the mediating roles of diet and physical activity. *Nutrients, 13*(4), 1316. https://doi.org/10.3390/nu13041316