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ORIGINAL ARTICLE

A longitudinal evaluation of a biopsychosocial model predicting BMI and disordered eating among young adults

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ABSTRACT

Objective: This study examined the utility of a biopsychosocial model to explain both higher body mass index (BMI) and disordered eating. The study was designed to examine the predictors of higher BMI and a number of measures of disordered eating (dietary restraint, drive for muscularity, drive for thinness, binge eating, and compensatory behaviour).

Method: Young adults ($N = 838$) recruited from seven countries, grouped into four regions (Europe, North American countries, Australia, Japan), completed an online survey, with each completion being 12 months apart. The survey included assessments of BMI and disordered eating, and a range of biological, psychological and sociocultural factors expected to predict both outcomes.

Results: Results revealed unique patterns of association between predictors and BMI as well as different measures of disordered eating in the four geographical regions.

Conclusions: The findings identify the specific nature of biopsychosocial factors that predict both higher BMI and different aspects of disordered eating. They also demonstrate that caution needs to be exercised in generalising findings from one country to other countries.

KEY POINTS

What is already known about this topic:

(1) The literature has already identified various aspects of the biopsychosocial model that predicts disordered eating and higher weight.
(2) These studies have primarily focused on disordered eating in cross-sectional studies among adolescents.
(3) Obesity and disordered eating have been shown to be related

What this topic adds:

(1) The study identified the biopsychosocial factors that predict higher BMI and disordered eating among young adults over a 12-month period.
(2) The study examined all components of the biopsychosocial model in the one study.
(3) The study was conducted across seven countries and identified how these relationships vary from one country to another.

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Disordered eating; obesity; cross-country research; biopsychosocial model; risk factors; longitudinal

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Introduction

Research has suggested that higher BMI and disordered eating may stem from similar underlying factors (e.g., Wilson, 2010). Although a body of research has been devoted to investigating the links between higher BMI and eating disorders (e.g., Marcus & Wildes, 2014; McCuen-Wurst et al., 2018), few studies have targeted the most common risk and protective factors of both higher BMI and disordered eating. A theoretical model that has been used to explain both higher BMI and disordered eating is the biopsychosocial model outlined by (McCabe et al., 2019). Much of the research has examined how biological, psychological and sociocultural factors are associated with either BMI or disordered eating. Earlier versions of this model have been developed to explain either higher BMI (Cheng et al., 2020; Heslehurst et al., 2019) or disordered eating (McCabe & Ricciardelli, 2004; Muris et al., 2005; Rodgers et al., 2020; Ricciardelli & McCabe, 2004). Most studies have been cross-sectional in design, with very limited research examining the relationship between the variables over time. Most importantly, gender and cross-country differences in the impact of the biopsychosocial factors predicting higher BMI and disordered eating have generally not been investigated. Further, these biopsychosocial models of higher BMI and disordered eating have been proposed and evaluated among adolescents with limited formulation or testing of such models among young adults.

It is important to note that the is some controversy in the literature regarding the meaning of a higher BMI; in particular, the social construction of obesity and the concept of an ideal weight (see a review by Gotovac et al., 2020). Further, a focus in healthcare on obesity has resulted in many overweight males and females being stigmatised due to their weight (Alberga et al., 2018). Research has suggested that a higher BMI may not indicate higher levels of obesity, but simply indicate higher levels of body mass (Okorodudu et al., 2010). It is not possible in this paper to discuss the differences between obesity and higher BMI, or the health consequences of either higher BMI or disordered eating. This is a contentious issue that goes beyond the scope of the current paper.

The current study was designed to advance our understanding of the factors related to higher BMI and disordered eating among young adults (18 to 30 years), an age group susceptible to changes in weight and vulnerable to disordered eating (Arnett et al., 2014). A model and design for the longitudinal study (across one year) to test it across eight countries was reported in a protocol paper by (McCabe et al., 2019). This proposal incorporated a biopsychosocial model to explain both higher BMI and disordered eating (see Figure 1). The research reviewed below examines past literature among young adults that has examined the association between the different components of the biopsychosocial model and BMI and disordered eating. The literature related to disordered eating is considered first, followed by the more limited literature on how past research on the biopsychosocial model informs our understanding of higher BMI.

There has been limited research that has examined the role of demographic variables in the development of disordered eating among young adults. The variables in the current study have been included based on studies among adolescent populations. In terms of biological factors related to disordered eating, Serdar et al. (2011) found that high levels of weight instability across the lifespan was associated with high levels of dieting and binge eating for both men and women. In relation to psychological factors, a wide range of cross-sectional studies have consistently shown an association between body image-related variables and disordered eating (Baillie & Copeland, 2013; Buchanan et al., 2013). Cross-sectional studies have shown that perfectionism (e.g., Barnett & Sharp, 2016), depression (e.g., Lombardo et al., 2014) and other psychological variables are associated with disordered eating. Sociocultural influences have been shown to be related to disordered eating, most particularly, use of social media (e.g., Qutteina et al., 2019; Schaumberg & Anderson, 2016; Tran et al., 2019), media pressure (e.g., Fitzsimmons-Craft et al., 2014; Keery et al., 2004; Tod et al., 2013; You & Shin, 2020), and pressure from peers, dating partners, and family (e.g., Fitzsimmons-Craft et al., 2014; Keery et al., 2004; You & Shin, 2020). Societal pressure also appears to be associated with drive for muscularity and strategies to increase muscles (Cramblitt & Pritchard, 2013; Daniel & Bridges, 2010; Lovering et al., 2018; Tod et al., 2013).

Both predictor and outcome variables related to muscularity were included in the current study, to ensure that the model was relevant for men as well as women. The above studies have primarily focused on women and the factors related to disordered eating. However, research has also shown the importance of messages from different social agents (e.g., family, peers, media, dating partners), as well as appearance comparison, internalisation of the muscular ideal, and body dissatisfaction, in predicting drive for muscularity among adult men (Girard, Chabrol, et al., 2018; You & Shin, 2020).

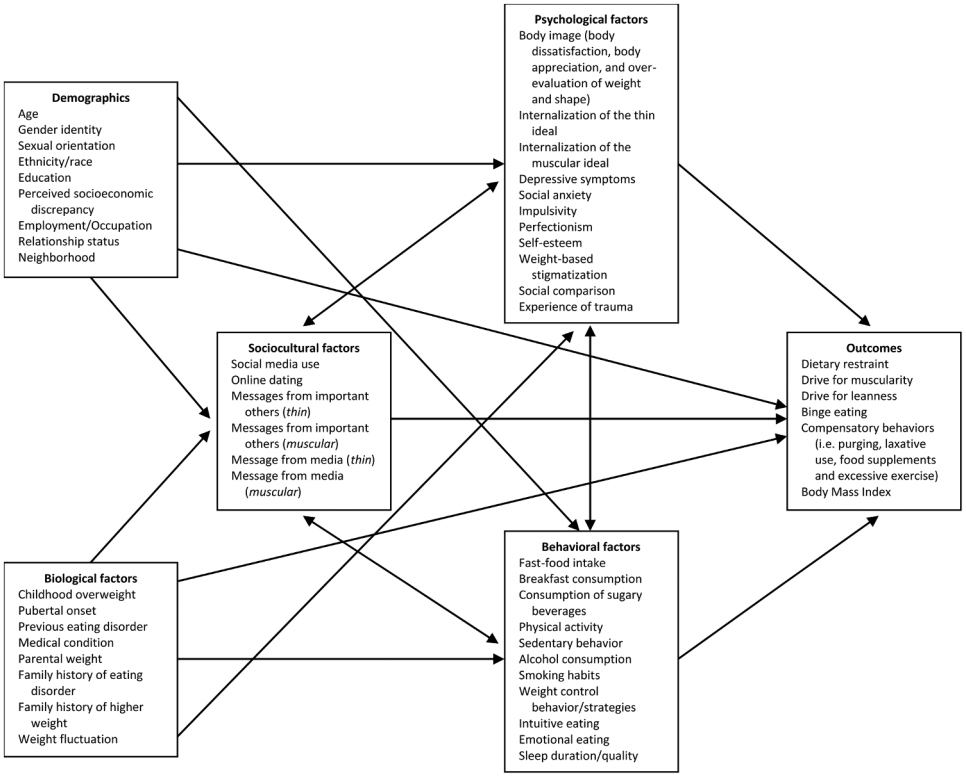

Figure 1. Conceptual model for shared risk factors for BMI and disordered eating in young adults.

Limited longitudinal studies have examined the association between biopsychosocial factors and disordered eating. A meta-analysis of longitudinal studies confirmed a prospective association between perfectionism and bulimic symptoms (Kehayes et al., 2019). In terms of sociocultural factors, messages from media, peers, and partners have been shown to be predictive of increased body dissatisfaction, drive for thinness and muscularity concerns over a 12-month period using appearance comparison in a female young adult group (Girard, Chabrol, et al., 2018). Similarly, body dissatisfaction, high negative affect, and low self-esteem are predictive of various dimensions of disordered eating among young men over a nine-month period (Dakanalis et al., 2016). Thus, although limited, the existing literature examining the longitudinal relationships among biopsychosocial factors and disordered eating outcomes, has supported the relevance of such models.

Few studies have examined the biopsychosocial predictors of higher BMI among young adults. For some of these studies the focus was on obesity and so that term has been retained in the description of the study. There is evidence that personality (neuroticism for women, extraversion for men), and lower levels of education are predictive of obesity over a 55-year period (Cheng et al., 2020). Also, childhood obesity, mothers' BMI, and low levels of childhood family income predicted obesity in adulthood for both men and women. A meta-analytic review found that the child's odds of having obesity increased by 264% when mothers had obesity before conception (Heslehurst et al., 2019), indicating the importance of also considering parental weight in predictive models. In addition, a systematic review found that children and adolescents with higher BMI were five times more likely to demonstrate obesity in adulthood than those who did not experience obesity earlier in life (Simmonds et al., 2016). Thus, although more limited, the data also support biopsychosocial models as useful for explaining higher BMI in early adulthood.

While the above relationships have been found to some extent across cultural settings, other research highlights the important role that culture plays in the development of eating behaviours, disordered eating, and BMI (Rozin et al., 1999; Sadia et al., 2021). Some research indicates similar degrees of prevalence of disordered eating in Eastern and Western cultures, but posits potentially unique aetiological factors, with family values (e.g., for conformity) particularly important in Eastern cultures such as Japan (Han, 2020; Kim et al., 2021; Nakai et al., 2021; Pike & Borovoy, 2004) and concerns about body size less pervasive in some Eastern countries (Kim et al., 2021; Pike & Dunne, 2015).

Cross-country longitudinal research that includes more than a few countries has not been conducted.

The current study is therefore novel in its design to compare biopsychosocial risk/protective factors for higher BMI and disordered eating among young adults across multiple countries. The baseline analyses, conducted on data derived from 6272 participants from eight countries (Fuller-Tyszkiewicz et al., 2022) revealed that just under 80% of the parameters in the proposed model were almost identical across countries. Given the difficulties of engaging a sufficient number of participants in the follow-up survey due to the Coronavirus pandemic, we needed to group countries and eliminate one (China, where the study site was Wuhan) for the longitudinal analyses reported here. The follow-up data were gathered in late 2019 to early 2020, just as the coronavirus was in the initial phase and so likely to cause concern among young adults and reduce their response rate.

In the current study, we predicted that demographic, biological, sociocultural, psychological and behavioural factors would predict higher BMI and greater disordered eating among all groups of participants over a 12-month period. A consensus decision was reached by the research team regarding whether a variable was a predictor or outcome variable, as it could be argued that some of the predictor variables in the model could be outcome variables and vice versa. Our cross-sectional baseline analysis for this study (Fuller-Tyszkiewicz et al., 2022) identified variables from each of these predictor categories as being associated with higher BMI and disordered eating. Even so, given the diffuse pattern of findings to emerge from the cross-sectional analyses, more specific hypotheses in relation to each outcome variable were not formulated for this longitudinal investigation. As per the baseline analysis, it was also expected that there would be some cross-country variability in the biopsychosocial risk factors predicting the outcome variables.

Method

Design

This research project is a cross-institutional international collaboration, with research teams from eight countries simultaneously collecting data. Ethics approval (DUHREC 2017–377) for the project and data management were obtained from the coordinating site in Australia and from at least one university ethics committee in each of the other countries (see list of university affiliations for authors to identify the universities where ethics approval was obtained). Data collection occurred between July 2018 and March 2019 for the first wave of data collection and between August 2019 and May 2020 for the second wave of data collection.

Participants

Participants were adults aged between 18 and 30 years living within the general community. Pregnant women were excluded from participation, given that they may have a different experience with their body from those who are not pregnant (Watson et al., 2016). Of the original 6272 participants, 3969 participants consented to being invited for a follow-up survey 12 months-later. At follow-up (T2), 846 (567 participants recruited pre-COVID, and 279 participants recruited post-COVID) of these participants completed the follow-up survey (Australia: $n = 125$, Belgium: $n = 57$, Canada: $n = 154$, China: $n = 8$, Italy: $n = 86$, Japan: $n = 118$, Spain: $n = 90$, U.S.: $n = 208$). In addition to usual attrition for longitudinal follow-up, lower than expected numbers are partially attributable to COVID-19 related disruptions during the follow-up period.

Measures

Full details of the measures to evaluate the outcome and predictor variables are described in the protocol paper for the study (McCabe et al., 2019). All measures were translated and back translated for French participants in Canada, Japan and European countries (Belgium, Italy, Spain). This section provides a brief summary of the scales for each of the outcome and predictor variables. All measures that were represented by multiple items showed adequate reliability at each of the data collection times (omega values over .70 for all countries), with the exception of the sociocultural influence on weight loss and gain measures (omega values ranged from .60 to .70).

Demographic and background predictors

Demographic information was collected, including participants' age, sex, gender identity, sexual orientation, relationship status, perceived socio-economic status, employment, education (e.g., years of education completed and current educational status), country of birth, and racial and ethnic identity.

Outcomes

Body mass index (BMI). Participants' self-reported height and weight were recorded and used to calculate BMI (weight kg/height m^2), which is our measure of weight status.

Eating pathology. Eating pathology, such as dietary restraint, binging, and purging were assessed with relevant subscales from the Eating Disorder Examination Questionnaire (EDE-Q; Fairburn et al., 2008). These items queried participants regarding binging or purging behaviours within the past 28 days. Dietary restraint was assessed with the 5-item Restrained Eating subscale (range 0–5). Binging and purging were assessed with the 5-item Binging and Purging subscale. For the purposes of the current study, the original Binging and Purging subscale was revised to include two additional items to assess the consumption of food supplements and steroids as a means of losing weight. Participants were classified as evidencing bingeing and purging behaviours (and so obtained a score of 1 on that item) if they responded "one or more times" to the behaviours. Scores ranged from 0–7. The two items that were used to inform on bingeing behaviours were the item asking about eating an unusually large quantity of food and the one about evidencing a loss of control within the last 28 days. The four items that informed on purging behaviours were those related to the three purging behaviours (vomiting, laxative use, diet pills/diuretics) or excessive exercise in the last 28 days.

Drive for muscularity. The Drive for Muscularity Scale (DMS; McCreary & Sasse, 2000; McCreary et al., 2004) is a 15-item self-report measure, which was used to assess level of preoccupation with increasing muscularity (range 15–90).

Drive for leanness. The Drive for Leanness Scale (DLS; Smolak & Murnen, 2008), is a 6-item self-report measure, which was used to assess the level of preoccupation with leanness (e.g., having relatively low body fat and toned muscles) (range 6–36).

Biological predictors

Pubertal timing, childhood weight status, previous history of eating disorders, medical conditions influencing weight, mother weight, father weight and family history of obesity were evaluated using single items (McCabe et al., 2019).

Sociocultural predictors

Use of social media and online dating platforms were evaluated as described in McCabe et al. (2019; time range per week from 0 minutes – 21 hours). Separate subscales were used to determine pressure from father, mother, peer and media to lose weight, gain muscle and gain weight (McCabe & Ricciardelli, 2001) (range for each subscale 1–5). These were calculated as latent variables from the partial invariance models (Rodgers et al., 2020).

Psychological predictors

Body satisfaction. The 9-item Multidimensional Body Self Relations Questionnaire- Body Area Satisfaction Scale (MBSRQ-BASS; Brown et al., 1990; Cash, 2000) was used to assess body satisfaction associated with specific body areas and attributes (range 1–5).

Weight and shape concern. The Weight Concern (5 items) and Shape Concern (8 items) subscales of the Eating Disorder Examination Questionnaire (Fairburn et al., 2008) were used to assess concerns regarding body weight and shape (range 0–6).

Body appreciation. Body appreciation was assessed using the 10-item Body Appreciation Scale-2 (BAS-2; (Tylka & Wood-Barcalow, 2015) (range 1–5).

Internalisation of the thin and muscular ideals. Internalisation of thin and muscular ideals were assessed using relevant subscales from the Sociocultural Attitudes Towards Appearance Questionnaire-4 (Schaefer et al., 2015), specifically the Internalisation of Thin/Low Body Fat subscale (5 items) and the Internalisation of Muscular/Athletic subscale (5 items) (range for each subscale1–5).

Internalisation of weight bias. Weight bias was measured using the 11-item Modified Weight Bias Internalization Scale (Pearl & Puhl, 2014) (range1–7).

Physical appearance comparison. The 5-item Physical Appearance Comparison Scale (PACS; Thompson et al., 1991) was used to assess participants' likelihood of comparing their physical appearance to the physical appearance of others (range 5–20).

Impulsivity. Impulsivity was assessed with the 4-item Negative Urgency subscale of the SUPPS-P Impulsive Behaviour Scale (Cyders et al., 2014) (range 4–16).

Perfectionism. Perfectionism was measured using the shortened form of the Hewitt and Flett Multidimensional Perfectionism Scale (Hewitt & Flett, 1991). There are two subscales; the Self-oriented Perfectionism subscale (5 items) measures participants' beliefs that striving for perfection is important and the Socially Prescribed Perfectionism subscale (5 items) measures participants' beliefs that striving for perfection is important to others (range 5–35).

Self-esteem. A short form of the Rosenberg Self-Esteem Scale (RSES; Rosenberg, 1965), which includes only the five positively worded items was used to assess self-esteem (Tambs & Røysamb, 2014), since the RSES negatively-worder items can reflect a predisposition to negative self-evaluation in eating disorders (Lo Coco et al., 2021) (range 5–20).

Depressive symptoms. The Patient Health Questionn aire-2 (PHQ-2; Kroenke et al., 2003) was used to assess participants' frequency of two key depression symptoms over the past seven days: "declined interest or pleasure" and "depressed or down mood" (range 0–6).

Social anxiety symptoms. The 6-item shortened form of the Social Interaction Anxiety Scale (SIAS-6; Peters et al., 2012) was used to assess participants' anxiety (range 0–24).

Experience of trauma. The Post-Traumatic Stress Disorder Checklist for DSM-5 (PCL; Weathers et al., 2013) was used to screen participants for trauma symptoms. In the current study, the 6-item hyperarousal subscale was utilised, with the items assessing symptoms such as irritability, hypervigilance, risk taking, and difficulties with concentration (range 0–24).

Behavioural predictors

Eating and drinking behaviours. Single items were used to assess the frequency of consumption of fried foods, sugary drinks and breakfast per week. Meta-analyses have shown that skipping breakfast (Ma et al., 2020), consuming sugary drinks (Ruanpeng et al., 2017) and eating fried food (Qin et al., 2021) are predictive of weight gain/obesity.

Substance use behaviours. Three items from the Alcohol Use Disorders Identification Test (AUDIT; Babor & Grant, 1989) were used to assess alcohol consumption (range for each item 0–4).

Sleep quality. Three items from The Pittsburgh Sleep Quality Index (Buysse et al., 1989) were used to assess the quality and pattern of sleep during the previous month (range 0–3).

Physical activity. Participants' physical activity was assessed using the 16-item Global Physical Activity Questionnaire (Armstrong & Bull, 2006), which assesses the frequency (*days*) and duration (*minutes/hour*) of moderate and vigorous intensity physical activity within three domains: (1) at work, (2) travel to/from places, and (3) at leisure (e.g., recreational activities).

Body change strategies. Two scales from the Body Change Inventory (BCI; Ricciardelli & McCabe, 2002) were used: Strategies to Decrease Body Size (6 items), and Strategies to Increase Muscle Size (6 items) (range for each scale 6–30).

Intuitive eating. Intuitive eating was assessed using the 6-item Reliance on Hunger and Satiety Cues (RHSC) subscale of the Intuitive Eating Scale-2 (Tylka & Kroon Van Diest, 2013) (range 1–5).

Emotional eating. The Emotional Eating subscale of the Three Factor Eating Questionnaire (Cappelleri et al., 2009) is a 6-item Emotional Eating subscale that was used to assess participants' experiences of overeating in response to negative affective states (range 1–4).

Procedure

Participants were recruited via social media sites (e.g., Facebook), online forums, and mailing lists associated with the universities collaborating in this research project. These universities are the home universities of the authors of the manuscript listed on the title page. Participants first completed a consent form online (e.g., Plain Language Statement; PLS) and then were directed to a Qualtrics survey. Only participants who consented to be contacted received an email invitation to the T2 survey, 12 months after completing the baseline (T1) survey. All variables included in Figure 1 were completed at Time 1, only the outcome measures were completed at Time 2.

Data analytic strategy

All analyses were performed with MPlus 7.1 (Muthén & Muthén, 1998–2012) and estimated with the robust maximum likelihood estimator (MLR), which provides standard errors and tests of model fit that are robust to non-normality of the data. Full information maximum likelihood was used for dealing with missing data. A significance level of $p < .05$ was used for all analyses.

Based on the profile of responses, countries were combined into geographical groupings expected to demonstrate a similar profile of responses: North American countries, European countries, Australia and Japan.

Given the large number of possible predictor variables, and number of countries in our study, several decisions were made to simplify the final analysis while including key predictors and meaningful comparisons across countries. First, to reduce the number of groups being compared – and in turn increase the sample size within each group – participants were split into four regions based on the profile of responses: North America (Canada and the U.S.),

Europe (Belgium, Italy, Spain), Australia, and Japan. China was omitted as participants were originally recruited from Wuhan, and the coronavirus pandemic complicated recruitment efforts there. Second, the number of predictors included in the final multivariable model for each outcome measure was determined through some preliminary steps. Zero-order correlations between predictor (T1) and outcome (T2) variables were inspected for each of the four regions being examined to anticipate the direction of the effect under consideration. Findings emerging from these analyses were then used to inform model building for the regression analyses as follows: six starting regression models (one for each outcome variable) were developed for each of the four regions being examined. The respective outcome variables assessed at T1 and gender were included as fixed predictors in these models. Gender was included for consistency with earlier analyses using these data (see McCabe et al., 2019), in which possible cross-gender differences in constructs were deemed highly plausible. Additional predictors with modification indices valued above 3.84 ($p < .05$) were progressively added one at a time as long as the direction of their effect conformed to the direction observed in zero-order correlations. This latter condition was included to prevent inclusion of effects due to suppression. The final predictors for each outcome variable are included in Appendices A-F.

Results

Demographics by group

Table 1 provides a breakdown of continuous and categorical demographic variables by region. Supplementary Tables S1 and S2 also provide descriptive data on all variables at Time 1.

The reduction in the numbers of participants at Time 2 was partly attributed to the COVID-19 pandemic.

The Chinese sample is the best illustration of this, with the initial sample derived from Wuhan. Statistical comparison between retained and drop out participants showed a range of significant differences on baseline variables, but only two that exceeded d > .2 (a threshold for small meaningful group differences). Those who dropped out tended to have lower idealisation scores for the muscular physique and lower endorsement of muscle change behaviours (see Supplementary Tables S1 and S2 for a full comparison across the two groups). Although it is disappointing that there was such a high dropout rate from Time 1 to Time 2, the minimal level of differences between the responses of those who dropped out and those who remained in the study at Time 1 gives us reasonable confidence in the value of the findings from the current study.

Change in outcomes over time

As shown in Table 2, paired samples t-tests for the whole sample revealed significant differences over time for dietary restraint, drive for muscularity, drive for leanness, binge eating, and BMI. Purge scores did not significantly change over time for the sample as a whole.

Variance explained in outcome variables

As shown in Table 3, variance explained in the six outcome variables varied by region, variable, and

Table 1. Demographics by region.

	Australia		Europe		Japan		North America	
Variable	M	SD	M	SD	M	SD	M	SD
Age	22.66	4.56	23.55	7.31	21.36	4.33	23.53	5.53
BMI T1	25.45	6.69	23.13	4.21	20.26	2.11	38.90	9.85
BMI T2	26.09	7.45	23.52	4.45	20.38	2.25	39.71	9.72
	n	%	n	%	n	%	n	%
Sex								
Male	41	32.8	53	22.7	13	11.0	75	20.7
Female	84	67.2	180	77.3	105	89.0	286	79.0
Gender identity								
Male	42	33.6	53	22.7	13	11.0	75	20.7
Female	79	63.2	180	77.3	104	88.1	281	77.6
Other	4	3.2	0	0	1	0.8	6	1.7
Sexual orientation								
Heterosexual	90	72.6	217	93.9	102	88.7	274	76.1
Other	34	27.4	14	6.1	13	11.3	86	23.9
Study status								
Not studying	32	25.6	42	18.0	22	18.8	83	22.9
Studying	93	74.4	191	82.0	95	81.2	279	77.1
Relationship status								
In relationship	48	38.4	107	45.9	41	34.7	151	41.7
Not in relationship	77	61.6	126	54.1	77	65.3	211	58.3

M = mean, SD = standard deviation.

Table 2. Evaluating change in outcome variables from Time 1 to Time 2.

	Time 1		Time 2				
Variable	M	SD	M	SD	*t*	*p*	*d*
Binge	3.33	6.46	2.77	5.13	2.36	.019	0.09
BMI	27.05	9.47	27.57	9.74	3.69	<.001	0.14
Dietary restraint	1.82	1.67	2.89	1.67	19.18	<.001	0.75
Drive for leanness	4.01	1.00	4.17	1.00	5.34	<.001	0.20
Drive for muscularity	3.49	1.10	3.69	0.98	6.22	<.001	0.24
Purge	0.65	2.03	0.54	1.54	1.48	.139	0.05

M = mean, SD = standard deviation.

contribution of predictors beyond scores on the respective dependent variable (DV) at Time 1. The two disordered eating constructs (binge eating and compensatory behaviours) tended to have the lowest amount of variance explained, though the amount of variance explained was considerably higher for Japanese participants. Variance in BMI, drive for leanness, and drive for muscularity scores were well accounted for in models across region, though the bulk of explained variance was – in most cases – attributable to T1 scores on these DVs.

Key predictors of disordered eating and weight changes over time

Binge eating

Reflecting sociocultural influences, pressure from fathers to lose weight was predictive of increases in binge eating in North America and Australia. For Australian participants, increases in reported binge eating were uniquely predicted by greater perceived pressure from fathers to lose weight, and those who were less likely to report smoking. Among European participants, trauma symptoms was associated with increased binge eating. Overweight status as a child, greater perceived pressure from fathers to lose weight, less sugary drink consumption and less intuitive eating were uniquely predictive of increased binge eating among North American participants. For Japanese participants, increases in binge eating were greater among individuals who were not students, who perceived less pressure from their fathers to lose weight, who engaged in fewer appearance comparisons, were more sedentary, were more likely to endorse strategies to decrease body size and less likely to endorse strategies to gain muscle (see Appendix A).

BMI

BMI at baseline was a strong predictor of BMI at follow-up for participants from all regions. Among North American participants, increased BMI at follow-up was greater for females, younger participants, those with a lifetime diagnosis of an eating disorder, those with lower social anxiety and lower body appreciation, participants who identified as smokers, and those who perceived less pressure from their fathers to lose weight. For European participants, greater perceived pressure from peers to lose weight, absence of a lifetime diagnosis of an eating disorder, and lower levels of sleep efficacy and internalisation of the thin ideal were unique predictors of increased BMI. Among participants from Australia, male gender status was predictive of increased BMI, whereas prior history of a medical condition was predictive of increased BMI among Japanese participants (see Appendix B).

Compensatory behaviours

As shown in Appendix C, increases in compensatory behaviours were more common for North American participants with higher father weight, family history of higher weight, greater perceived pressure from fathers to gain muscle, lower perceived pressure from media to lose weight, and greater personal engagement in strategies to decrease body size. For European participants, higher father weight, greater fried food consumption, less sedentary behaviour, less intuitive eating, and greater sleep efficiency were uniquely predictive of increased self-reported use of compensatory behaviours. Greater internalisation of weight bias and greater levels of alcohol consumption were predictive of increased compensatory behaviours for Australian participants. Lower mother weight, greater use of online dating apps, elevated impulsivity, greater use of strategies to decrease body size, less physical appearance comparisons, and poorer sleep quality were predictive of increased compensatory behaviours among Japanese participants.

Dietary restraint

Among North American participants, less perceived pressure from peers to gain muscle, greater self-oriented perfectionism, internalisation of weight bias, and more frequent physical appearance comparisons, and less sugary drink consumption were predictive of

Table 3. Variance explained in outcome measures at Time 2 by Time 1 variables.

		North America			Europe			Australia			Japan		
Outcome	Predictors	R^2	SE	*p-value*	R^2	SE	*p-value*	R^2	SE	*p-value*	R^2	SE	*p-value*
Binge eating	T1 Binge eating	.111	.067	.097	.205	.067	.002	.066	.067	.379	.411	.118	<.001
	T1 Binge eating + other predictors	.263	.046	<.001	.298	.072	<.001	.273	.095	.004	.638	.088	<.001
BMI	T1 BMI	.665	.082	<.001	.819	.032	<.001	.836	.037	<.001	.828	.031	<.001
	T1 BMI + other predictors	.756	.043	<.001	.840	.027	<.001	.845	.032	<.001	.835	.028	<.001
Comp	T1 Comp	.291	.058	<.001	.230	.095	<.001	.230	.077	.003	.596	.059	<.001
	T1 Comp + other predictors	.163	.068	.018	.027	.046	.553	.033	.038	.378	.132	.101	.189
Restraint	T1 Restraint	.404	.047	<.001	.386	.067	<.001	.399	.088	<.001	.506	.079	<.001
	T1 Restraint + other predictors	.501	.039	<.001	.638	.041	<.001	.434	.078	<.001	.747	.040	<.001
Leanness	T1 Leanness	.524	.039	<.001	.385	.070	<.001	.523	.067	<.001	.303	.082	<.001
	T1 Leanness + other predictors	.544	.038	<.001	.456	.069	<.001	.561	.072	<.001	.505	.069	<.001
Muscularity	T1 Muscularity	.502	.041	<.001	.408	.067	<.001	.437	.082	<.001	.211	.072	.003
	T1 Muscularity + other predictors	.530	.038	<.001	.502	.062	<.001	.578	.054	<.001	.400	.072	<.001

BMI = body mass index, Comp = compensatory behaviours, restraint = dietary restraint, leanness = drive for leanness.
Muscularity = drive for muscularity, T1 = time 1, other predictors are those listed in Table 2.

increased dietary restraint. Heterosexual sexual orientation, being single, greater perceived pressure from mothers to lose weight, greater internalisation of the thin ideal and less internalisation of weight bias, greater fried food consumption, lower alcohol consumption, and greater engagement in strategies to decrease body size were predictive of increased dietary restraint among European participants. Greater endorsement of strategies to decrease body size was also predictive of increased dietary restraint among Australian participants. For Japanese participants, heterosexual sexual orientation, absence of a lifetime diagnosis of an eating disorder, greater overvaluation of weight and shape, less consistent breakfast consumption, and greater endorsement of strategies to decrease body size were predictive of increased dietary restraint (see Appendix D).

Drive for leanness

Appendix E shows that greater self-oriented perfectionism was predictive of increased drive for leanness among North American participants, whereas trauma symptoms was predictive of this outcome for European participants. Among Australian participants, lower mother weight and elevated self-oriented perfectionism were predictive of increased drive for leanness. In Japan, heterosexual sexual orientation, less pressure from peers to lose weight, and greater engagement in appearance comparisons were uniquely predictive of increases in drive for leanness.

Drive for muscularity

As shown in Appendix F, more regular consumption of breakfast was predictive of increased drive for muscularity among North American participants. Younger age, male gender status, and trauma symptoms were predictive of increased drive for muscularity for European participants, while less perceived pressure from fathers and greater pressure from the media to gain muscle, and stronger internalisation of the thin ideal were predictive of drive for muscularity for Australian participants. For Japanese participants, more frequent use of online dating apps, stronger perceived pressure from mothers and yet less pressure from peers to gain muscle were associated with increased drive for muscularity.

Discussion

The current study examined the utility of a biopsychosocial model (see Figure 1) to predict both higher BMI and disordered eating among young adult men and women from seven countries over a 12-month period. A summary table of the risk factors for the outcome variables for each region is included as Table 4.

Binge eating

Binge eating at Time 1 was a significant predictor for all cultural groups, except Australia, and gender differences were not evident in binge eating symptoms for any group. North American participants were more likely to show binge eating when they reported a history of elevated weight and lower likelihood of intuitive eating. This suggests that North American participants may engage in binge eating regardless of their feelings of hunger or satiety, which may be exacerbated by the North American food environment (Rodgers & Sonneville, 2018; Ufholz et al., 2021). Australian participants were more likely to binge eat when they experienced pressure from their fathers to lose weight, whereas Japanese participants were more likely to binge eat when they experienced *less* pressure from their fathers to lose weight. These divergent findings may emerge in dissimilar cultural contexts; among young adults in Australia, binge eating may be a by-product of pressure from parents to lose weight or broader interpersonal distress from clashes with parents about weight issues (Ivanova et al., 2015; Lo Coco et al., 2016); in Japan it may be that participants are less likely to have a higher BMI or it may occur when young adults don't experience parental pressures. Pike et al. (2021) found that Japanese women with an eating disorder reported lower exposure to problems with parents, family weight and eating concerns, levels of family dieting, and higher family BMI than women in other western countries. Other findings among Japanese participants support the possibility that binge eating occurs when self-discipline and/or concerns about appearance ideals are relatively low; binge eating was negatively associated with base physical activity, physical appearance comparisons, and interest in gaining muscle. Only one predictor, trauma symptoms, was predictive of European participants' binge eating. This may reflect European food culture's emphasis on enjoyment of food and a relaxed approach to eating that is not as likely to be experienced in the other countries (Rozin et al., 1999). Binge-eating may therefore be used among trauma survivors to alleviate distressing memories or to manage distressing emotions (Braun et al., 2019).

BMI

As would be expected, given research indicating consistency in weight status (Field et al., 2005), BMI during the

Table 4. Summary of significant predictors of BMI and disordered eating outcomes examined, by country region.

	North America	Europe	Australia	Japan
Binge eating	• greater child overweight* • less pressure father to lose wgt^ • less sugary drinks* • less intuitive eating	• greater trauma symptoms*	• greater pressure father lose wgt • greater smoking^	• not being a student* • lower pressure father lose wgt • lower appearance comparisons* • more sedentary* • greater strategies to decrease weight • fewer strategies to gain muscle*
BMI	• female higher^ • younger higher^ • greater ED history^ • less pressure to lose wgt^ • lower body appreciation^ • lower social anxiety • greater smoking*	• no ED history^ • greater peer pressure to lose wgt • higher thin ideal^ • lower sleep efficiency	• male higher	• greater medical conditions*
Compensatory behaviours	• higher father wgt* • family history higher wgt* • higher pressure father gain muscle* • lower pressure media lose wgt • higher strategies to decrease body size	• higher father wgt* • higher fried foods* • lower sedentary* • less intuitive eating* • greater sleep efficiency*	• greater internalisation wgt bias* • greater alcohol*	• lower mother wgt* • greater online dating* • greater impulsivity* • fewer appearance comparisons* • greater strategies decrease body size • lower sleep efficacy
Restrained Eating	• lower pressure peers gain muscle^ • greater self perfectionism • lower sugary drinks • greater appearance compare* • greater internalisation weight bias*	• heterosexual* • single • great pressure mother lose wgt* • greater thin ideal • less internalisation weight bias* • greater fried foods^ • lower alcohol consumption* • greater strategies to decrease size	• strategies to decrease size	• heterosexual higher* • no ED history^ • greater value wgt and shape • lower breakfast* • greater strategies to decrease size
Drive for leanness	• greater self perfectionism	• greater trauma symptoms*	• lower mother weight* • greater self perfectionism	• heterosexual* • lower peer pressure lose wgt* • greater appearance comparison*
Drive for Muscularity	• greater breakfast	• male higher • younger higher* • greater trauma symptoms	• greater media pressure to gain muscle* • lower pressure father gain muscle^ • greater thin ideal^	• greater online dating* • greater pressure mothers gain muscle • less pressure peers gain muscle^

*effect that was non-significant in baseline analyses. ^effect that is on opposite direction for cross-sectional (baseline) versus longitudinal analyses.

first time of data collection predicted participants' BMIs at T2. However, other predictors of BMI seemed to operate differently in different countries. Among North American participants, women were more likely to report a greater increase in weight status a year later, whereas in Australia, men were more likely to report a greater increase in weight status over this time period. North American participants with a history of an eating disorder were more likely to report an increased BMI at T2, whereas European participants were likely to report increased BMI when they did not have a history of an eating disorder. North American participants with lower body appreciation reported higher BMIs and in parallel European participants with greater internalisation of the thin ideal reported higher BMIs. Aside from their initial reports of their BMIs, the only factor that predicted Japanese participants' BMIs was their history of medical conditions. Taken together, it seems that vulnerabilities for weight gain among North Americans (being female, a history of disordered eating, low body appreciation) may be attributable to sociocultural values that emphasise the importance of slenderness and lead to a focus on body shame and food avoidance. In contrast, Japanese participants appear to report weight gain across the study when they had a history of health problems; it seems that weight gain may follow a return to health.

Compensatory behaviours

T1 compensatory behaviours predicted T2 compensatory behaviours across all of the regions included in our analyses. Among North American and European participants, participation in compensatory behaviours

was more likely when they also reported some family history of higher BMI. This may be due to family socialisation regarding concern about weight or even health concerns associated with weight within these families. Past findings suggest a cycle of elevated weight being associated with weight concerns and dieting, which often leads to weight gain, not weight loss (Mann et al., 2007; Markey, 2014). Among Australian participants, more compensatory behaviours at T2 were likely when they had higher levels of internalised weight bias at T1. This may indicate that these participants were sensitive to negative perceptions of elevated weight and actively work to avoid weight gain, even though disordered behaviours are unlikely to be efficacious long-term. Among Japanese participants, lower mother weight and lower T1 physical appearance concerns were more likely to be associated with compensatory behaviours at T2. This suggests that compensatory behaviours among these participants may have less to do with interest in weight loss, but possibly concerns about autonomy and control. Some past research has suggested that disordered eating in Asian cultures may not always be accompanied by the body image and weight concerns that tend to be a hallmark of these disorders among Western cultures (Braun et al., 2019; Pike & Dunne, 2015). This is not to say that these disorders are necessarily less prevalent in Asian cultures, just that they may not have the same aetiological origins (Kim et al., 2021; Thomas et al., 2016).

Dietary restraint

T1 restraint predicted participants' restraint at T2 across all countries considered. Internalisation of weight bias, internalisation of the thin ideal, and endorsement of strategies to decrease body size at T1 were among the predictors that explained unique variance in participants' T2 reports of dietary restraint. Specifically, North American and European participants who internalised weight bias were more likely to engage in dietary restraint. European, Australian, and Japanese participants who endorsed strategies to decrease body size were at risk of engaging in restrained eating behaviours. Among European participants, endorsement of the thin ideal also placed them at risk of dietary restraint. Taken together, these findings suggest that concerns about body size are an important factor associated with dietary restraint across different countries. There have been limited studies that have examined dietary restraint as an outcome variable, with most studies including it as a predictor of eating disorders or psychological distress. A longitudinal study among adolescents found that restraint was predicted by negative attitudes to eating rather than body dissatisfaction (Johnson & Wardle, 2005).

Drive for leanness

Aside from participants' reports of their drive for leanness at Time 1, few of the predictors considered accounted for unique variance in participants' reports of their drive for leanness at Time 2. Both North American and Australian participants who reported high levels of perfectionism at T1 were more likely to also be driven towards leanness at T2. Among European participants, trauma symptoms were most predictive of drive for leanness. Among Japanese participants, one of the significant unique predictors was engagement in appearance comparisons. All of these significant predictors suggest that physical appearance concerns and a certain degree of personality rigidity or distress are associated with young adults' concerns about maintaining a lean physique. No studies were located that have explored the role of personality on drive for leanness, with studies primarily focussed on sociocultural concerns (Girard, Chabrol, et al., 2018). Clearly further work in this area is needed.

Drive for muscularity

Drive for muscularity at Time 1 predicted drive for muscularity at Time 2 among all country groups examined. However, no other similarities in significant, unique predictors of drive for muscularity across the groups emerged. Perhaps not surprisingly, European participants who were male were more driven to increase muscularity than were females. Among Australian participants, perceived media pressure to gain muscle was the most important predictor of subsequent drive for muscularity. Among Japanese participants, both pressure from mothers to gain muscle but less pressure from peers to gain muscle were associated with higher reports of drive for muscularity. Among North American participants, the only predictor was breakfast consumption. Taken together these findings are somewhat reconcilable with past research suggesting the importance of muscularity to boys' positive body image (Baker et al., 2019) and the role of social pressures to engage in muscle building (Girard, Chabrol, et al., 2018, 2018; Tylka, 2011; Yager & McLean, 2020)

Given there was not a clear pattern of findings across country groups (see Table 2), our results suggest the

importance of considering the cultural context when predicting disordered eating attitudes and behaviours as well as higher BMI. Generally speaking, across the outcomes explored, pressure to lose weight seems to emerge as the most consistent, unique predictor of North American participants' disordered eating and weight. Trauma symptoms emerged among European participants as a predictor of two of the outcomes in this sample (but was not a predictor in other cultural groups). Japanese participants reported engaging in strategies to decrease body size as the most consistent, unique predictor of disordered eating and weight. Sexual orientation and use of online dating apps emerged as predictors of Japanese participants' outcomes, but these predictors did not emerge as significant among other cultural groups. Finally, analyses of predictors of Australian participants' BMI and disordered eating did not reveal much in the way of consistent predictors of the body change behaviours.

Strengths and limitations

Although this is the first study to longitudinally examine higher BMI and disordered eating among a large sample of young adults across seven countries, several limitations are worth noting. The findings relate to young adults aged 18 to 30 years and may not be generalisable to adults over the age of 30 years. Information on all variables were based on self-report : height and weight as well as psychological symptoms may not be accurate. Perhaps the greatest limitation is the attrition of participants from Time 1 to Time 2. Over 6000 participants completed the survey at Time 1 but at follow-up, the sample was considerably smaller (under 1000). Some of this attrition is likely related to length of the survey and a lack of financial incentives for participation, but some is also attributable to the beginning of the coronavirus pandemic in 2020. Reyes-Olavarría et al. (2020) found that among both men and women the increase in BMI during the COVID pandemic was associated with a range of factors included in the current study, most particularly, over half of the sample were eating more than prior to the pandemic. Eating junk food was associated with weight gain among both men and women. In relation to disordered eating, Termorshuizen et al. (2020) found that there was a reported increase in binge eating episodes and that mental health problems among adults in both the US and the Netherlands increased after the onset of the pandemic. Since the current study was completed during the first wave of the coronavirus pandemic, it is unlikely that the completion of an on-line survey would be a priority for young adults who may be struggling with social isolation, home study and disrupted life goals. As a result of the more modest sample at Time 2, the models examined needed to be simplified and participants were grouped according to geographic similarity. Although the extent of systematic bias in results due to attrition is ultimately unknowable, it is encouraging to see negligible differences between participants who completed Time 2 assessments and those who dropped out after Time 1. Replication of this model with a larger longitudinal sample of participants would be optimal; the present results suggest constructs worth focusing on as predictors of cross-country similarities and differences in BMI, eating behaviours and disordered eating.

Conclusions

Despite the limitations of this study, important take-away messages emerge from the current research. Most notably, predictors of BMI and disordered eating varied considerably across the outcomes and regions examined, reinforcing the importance of cross-country evaluations of risk and protective factors for higher BMI and disordered eating (McCabe et al., 2019). Although identification of simple, replicable patterns of associations is often viewed as preferable, we believe that the more complex findings from the current study highlight the need to examine the predictors of higher BMI and disordered eating more thoroughly in a cultural context. In particular, there appear to be significant differences in the factors associated with weight status and eating-related behaviours in western (e.g., North America) versus eastern (e.g., Japan) cultures, which would support the limitation of the "Westernisation" model as a central structure in the explanation of the risks associated with higher BMI and disordered eating (Han, 2020; Pike & Dunne, 2015; Pike et al., 2021). It is also somewhat surprising that gender did not emerge as a significant predictor in more of the models, given the historical tendency to consider disordered eating as a predominantly female concern (Griffiths & Yager, 2019). However, we note that expected gender differences were evident at baseline (Fuller-Tyszkiewicz et al., 2022). Thus, it is possible that while gender differences may exist in terms of prevalence of disordered eating, their rate of change during early adulthood may not be determined by gender.

In summary, this longitudinal study of young adults in seven countries suggests that weight status, binge eating behaviours, compensatory behaviours, dietary restraint, drive for leanness and drive for muscularity should be considered within cultural contexts and that predictors of these attitudes and behaviours are complex and country-specific.

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Consent to participate

Consent to take part in the study was provided by all participants.

Consent for publication

All authors provided this approval.

Ethics approval

The questionnaire and methodology was approved by the Human Research Ethics Committee of Deakin University (Ethics Approval Number: DUHREC 2017–377).

Data availability statement

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

Authors' contribution

All authors made a substantial contribution to the design of the study, data collection and/or interpretation of the data.

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Appendices

Appendix A

Results of Regression Analyses Predicting Binge Eating at T2 from Time 1 Predictors Across Regions

		North America			Europe			Australia			Japan		
Type of variable	Predictors at Time 1	β (*SE*)	95% CI	*p-value*	β(*SE*)	95% CI	*p-value*	β(*SE*)	95% CI	*p-value*	β(*SE*)	95% CI	*p-value*
Covariate	Binge eating	.267 (.077)	.116, .417	.001	.441 (.073)	.297, .584	<.001	.196 (.112)	−.024, .415	.080	.556 (.075)	.409, .703	<.001
Covariate	Gender	−.091 (.053)	−.195, .013	.086	−.125 (.069)	−.260, .010	.070	−.029 (.070)	−.166, .108	.679	−.064 (.052)	−.166, .037	.213
Demographic	Study status	−.086 (.052)	−.188, .015	.094	-	-	-	-	-	-	−.111 (.048)	−.211, −.012	.026
Biological	Overweight at child	.186 (.051)	.086, .286	<.001	-	-	-	-	-	-	-	-	-
Sociocultural	Pressures to lose weight (father)	.157 (.065)	.030, .284	.016	-	-	-	.297 (.113)	.075, .519	.009	−.206 (.062)	−.327, −.086	.001
Psychological	Internalisation of the thin ideal	-	-	-	-	-	-	-	-	-	-	-	-
Psychological	Self-oriented perfectionism	-	-	-	-	-	-	-	-	-	-	-	-
Psychological	Appearance comparison	-	-	-	-	-	-	-	-	-	−.168 (.095)	−.353, .018	.077
Psychological	Trauma symptoms	-	-	-	.279 (.102)	.079, .479	.006	-	-	-	-	-	-
Behavioural	Sugary drinks consumption	−.120 (.052)	−.222, −.019	.020	-	-	-	-	-	-	-	-	-
Behavioural	Sedentary behaviour	-	-	-	-	-	-	-	-	-	.119 (.077)	−.033, .270	.126
Behavioural	Smoking habits				-	-	-	−.326 (.162)	−.643, −.008	.044	-	-	-
Behavioural	Strategies to decrease body size	-	-	-	-	-	-	-	-	-	.453 (.072)	.313, .593	<.001
Behavioural	Strategies to gain muscle	-	-	-	-	-	-	-	-	-	−.327 (.089)	−.502, −.153	<.001
Behavioural	Intuitive eating	−.144 (.052)	−.246, −.042	.006	-	-	-	-	-	-	-	-	-

β = Standardised regression coefficients; SE = Standard error; CI = Confidence interval. Gender was coded as 0 = male, 1 = female; Study status was coded as 0 = not currently studying, 1 = full or part-time study; Lifetime diagnosis of eating disorder was coded as 0 = yes, 1 = no.

Appendix B

Results of Regression Analyses Predicting BMI at T2 from Time 1 Predictors Across Regions

		North America			Europe			Australia			Japan		
Type of variable	Predictors at Time 1	β (*SE*)	95% CI	*p-value*	β(*SE*)	95% CI	*p-value*	β(*SE*)	95% CI	*p-value*	β(*SE*)	95% CI	*p-value*
Covariate	BMI	.637 (.074)	.492, .783	<.001	.850 (.028)	.794, .905	<.001	.917 (.019)	.880, .954	<.001	.908 (.019)	.870, .946	<.001
Covariate	Gender	.150 (.057)	.059, .241	.001	−.025 (.030)	−.085, .034	.404	.100 (.035)	.031, .170	.005	−.089 (.051)	−.189, .001	.082
Demographic	Age	−.104 (.040)	−.183, −.025	.010	-	-	-	-	-	-	-	-	-
Biological	Lifetime diagnosis of eating disorder	.149 (.056)	.038, .259	.008	−.085 (.038)	−.159, −.010	.026	-	-	-	-	-	-
Biological	Medical condition	-	-	-	-	-	-	-	-	-	.066 (.034)	.000, .132	.050
Sociocultural	Pressures to lose weight (father)	−.265 (.061)	−.385, −.145	<.001	-	-	-	-	-	-	-	-	-
Sociocultural	Pressures to lose weight (peers)	-	-	-	.111 (−036)	.041, .182	.002	-	-	-	-	-	-
Psychological	Body appreciation	−.185 (.055)	−.294, −.077	.001	-	-	-	-	-	-	-	-	-
Psychological	Internalisation of the thin ideal	-	-	-	−.058 (.028)	−.112, −.004	.034	-	-	-	-	-	-
Psychological	Social anxiety	−.121 (.055)	−.228, −.014	.027	-	-	-	-	-	-	-	-	-
Behavioural	Smoking habits	.074 (.035)	.006, .143	.033	-	-	-	-	-	-	-	-	-
Behavioural	Sleep efficacy	-	-	-	−.082 (.031)	−.144, −.020	.009	-	-	-	-	-	-

β = Standardised regression coefficients; SE = Standard error; CI = Confidence interval; BMI = Body mass index. Gender was coded as 1 = male, 2 = female; Medical condition was coded as 0 = no, 1 = yes; Lifetime diagnosis of eating disorder was coded as 0 = yes, 1 = no.

Appendix C

Results of Regression Analyses Predicting Compensatory Behaviours at T2 from Time 1 Predictors Across Regions

		North America			Europe			Australia			Japan		
Type of variable	Predictors at Time 1	β (*SE*)	95% CI	*p-value*	β(*SE*)	95% CI	*p-value*	β(*SE*)	95% CI	*p-value*	β(*SE*)	95% CI	*p-value*
Covariate	Purging behaviours	.301 (.075)	.155, .447	<.001	.152 (.133)	−.109, .412	.254	.116 (.091)	−.061, .294	.199	.140 (.106)	−.068, .349	.187
Covariate	Gender	−.038 (.068)	−.171, .095	.557	.053 (.076)	−.096, .201	.487	−.078 (.069)	−.312, .058	.260	−.036 (.039)	−.112, .039	.349
Biological	Lifetime diagnosis of eating disorder	−.101 (.057)	−.212, .011	.076	-	-	-	−.221 (.120)	−.457, .014	.066	-	-	-
Biological	Father weight	.120 (.040)	.040, .199	.003	.143 (.062)	.020, .265	.022	-	-	-	-	-	-
Biological	Mother weight	-	-	-	-	-	-	-	-	-	−.227 (.051)	−.327, −.128	<.001
Biological	Family history of higher weight	.198 (.056)	.088, .307	<.001	-	-	-	-	-	-	-	-	-
Sociocultural	Online dating	-	-	-	-	-	-	-	-	-	.315 (.091)	.136, .494	.001
Sociocultural	Pressures lose weight (media)	−.165 (.061)	−.284, −.045	.007	-	-	-	-	-	-	-	-	-
Sociocultural	Pressures to gain muscle (father)	.164 (.087)	−.006, .334	.059	-	-	-	-	-	-	-	-	-
Psychological	Impulsivity	-	-	-	-	-	-	-	-	-	.188 (.060)	.071, .306	.002
Psychological	Internalisation of weight bias	-	-	-	-	-	-	.228 (.065)	.101, .354	<.001	-	-	-
Psychological	Physical appearance comparison	-	-	-	-	-	-	-	-	-	−.398 (.107)	−.606, −.189	<.001
Behavioural	Fried foods consumption	-	-	-	.234 (.103)	.033, .436	.023	-	-	-	-	-	-
Behavioural	Sedentary behaviour	-	-	-	−.231 (.086)	−.400, −.062	.007	-	-	-	-	-	-
Behavioural	Alcohol consumption	-	-	-	-	-	-	.228 (.088)	.056, .399	.009	-	-	-
Behavioural	Strategies to decrease body size	.298 (.063)	.175, .421	<.001	-	-	-	-	-	-	.575 (.082)	.415, .735	<.001
Behavioural	Intuitive eating	-	-	-	−.229 (.082)	−.390, −.069	.005	-	-	-	-	-	-
Behavioural	Sleep efficiency	-	-	-	.189 (.050)	.091, .288	<.001	-	-	-	-	-	-
Behavioural	Sleep quality	-	-	-	-	-	-	-	-	-	−.228 (.079)	−.382, −.073	.004

β = Standardised regression coefficients; SE = Standard error; CI = Confidence interval. Gender was coded as 1 = male, 2 = female; Lifetime diagnosis of eating disorder was coded as 0 = yes, 1 = no.

Appendix D

Results of Regression Analyses Predicting Dietary Restraint at T2 from Time 1 Predictors Across Regions

		North America			Europe			Australia			Japan		
Type of variable	Predictors at Time 1	β(*SE*)	95% CI	*p-value*	β(*SE*)	95% CI	*p-value*	β(*SE*)	95% CI	*p-value*	β(*SE*)	95% CI	*p-value*
Covariate	Restraint	.472 (.053)	.369, .576	<.001	.288 (.087)	.117, .459	.001	.443 (.114)	.220, .667	<.001	.338 (.069)	.204, .473	<.001
Covariate	Gender	−.031 (.049)	−.128, .066	.503	.032 (.051)	−.069, .132	.536	−.060 (.081)	−.218, .099	.459	−.010 (.056)	−.119, .099	.863
Demographic	Sexual orientation	-	-	-	.120 (.045)	.033, .208	.007	-	-	-	.173 (.064)	.047, .299	.007
Demographic	Relationship status	-	-	-	−.203 (.048)	−.296, −.109	<.001	-	-	-	-		-
Biological	Lifetime diagnosis of eating disorder	-	-	-	-	-	-	-	-	-	−.114 (.055)	−.222, −.006	.039
Sociocultural	Pressures to lose weight (peers)	-	-	-	.105 (.059)	−.012, .221	.078	-	-	-	-	-	-
Sociocultural	Pressures to lose weight (mother)	-	-	-	.168 (.074)	.024, .313	.022	-	-	-	-	-	-
Sociocultural	Pressures to gain muscle (peers)	−.136 (.050)	−.234, −.039	.006	-	-	-	-	-	-	-	-	-
Psychological	Overvaluation of weight and shape	-	-	-	-	-	-	-	-	-	.339 (.076)	.191, .488	<.001
Psychological	Internalisation of the thin ideal	-	-	-	.229 (.059)	.114, .344	<.001	-	-	-	-	-	-
Psychological	Self-oriented perfectionism	.110 (.041)	.030, .191	.007	-	-	-	-	-	-	-	-	-
Psychological	Internalisation of weight bias	.219 (.060)	.103, .336	<.001	−.155 (.076)	.304, .003	.042	-	-	-	-	-	-
Psychological	Physical appearance comparison	.115 (.053)	.012, .218	.029	-	-	-	-	-	-	-	-	-
Behavioural	Fried foods consumption	-	-	-	.133 (.052)	.031, .235	.010	-	-	-	-	-	-
Behavioural	Breakfast consumption	-	-	-	-	-	-	-	-	-	−.124 (.054)	−.230, −.018	.039
Behavioural	Sugary drinks consumption	−.124 (.041)	−.205, −.042	.003	-	-	-	-	-	-	-	-	-
Behavioural	Alcohol consumption	-	-	-	−.252 (.051)	−.352, −.151	<.001	-	-	-	-	-	-
Behavioural	Strategies to decrease body size	-	-	-	.276 (.097)	.086, .467	.004	.289 (.106)	.081, .496	.006	.239 (.079)	.083, .394	.003

β = Standardised regression coefficients; SE = Standard error; CI = Confidence interval. Gender was coded as 1 = male, 2 = female; Sexual orientation was coded as 0 = other, 1 = heterosexual; Relationship status was coded as 0 = not in a relationship/other, 1 = in a relationship/married; Lifetime diagnosis of eating disorder was coded as 0 = yes, 1 = no.

Appendix E

Results of Regression Analyses Predicting Drive for Leanness at T2 from Time 1 Predictors Across Regions

		North America			Europe			Australia			Japan		
Type of variable	Predictors at Time 1	β (*SE*)	95% CI	*p-value*	β(*SE*)	95% CI	*p-value*	β(*SE*)	95% CI	*p-value*	β(*SE*)	95% CI	*p-value*
Covariate	Drive for leanness	.627 (.046)	.537, .716	<.001	.595 (.060)	.478, .712	<.001	.663 (.055)	.555, .770	<.001	.544 (.066)	.415, .673	<.001
Covariate	Gender	−.059 (.044)	−.146, .028	.184	−.117 (.062)	−.239, .004	.058	−.061 (.074)	−.205, .084	.411	−.271 (.070)	−.407, −.134	<.001
Demographic	Sexual orientation	-	-	-	-	-	-	-	-	-	.258 (.099)	.064, .451	.009
Biological	Lifetime diagnosis of eating disorder	−.069 (.035)	−.138, .001	.052	-	-	-	-	-	-	-	-	-
Biological	Mother weight	-	-	-	-	-	-	−.187 (.080)	−.344, −.030	.020	-	-	-
Sociocultural	Pressures lose weight (peers)	-	-	-	-	-	-	-	-	-	−.265 (.065)	−.385, −.145	<.001
Psychological	Internalisation of the muscular ideal	.097 (.051)	−.003, .198	.058	-	-	-	-	-	-	-	-	-
Psychological	Self-oriented perfectionism	.083 (.041)	.002, .164	.044	-	-	-	.174 (.075)	.027, .320	.020	-	-	-
Psychological	Appearance comparison	-	-	-	-	-	-	-	-	-	.196 (.072)	.054, .338	.007
Psychological	Trauma symptoms	-	-	-	.268 (.093)	.087, .450	.004	-	-	-	-	-	-

β = Standardised regression coefficients; SE = Standard error; CI = Confidence interval. Gender was coded as 1 = male, 2 = female; Sexual orientation was coded as 0 = other, 1 = heterosexual; Lifetime diagnosis of eating disorder was coded as 0 = yes, 1 = no.

Appendix F

Results of Regression Analyses Predicting Drive for Muscularity at T2 from Time 1 Predictors Across Regions

		North America			Europe			Australia			Japan		
Type of variable	Predictors at Time 1	β(*SE*)	95% CI	*p-value*	β(*SE*)	95% CI	*p-value*	β(*SE*)	95% CI	*p-value*	β(*SE*)	95% CI	*p-value*
Covariate	Drive for muscularity	.718 (.031)	.657, .779	<.001	.555 (.064)	.430, .680	<.001	.603 (.071)	.465, .742	<.001	.528 (.079)	.373, .684	<.001
Covariate	Gender	.053 (.047)	−.039, .144	.257	−.195 (.071)	−.334, −.056	.006	−.126 (.081)	−.284, .032	.118	−.154 (.081)	−.313, .006	.059
Demographic	Age	-	-	-	−.150 (.052)	−.251, −.048	.004	-	-	-	-	-	-
Sociocultural	Online dating	-	-	-	-	-	-	-	-	-	.261 (.060)	.143, .380	<.001
Sociocultural	Pressures to gain muscle (father)	-	-	-	-	-	-	−.197 (.070)	−.335, −.059	.005	-	-	-
Sociocultural	Pressures to gain muscle (mother)	-	-	-	-	-	-	-	-	-	.225 (.090)	.049, .401	<.001
Sociocultural	Pressures to gain muscle (peers)	-	-	-	-	-	-	-	-	-	−.333 (.080)	−.488, −.177	<.001
Sociocultural	Pressures to gain muscle (media)	-	-	-	-	-	-	.233 (.064)	.107, .360	<.001	-	-	-
Psychological	Body satisfaction	−.084 (.043)	−.169, .000	.051	-	-	-	-	-	-	-	-	-
Psychological	Internalisation of the thin ideal	-	-	-	-	-	-	.271 (.067)	.140, .402	<.001	-	-	-
Psychological	Trauma symptoms	-	-	-	.223 (.097)	.033, .414	.022	-	-	-	-	-	-
Behavioural	Breakfast consumption	.124 (.037)	.051, .197	.001	-	-	-	-	-	-	-	-	-

β = Standardised regression coefficients; SE = Standard error; CI = Confidence interval. Gender was coded as 1 = male, 2 = female; Sexual orientation was coded as 0 = other, 1 = heterosexual; Relationship status was coded as 0 = not in a relationship/other, 1 = in a relationship/married; Lifetime diagnosis of eating disorder was coded as 0 = yes, 1 = no.