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Motivational profiles for eating behavior and their associations with intuitive eating

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ABSTRACT

Intuitive eating is an adaptive eating approach shown to have positive psychological and physical health outcomes. Understanding the motivation behind eating behavior can provide valuable information for why some women eat intuitively and others do not. Using self-determination theory (SDT), this study aimed to identify motivational profiles for eating behavior and examine differences in intuitive eating across these motivational profiles. A nationally representative sample of New Zealand women ($n = 1447$) aged 40–50 years ($M = 45.4$; $SD = 3.2$) completed questionnaires assessing motivation and intuitive eating. Latent profile analysis identified five profiles characterized by varying levels of the global and specific forms of behavioral regulation described by SDT. The *self-determined* profile, characterized by high levels of global self-determination, had higher intuitive eating scores. The *internalized* profile, characterized by high levels of identified and integrated regulation, had average intuitive eating scores. The *conflicted* profile, characterized by high levels on most forms of behavioral regulation, and the *unmotivated* profile, characterized low levels on all forms of behavioral regulation, had a mix of high and low intuitive eating subscale scores. The *amotivated* profile, characterized by very high levels of amotivation, had lower intuitive eating scores. A motivational profile characterized by higher levels of self-determination and lower levels of the extrinsic forms of behavioral regulation appears to be beneficial for intuitive eating. Therefore, SDT-informed eating behavior interventions that enhance women's self-determined motivation should be created to facilitate intuitive eating in midlife women.

1. Introduction

Intuitive eating is an adaptive eating style primarily characterized by individuals' eating in response to their physical hunger and satiety cues (Tylka & Kroon Van Diest, 2013). Individuals who eat intuitively are not preoccupied with food and dieting, they do not try to stave off hunger or label certain foods as forbidden. Instead, they make food choices that optimize their body's functioning and allow themselves foods that they enjoy without guilt. They tend to eat for physical reasons rather than as a coping response for emotions (e.g., boredom, anxiety, loneliness). They rely on their hunger and satiety cues to determine when and how much to eat. Overall, intuitive eating emphasizes both honoring health with nutritious food (gentle nutrition) and fostering a positive relationship with food (Tribole & Resch, 2020; Tylka & Kroon Van Diest, 2013). As such, it has been proposed as an alternative to dieting, shifting the focus of eating from weight loss to improved health. Unlike dieting, which is associated with adverse physical and psychological health outcomes such as weight cycling and food and body preoccupation (Bacon & Aphramor, 2011; Brownell & Rodin, 1994), intuitive eating is associated with positive physical and psychological health outcomes (Linardon et al., 2021; Schaefer & Magnuson, 2014). Research has shown intuitive eating to be positively related to body appreciation, self-esteem, self-compassion, and satisfaction with life, and inversely related to eating disorder symptomatology, body dissatisfaction, internalization of the thin ideal, and body mass index (for a review see Linardon et al., 2021). Interventions designed to increase intuitive eating have resulted in weight maintenance and improved psychological health such as improvements in depression and self-esteem, dietary intake and/or eating behaviors such as decreases in disordered eating behaviors, and physical indicators such as blood pressure and cholesterol levels (Babbott et al., 2022; Schaefer & Magnuson, 2014; Van Dyke & Drinkwater, 2014).

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Abbreviations

SDT	Self-determination theory
REBS	Regulation of Eating Behaviors Scale
IES	Intuitive Eating Scale
UPE	Unconditional Permission to Eat
EPR	Eating for Physical Rather than Emotional Reasons
RHSC	Reliance on Internal Hunger and Satiety Cues
B-FCC	Body-Food Choice Congruence
ESEM	Exploratory structural equation modelling
CFA	Confirmatory factor analysis
CFI	Comparative fit index
TLI	Tucker-Lewis index
SRMR	Standardized root mean square residual
RMSEA	Root mean square error of approximation
LPA	Latent profiles analysis
BLRT	Bootstrap likelihood ratio test
LMR-LRT	Lo-Mendell-Rubin likelihood ratio test
CAIC	Consistent Akaike's information criterion
BIC	Bayesian information criterion
SSA-BIC	Sample-size adjusted BIC
CI	Confidence interval
MVPA	Moderate-vigorous physical activity

Given these benefits of intuitive eating, health professionals are being advised to support this adaptive way of eating (Bacon & Aphramor, 2011). A comprehensive understanding of the motivational determinants of eating behavior and how this relates to intuitive eating would provide health professionals knowledge on how best to support their clients to engage in this way of eating.

Self-determination theory (SDT; Ryan & Deci, 2017) is one of the most widely regarded conceptual frameworks for guiding the study of human motivation. SDT emphasizes fostering healthy behaviors, making it well-suited to understanding the relationship between motivation and intuitive eating. SDT has proved influential in understanding motivation for other health behaviors such as physical activity and smoking cessation (Ntoumanis et al., 2021). SDT describes six qualities of motivation known as behavioral regulations: amotivation (lack of any intention to engage in the behavior or the perception that factors beyond one's control cause behavior), external regulation (motivated by pressure exerted by others such as from rewards, demands, avoiding criticism), introjected regulation (motivated by pressure that is self-imposed, such as from guilt, shame, rebellious feelings), identified regulation (motivated by personally valued outcomes of the behavior), integrated regulation (motivated by the behavior fitting with one's sense of self) and intrinsic motivation (inherent satisfaction or enjoyment in the behavior; Ryan & Deci, 2017). These behavioral regulations sit along a continuum of self-determination, with amotivation sitting at one end of the continuum (non-self-determined) and intrinsic motivation sitting at the other end (completely self-determined; Ryan & Deci, 2000).

Previous studies have found intuitive eating to be positively related to identified regulation, integrated regulation, and intrinsic motivation (Carraça et al., 2019) and more generally to autonomous motivation (a combined identified regulation, introjected regulation, and intrinsic motivation score; Carbonneau et al., 2015; Román et al., 2021). It is also negatively related to amotivation, extrinsic regulation, and introjected regulation (Carraça et al., 2019) and more generally to controlled motivation (a combined amotivation, external regulation, and introjected regulation score; Carbonneau et al., 2015; Román et al., 2021). In other words, individuals are more likely to engage in intuitive eating behaviors when their eating is motivated by personal values and choices rather than internal or external pressures. Despite the importance of these initial studies, by using variable-centered approaches and treating the behavioral regulations separately, they have not taken into account that people can simultaneously endorse more than one form of behavioral regulation as influencing their eating behavior (Vallerand, 1997). For example, an individual may be motivated to eat in a particular way because they see the value in doing so (identified regulation) but also because they would feel guilty if they did not (introjected regulation). Therefore, these studies have not examined how the behavioral regulations interact to influence intuitive eating. A promising approach for modelling complex interactions among the behavioral regulations is to rely on person-centered methods and examine motivational profiles.

Researchers have examined motivational profiles and their outcomes in other contexts including physical activity (Emm-Collison et al., 2020; Lindwall et al., 2017; Nuss et al., 2023), education (Moreno-Murcia & Corbí, 2021; Vansteenkiste et al., 2009), and work (Chen et al., 2019; Howard et al., 2016). This research has found that, in contrast to profiles characterized by higher levels of the controlled and lower levels of the autonomous forms of behavioral regulation, profiles characterized by higher levels of the autonomous and lower levels of the controlled forms of behavioral regulation have been associated with higher levels of physical activity (Friederichs et al., 2015; Lindwall et al., 2017), greater academic performance (Vansteenkiste et al., 2009), and greater job satisfaction and lower levels of burnout (Howard et al., 2016). These results support the SDT position that individuals can have a variety of different motivations for engaging in a behavior and that the composition of their motivational profile will influence participation in a behavior (Vallerand, 1997).

Recent research conducted within SDT has shown that motivation is best represented by a global self-determination factor alongside specific factors representing the distinct behavioral regulations (Bureau et al., 2023; Stenling et al., 2023). This method captures the continuum of self-determination that is theorized to be underlying the individual behavioral regulations (Howard et al., 2020), enabling a more accurate understanding of motivation as conceptualized by SDT. Modelling motivation in this way means that it is possible to differentiate the role of self-determination from the role of the unique component of the different types of behavioral regulation (Bureau et al., 2023; Howard et al., 2020). That is, it is now possible to distinguish whether outcomes associated with, for example identified regulation, are due to the self-determination underlying it or to the effect of the unique characteristics of this regulation (i.e., personal importance). Research examining motivational profiles that considers the specific regulation styles as well as the degree of self-determination in the work and academic contexts demonstrates that this approach yields a more complete picture of motivation and its relationship to behavior by separating global from specific aspects (Tóth-Király et al., 2021, 2022).

The aim of the present study was to identify motivational profiles for eating behavior and to compare the profiles on intuitive eating in a nationwide sample of New Zealand midlife women. A comprehensive understanding of how motivation for eating behavior relates to intuitive eating would aid in fostering intuitive eating behavior. Many midlife women have deeply entrenched restrained and weight focused eating behaviors (Leong et al., 2013; Slof-Op't Landt et al., 2017). Dieting often occurs in a cyclical fashion and weight cycling and yo-yo ('on' and 'off') dieting is metabolically harmful and impairs psychological well-being (Bacon & Aphramor, 2011; Quinn et al., 2020). Therefore, intuitive eating, as a weight-neutral approach, may be especially beneficial for this group. It was hypothesized that women belonging to profiles characterized with higher levels of self-determination and the autonomous forms of behavioral regulation alongside lower levels of the controlled forms of regulation would eat more intuitively than women belonging to profiles with higher levels of the controlled forms of regulation

alongside lower levels of the autonomous forms of regulation and self-determination.

2. Method

2.1. Participants and study design

In May 2009, a random sample of 2500 women aged 40–50 years were selected from the General and Māori New Zealand electoral rolls to take part in a longitudinal study designed to examine modifiable factors associated with the prevention of weight gain in midlife women. The present study analyses data from the baseline survey which achieved a 66% response rate ($n = 1601$). Respondents were representative of the New Zealand population at the time in terms of socioeconomic status and percentage identifying as Māori (Indigenous New Zealanders; for details see Leong et al., 2011). Participants received a survey to complete in the mail which comprised a number of validated questionnaires primarily relating to eating behavior and physical activity as well as demographic questions taken from the 2006 New Zealand Census (Statistics New Zealand, 2006). The completed questionnaire was returned in a prepaid envelope. The mail survey procedure was based on the Dillman method (Dillman, 2006) with non-monetary (pen and tea bag) and monetary (entered into draw to win money upon the return of a completed booklet) incentives. Full details of the method can be found in Leong et al. (2011). The study was approved by the University of Otago Ethics Committee and the Ngāi Tahu Research Consultation Committee. Participants were informed that by completing and returning the questionnaire they were giving their consent to take part in the study.

For the current study, we only included the 1447 participants who had responded to the Regulation of Eating Behaviors Scale (REBS; Pelletier et al., 2004) and the Intuitive Eating Scale (IES; Tylka, 2006). These participants (see Table 1) ranged in age between 40 and 51 years ($M = 45.4$, $SD = 3.2$). The majority of the sample were New Zealand European (≈67%) and were classified as being of middle socioeconomic status (≈66%) according to the occupation-based New Zealand socioeconomic index 1996 (Statistics New Zealand, 2006). Participants also reported if they had any health conditions. This was included because we recognized that while having a medical condition does not preclude someone from eating intuitively, this may influence the results. However, only 25 participants reported conditions that might require medically based dietary restrictions (e.g., diabetes, Coeliac disease, irritable bowel syndrome) that may prevent them from eating intuitively.

Table 1
Demographic characteristics of women who participated in the baseline survey.

Variable	*n* (%)
Ethnicity	
New Zealand European	962 (66.8)
Other	191 (13.3)
Māori	163 (11.3)
Asian	82 (5.7)
Pacific Island	43 (3.0)
Socioeconomic status[a]	
Low (10–29)	211 (14.6)
Middle (30–59)	957 (66.3)
High (60–90)	275 (19.1)
BMI category	
Underweight (<18.5)	25 (1.8)
Healthy weight (18.5–24.9)	667 (48.5)
Overweight (25.0–29.9)	402 (29.2)
Obese (≥30.0)	282 (20.5)
Smoking status	
Current smoker	273 (19.2)
Former smoker	373 (26.4)
Never smoker	775 (54.5)
Highest level of education attained	
Primary and/or some secondary school	445 (30.9)
Completed secondary school	138 (9.6)
Technical/trade school/polytechnic	398 (27.7)
University	458 (31.8)

Note. BMI = body mass index.
[a] Socioeconomic status was based on the New Zealand Socioeconomic Index 1996, with 10 representing the lowest socioeconomic groups and 90 representing the highest socioeconomic groups. This is based on a standard New Zealand classification of occupations.

2.2. Measures

2.2.1. Motivation for eating behavior

Motivation for eating behavior was assessed using the validated 24-item REBS (Pelletier et al., 2004). The scale consists of six subscales (each containing four items) that measure the six behavioral regulations as proposed by SDT: amotivation ($\omega = 0.84$ in the present study); external regulation ($\omega = 0.76$), introjected regulation ($\omega = 0.76$), identified regulation ($\omega = 0.83$), integrated regulation ($\omega = 0.91$), and intrinsic motivation ($\omega = 0.90$). Participants are provided with the introductory statement, "please indicate the degree to which the proposed reasons correspond to your reasons for eating the way you do". This was changed from the original wording of the REBS which used the phrase, "… correspond to your reasons for regulating your eating behavior", based on previous pilot work among 36 New Zealand midlife women where participants found the word "regulating" difficult to understand (Leong et al., 2012). Example items are: "Honestly, I don't know. I can't see what I'm getting out of it" (amotivation), "Because it is expected of me" (external regulation), "Because I would feel ashamed of myself if I was not eating healthily" (introjected regulation), "Because I think it's a good idea" (identified regulation), "Because it has become a fundamental part of who I am" (integrated regulation), "Because it is fun to create meals that are good for my health" (intrinsic motivation). Items are rated on a seven-point Likert scale, ranging from one (does not correspond at all) to seven (corresponds exactly) with higher scores indicating greater levels of motivation. The factor structure, reliability, and criterion-related validity of the REBS has been demonstrated in studies among Canadian university students (Pelletier et al., 2004), Portuguese adults (Teixeira et al., 2021), and New Zealand midlife women (Stenling et al., 2023). Generally, amotivation, external regulation, and introjected regulation were positively related to unfavorable outcomes such as bulimic symptomatology, depressive symptomatology, and lower fruit and vegetable intake (Pelletier et al., 2004; Stenling et al., 2023). Whereas identified regulation, integrated regulation, and intrinsic motivation generally were positively related to favorable outcomes such as self-esteem, life satisfaction, healthy eating behaviors, and intuitive eating (Pelletier et al., 2004; Stenling et al., 2023; Teixeira et al., 2021).

2.2.2. Intuitive eating

Intuitive eating was assessed using the validated 21-item IES (Tylka, 2006). The scale consists of three subscales: (a) Unconditional Permission to Eat (UPE) that reflects individuals' willingness to eat when hungry (rather than ignoring hunger signals) and their refusal to label foods as "good" or "bad" and attempt to avoid food in the latter category (nine items; $\omega = 0.76$ in the present study); (b) Eating for Physical Rather than Emotional Reasons (EPR) that reflects individuals' use of food to satisfy physical hunger rather than to cope with emotions such as stress, anxiety, loneliness, or boredom (six items; $\omega = 0.87$); (c) Reliance on Internal Hunger and Satiety Cues (RHSC) that reflects individuals' awareness of and trust in these cues to guide them on when and how much to eat (six items; $\omega = 0.75$). Example items are: "If I am craving a certain food, I allow myself to have it" (UPE), "I use food to help soothe my negative emotions" (EPR; reverse scored), and "When I am eating, I can tell when I am getting full" (RHSC). Items are rated on a five-point Likert scale ranging from one (strongly disagree) to five (strongly agree) with higher scores indicating a more intuitive style of eating. At the time the study was initiated, this was the only scale available to measure

intuitive eating, the updated IES with the additional Body-Food Choice Congruence subscale had not been published (Tylka & Kroon Van Diest, 2013). The factor structure of the IES has been demonstrated in a sample of United States university students (Tylka, 2006). The three subscales were each positively related to satisfaction with life, self-esteem, and proactive coping and negatively related to eating disorder symptomatology, body dissatisfaction, and pressure for thinness. Studies among middle adult women (40–65 years) have supported the construct validity of the IES. These studies examined total intuitive eating scores, rather than the individual subscales, and found them to be positively related to body appreciation and self-esteem and negatively related to body mass index, weight concern, binge eating, and disordered eating behavior (Augustus-Horvath & Tylka, 2011; Godde et al., 2022; Madden et al., 2012).

2.3. Statistical analysis

Stata (version 18.0; StataCorp, 2023) was used for descriptive statistical analyses.

2.3.1. Preliminary analyses

Bifactor S-1 exploratory structural equation modelling (ESEM) was used to model the REBS and was conducted using Mplus software (version 8.11; Muthén & Muthén, 1998-2017). This specification has been shown to be superior when compared to modelling the REBS using confirmatory factor analysis (CFA), bifactor S-1 CFA, and ESEM (Stenling et al., 2023). Bifactor models estimate a global factor capturing shared variance across factors, along with several specific factors capturing variance unique to each subfactor (Morin et al., 2020).

Specifically, this approach involves loading all items onto the global factor and loading subsets of items onto five specific factors of integrated regulation, identified regulation, introjected regulation, external regulation, and amotivation. A specific factor for intrinsic motivation is not included in bifactor S-1 modelling, thus allowing the global factor to be grounded in these items (Bureau et al., 2023). Cross-loadings for non-target items are specified to be close to zero for the specific factors in the bifactor S-1 ESEM approach and orthogonal rotation is used. The orthogonality of the factors in the bifactor model provides a clean partitioning of the variance that is explained by the global factor, which absorbs the covariance shared among all items, and the specific factors that represents the covariance shared among a subset of items that is not shared with the other subsets (Morin et al., 2020).

The IES has traditionally been modelled using CFA (Tylka, 2006), however, CFA's often lead to misfit models as they are overly restrictive with no cross-loadings (Marsh et al., 2014). ESEM models are preferable as they overcome some of the limitations inherent in CFA models (Marsh et al., 2014). Model fit for the IES ESEM and REBS bifactor S-1 ESEM was evaluated using the comparative fit index (CFI), the Tucker-Lewis index (TLI), the standardized root mean square residual (SRMR), and the root mean square error of approximation (RMSEA). CFI and TLI values 0.90 or greater and SRMR and RMSEA values 0.08 or lower indicate acceptable model fit (Marsh, 2007). The REBS bifactor S-1 ESEM had good model fit to the data: CFI = 0.969; TLI = 0.941; SRMR = 0.018; RMSEA = 0.048, 90% CI [0.044, 0.052]. The factor scores from this model were saved to use in the latent profile analysis. The IES ESEM had acceptable model fit to the data: CFI = 0.883; TLI = 0.837; SRMR = 0.042; RMSEA = 0.072, 90% CI [0.068, 0.075]. The model fit of the IES CFA was CFI = 0.802; TLI = 0.776; SRMR = 0.088; RMSEA = 0.084, 90% CI [0.081 0.087]. The higher CFI and TLI values and lower SRMR and RMSEA values in the ESEM indicate improved model fit compared to the CFA. The standardized factor loadings in the CFA ranged from −0.030 to 0.843 (M = 0.583) and in the ESEM ranged from 0.157 to 0.860 (M = 0.571). Most cross-loadings in the ESEM were relatively weak (<0.3) except for two which were −0.326 and 0.441. The latent factor correlations in the CFA ranged from 0.339 to 0.582 (M = 0.497) and in the ESEM ranged from 0.187 to 0.522 (M = 0.371). The ESEM model was retained for use in subsequent analyses as it had improved model fit, positive factor loadings, and reduced latent factor correlations (Marsh et al., 2014). This ESEM approach has recently been highlighted by Tylka et al. (2024) as a suitable approach when one is interested in the specific subscales of intuitive eating.

2.3.2. Latent profile analysis

Latent profiles analysis (LPA) was performed using Mplus software (version 8.11; Muthén & Muthén, 1998-2017) with the six REBS factors (the specific factors amotivation, external regulation, introjected regulation, identified regulation, introjected regulation, and the global self-determination factor) as input variables. The robust full-information maximum likelihood estimator was used to uncover the latent profiles. Latent factor scores derived from the bifactor S-1 ESEM were used, rather than mean scale scores, as they provide a partial control for measurement errors by giving more weight to items with lower levels of measurement errors (Howard et al., 2016). Therefore, latent factor scores are considered to reflect a more accurate representation of a woman's level of motivation compared to manifest mean scores. A sequence of nested models, with an increasing number of profiles (starting with one) were compared to determine if more complex models (with more profiles) fit the data better than more parsimonious models with fewer profiles. Models with one to 10 profiles were tested to identify the optimal number of profiles. Profiles were added iteratively to identify the best model fit. Based on recommendations (Nylund et al., 2007), a number of statistical criteria were used to examine model fit and to identify the model with the optimal number of profiles. A p value of <0.05 for the bootstrap likelihood ratio test (BLRT) and the Lo-Mendell-Rubin likelihood ratio test (LMR-LRT) indicates that the model being examined fits the data better compared to a model with one less profile (Nylund et al., 2007). The consistent Akaike's information criterion (CAIC), Bayesian information criterion (BIC), and the sample-size adjusted BIC (SSA-BIC) are "parsimony criteria" with lower values indicating a better model fit (Nylund et al., 2007). Entropy values were examined to assess how accurately women were categorized into their respective profiles with a higher value indicating better precision (Berlin et al., 2014). Model fit tends to improve as profiles are added, therefore, the optimal model was defined as the model with the minimum number of profiles possible while achieving an acceptable model fit (DiStefano & Kamphaus, 2006). In addition to the fit criteria, interpretability and theoretical meaningfulness were assessed when determining the optimal model (Marsh et al., 2009). Standardized REBS z-scores, with a mean of zero and standard deviation of one, were used to support the interpretation of the best-fitting model.

Overall tests of associations and pairwise class comparisons were performed using Wald tests (the BCH method; Asparouhov & Muthén, 2014) to examine differences between each of the latent profiles and the three subscales of intuitive eating. These were entered in the analysis as auxiliary outcome variables. A p value < 0.05 was considered statistically significant.

3. Results

3.1. Preliminary analyses

Means, standard deviations, and correlations among primary study measures are reported in Table 2. Women reported relatively low levels of amotivation, external regulation, and introjected regulation and relatively high levels of identified regulation, integrated regulation, and intrinsic motivation. Neighboring subscales were more strongly correlated with one another than with subscales that are farther apart on the self-determination continuum. For the intuitive eating subscales, women reported average to high levels of UPE and EPR, and higher levels of RHSC. The EPR and RHSC subscales were positively correlated with autonomous forms of regulation and were negatively correlated with controlled forms of regulation. The UPE subscale was negatively

Table 2
Correlations among study latent variables.

Subscale	*M (SD)*	1	2	3	4	5	6	7	8	9
Regulation of Eating Behavior Scale[a]										
1. Amotivation	1.9 (1.1)	–								
2. External regulation	2.2 (1.1)	0.56	–							
3. Introjected regulation	2.8 (1.3)	0.25	0.54	–						
4. Identified regulation	4.8 (1.4)	−0.17	0.15	0.39	–					
5. Integrated regulation	4.5 (1.5)	−0.37	0.03[c]	0.23	0.60	–				
6. Intrinsic motivation	4.4 (1.5)	−0.28	0.09	0.22	0.56	0.69	–			
Intuitive Eating Scale[b]										
7. UPE	3.2 (0.6)	−0.04[c]	−0.32	−0.53	−0.39	−0.24	−0.25	–		
8. EPR	3.3 (0.8)	−0.22	−0.19	−0.15	0.06[c]	0.35	0.25	0.39	–	
9. RHSC	3.6 (0.6)	−0.22	−0.07[c]	−0.04[c]	0.17	0.39	0.38	0.18	0.52	–

Note. Subscale means and standard deviations are calculated from raw subscale scores. Correlations are calculated from factor scores. UPE = Unconditional Permission to Eat subscale, EPR = Eating for Physical Rather than Emotional Reasons subscale, RHSC = Reliance on Internal Hunger and Satiety Cues subscale.
[a] Items are measured on a scale from one (does not correspond at all) to seven (corresponds exactly).
[b] Items are measured on a scale from one (strongly disagree) to five (strongly agree).
[c] $p > 0.05$.

correlated with both autonomous and controlled forms of regulation.

3.2. Latent profile analysis

The model fit of the 10 estimated latent profile solutions are reported in Table 3. Values for the CAIC, BIC, and SSA-BIC decrease with each profile added, suggesting an improvement in fit in models with more profiles. The BLRT *p* value suggests that compared to models with one less profile, model fit improves with each successive profile added. The adjusted LMR-LRT suggests that, compared to models with one less profile, model fit is improved for models with two, three, five, and seven profiles. Based on interpretability and theoretical meaningfulness of the profiles adding a fifth profile to the four-class model provided a theoretically interpretable and meaningful additional profile. The addition of a sixth profile, however, resulted in two profiles that did not differ substantially with respect to their outcomes, hence the sixth class was not a meaningful addition. Furthermore, the LMR-LRT fit statistic suggested there was no improvement in model fit with the addition of a sixth profile. Therefore, the five-class model was retained.

Motivational profiles for the five-class model are depicted in Fig. 1. Descriptions of the five latent profiles are based on standardized *z*-scores and thus represent standard deviation units above (positive values) or below (negative values) the sample mean of zero. Differences from the mean were described as very low or very high (>± 1.0 *SD*), low or high (±0.5 to 1.0 *SD*), or slightly below or slightly above average (−0.5 to 0.5 *SD*; (Gustafsson et al., 2018).

Women in profile one (n = 769, 53%), labelled *self-determined*, reported slightly below average levels of amotivation and external, introjected, identified, and integrated regulations. They reported high levels of self-determination. This means that women in this profile choose to eat healthily because they want to. Profile two (n = 125, 9%) was labelled *internalized*. Women in this profile reported low levels of amotivation, slightly below average levels of external regulation, slightly above average levels of introjected regulation, high levels of identified regulation, very high levels of integrated regulation, and slightly below average levels of self-determination. This means that women in this profile are motivated to eat healthily because it is important for their identity, they value the outcomes of eating healthily, and they would feel guilty if they did not eat healthily. Profile three (n = 30, 2%) was labelled *conflicted*. Women in this profile reported very high levels of amotivation, external regulation, and introjected regulation, slightly below average levels of identified regulation, slightly above average levels of integrated regulation, and high levels of self-determination. The women in this profile report that they do not know why they are bothering to eat healthily but feel pressure from others and themselves to eat healthily. At the same time, they choose to eat healthily because they want to, and it is important for their identity. Women in profile four (n = 275, 19%), labelled *amotivated*, reported very high levels of amotivation, slightly above average levels of external, introjected, and identified regulations, and slightly below average levels of integrated regulation and self-determination. The women in this profile do not know why they are bothering to eat healthily but are experiencing some pressure from others to eat this way. Women in profile five (n = 248, 17%), labelled *unmotivated*, reported slightly below average levels of amotivation and external, introjected, identified, and integrated regulations, and very low levels of self-determination. The women in this profile are not motivated to eat healthily.

3.3. Differences in intuitive eating between motivational profiles

Latent profile differences in the intuitive eating subscales are depicted in Table 4. The results are presented as standardized *z*-scores

Table 3
Fit indices, entropy, and model comparisons for the estimated latent profile analysis models.

Model	LL	#fp	CAIC	BIC	SSA-BIC	Entropy	BLRT	LMR-LRT	Adjusted LMR-LRT	nC < 10/5%
1 class	−12319.22	12	24737.77	24725.77	24687.65	*NA*	*NA*	*NA*	*NA*	*NA*
2 class	−12087.02	19	24331.31	24312.31	24251.95	0.88	<0.001	<0.001	<0.001	0/0
3 class	−11985.77	26	24186.75	24160.75	24078.16	0.91	<0.001	0.037	0.039	1/1
4 class	−11895.73	33	24064.60	24031.60	23926.77	0.88	<0.001	0.665	0.668	2/0
5 class	−11805.42	40	23941.94	23901.94	23774.87	0.82	<0.001	0.013	0.014	2/1
6 class	−11715.65	47	23820.33	23773.33	23624.03	0.82	<0.001	0.165	0.169	3/1
7 class	−11642.64	54	23732.25	23678.25	23506.71	0.83	<0.001	0.002	0.003	4/2
8 class	−11573.35	61	23651.60	23590.60	23396.83	0.83	<0.001	0.390	0.393	5/2
9 class	−11526.83	68	23616.52	23548.52	23332.51	0.83	<0.001	0.289	0.293	6/3
10 class	−11480.62	75	23582.03	23507.03	23268.78	0.84	<0.001	0.112	0.116	7/4

Note. LL = log-likelihood #fp = number of free parameters, CAIC = consistent Akaike's information criterion, BIC = Bayesian information criterion, SSA-BIC = sample size adjusted Bayesian information criterion, BLRT = bootstrap likelihood ratio test, LMR-LRT = Lo-Mendell-Rubin likelihood ratio test, nC < 10/5% = number of classes with less than 10 and 5% of participants, respectively, NA = not applicable.

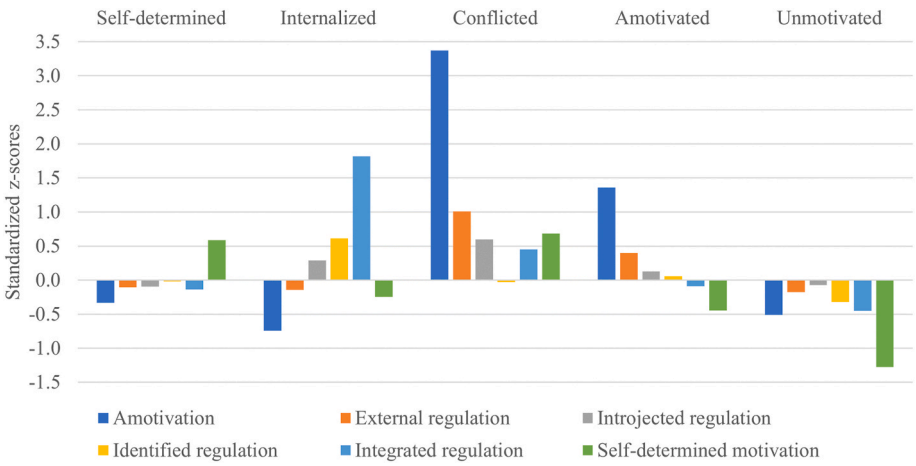

Fig. 1. Motivational profiles in the five-class model.

Table 4
Latent profile characteristics for the five-class model.

Variable	Latent profiles, *M* (*SE*)				
	Self-determined	Internalized	Conflicted	Amotivated	Unmotivated
UPE	-0.07^{b} (0.04)	-0.15^{bc} (0.11)	-0.59^{c} (0.21)	-0.06^{b} (0.06)	0.44^{a} (0.07)
EPR	0.20^{a} (0.04)	0.07^{a} (0.11)	0.12^{a} (0.18)	-0.33^{b} (0.07)	-0.30^{b} (0.08)
RHSC	0.25^{a} (0.04)	-0.03^{b} (0.10)	0.36^{ab} (0.17)	-0.34^{c} (0.06)	-0.42^{c} (0.07)

Note. Table depicts standardized factor scores. UPE = Unconditional Permission to Eat subscale; EPR = Eating for Physical Rather than Emotional Reasons subscale; RHSC = Reliance on Internal Hunger and Satiety Cues subscale. Values in the same row that do not share common superscripts (e.g., a, b) are significantly different at $p < 00.05$ level in pairwise tests.

which represent standard deviation units above or below the mean of zero for the sample. Table S1 in the supplementary material depicts the mean raw scores on the IES subscales for each of the profiles.

3.3.1. Latent profile differences in unconditional permission to eat

The *unmotivated* profile reported a higher UPE score ($M = 0.44$) than all other profiles (range −0.59 to −0.06). The *amotivated*, *self-determined*, and *internalized* profiles did not differ significantly in their UPE scores. The *amotivated* ($M = -0.06$) and *self-determined* ($M = -0.07$) profiles reported a higher UPE score than the *conflicted* profile ($M = -0.59$). The *internalized* and *conflicted* profiles did not differ in their UPE scores.

3.3.2. Latent profile differences in eating for physical reasons

The EPR scores for the *self-determined* ($M = 0.20$), *conflicted* ($M = 0.12$), and *internalized* ($M = -0.15$) profiles did not differ significantly from one another, but these profiles all scored significantly higher than the *unmotivated* ($M = -0.30$) and *amotivated* ($M = -0.33$) profiles. The EPR scores of the *unmotivated* and *amotivated* profiles were not significantly different.

3.3.3. Latent profile differences in reliance on internal hunger and satiety cues

The RHSC scores of the *conflicted* ($M = 0.36$), *self-determined* ($M = 0.25$) and *internalized* ($M = -0.03$) profiles were all significantly higher than both the *amotivated* ($M = -0.34$) and *unmotivated* ($M = -0.42$) profiles. The *amotivated* and *unmotivated* profiles did not differ significantly from one another. The *self-determined* profile ($M = 0.25$) reported a significantly higher RHSC score than the *internalized* profile ($M = -0.03$).

4. Discussion

This study sought to better understand motivation for eating by (a) relying on person-centered methods to detect the most common motivational configurations and (b) by investigating how these motivational profiles related to intuitive eating outcomes. Five latent profiles were identified that were characterized by varying levels of the global and specific forms of behavioral regulation for eating. The results show that midlife women endorse combinations of the different qualities of motivation for eating behavior as proposed by SDT (Ryan & Deci, 2017; Vallerand, 1997). Supporting our hypotheses, results showed that midlife women belonging to profiles with higher levels of self-determination, integrated regulation, and/or identified regulation, alongside lower levels of introjected regulation, external regulation, and amotivation, had higher intuitive eating subscale scores than those belonging to profiles with higher levels of amotivation, external regulation, and/or introjected regulation, alongside lower levels of identified regulation, integrated regulation, and self-determination.

4.1. Motivational profiles for eating behavior

Our person-centered approach shows that midlife women's motivation for how they eat can be influenced by both autonomous and controlled forms of behavioral regulation simultaneously. It is the combination and interaction of these regulations that seem to determine outcomes. There has been no previous research investigating motivational profiles in relation to eating motivation with which to compare the profiles identified in the current study, however, studies have identified motivational profiles for physical activity motivation in adults (Emm-Collison et al., 2020; Friederichs et al., 2015; Gustafsson et al., 2018; Lindwall et al., 2017; Nuss et al., 2023). There are clear differences between physical activity and eating behavior, for instance eating

behavior is physiologically driven by hunger and satiation whereas physical activity lacks such drivers. However, they are both health behaviors and there are some similarities between the motivational profiles identified for physical activity and the profiles identified for eating behavior in our study. We identified an *amotivated* profile that displayed high levels of amotivation alongside lower levels of the other behavioral regulations, which also has been found in physical activity contexts (Emm-Collison et al., 2020; Gustafsson et al., 2018; Lindwall et al., 2017; Nuss et al., 2023). Similarly, the *unmotivated* profile characterized by low levels on all behavioral regulations were similar to profiles in physical activity contexts (Emm-Collison et al., 2020; Friederichs et al., 2015; Gustafsson et al., 2018; Lindwall et al., 2017; Nuss et al., 2023). Though eating and physical activity are different behaviors, these profiles appear to replicate across contexts indicating that these combinations of the regulations are common to lifestyle behaviors in the health context.

Profiles characterized by lower levels of amotivation, external regulation, and introjected regulation and higher levels of identified regulation, integrated regulation, and intrinsic motivation are also common profile shapes in physical activity contexts (Emm-Collison et al., 2020; Friederichs et al., 2015; Lindwall et al., 2017; Nuss et al., 2023). These low controlled/high autonomous motivational profiles are similar to the *self-determined* and *internalized* profiles in the present study, but with some noteworthy distinctions. Unlike the low controlled/high autonomous profiles in the physical activity research, the *self-determined* profile in the present study does not show high levels of identified and integrated regulation. This is surprising given that they are considered autonomous forms of regulation. This suggests that in this profile it is the self-determination that is driving the association to the positive outcomes rather than the specific reasons/behavioral regulations. The research conducted in the physical activity context, however, did not use methods that separate global self-determination from specific factors. As such, it was not possible to determine whether it was the underlying self-determination or the unique aspect of identified regulation that was salient for those outcomes. The present findings suggest that it could be the underlying self-determination that led to those associations with positive outcomes. This contrasts with the *internalized* profile, characterized by low levels of self-determination and high levels of identified and integrated regulation. In this profile, it appears that identified and integrated regulation are the motivating factors for midlife women in this profile (i.e., the specific factors) rather than the self-determination. In other words, they see the importance of eating healthily and it fits in with their identity, but that aspect of "I want to" is lacking. These two profiles highlight the value of the more detailed approach we took in the present study in which global and specific levels of motivation were disaggregated.

The *conflicted* profile exhibited an unexpected combination of behavioral regulations, given it had high levels of self-determination and external, introjected, and integrated regulations, as well as very high levels of amotivation. This motivational profile appears to be relatively unique with a similar profile appearing only in one previous study on physical activity (Nuss et al., 2023). In both studies this was the smallest of the profiles, containing just 2% of the sample (30 women) in our study and 5.7% of the sample (57 people) in the study by Nuss et al. (2023), but was likely identified as a profile because of its distinctive shape. It appears people in this profile do not recognize the value of engaging in the health behavior (very high amotivation and lower identified regulation) but engage in the health behavior out of pressure (high external and introjected regulations) but perhaps want it to be part of who they are (high levels of integrated regulation and self-determination/intrinsic motivation). In our study, this profile had mixed intuitive eating results having higher/average scores on the RHSC and EPR subscales but a much lower score on the UPE subscale. The low UPE score could be a result of the high level of external regulation and indicates that a high degree of self-determined motivation may not protect against the negative effects of non-self-determined types of motivation (if they are high/strong enough) in the intuitive eating context. Nuss et al. (2023) examined the outcome of moderate-vigorous physical activity (MVPA) and found that their high controlled/high autonomous profile had the highest levels of MVPA before, during, and after the COVID-19 pandemic compared to the other three profiles identified in their study. If additional outcome variables were examined, a mixed pattern of desirable and less desirable results may have been observed as was seen in our study. This unique profile is theoretically difficult to explain as it has high controlled *and* autonomous forms of motivation and so does not follow the expected SDT pattern of having either high controlled *or* autonomous forms of motivation (Ryan & Deci, 2017). This finding highlights a major benefit of person-centered approaches, which is their ability to reveal complex patterns of interactions among multiple variables, thus providing an important theoretical insight into the complex pattern of within-person behavioral regulation interactions. Future qualitative research of why this profile occurs would be most illuminating from a practical and theoretical perspective.

4.2. Profile differences in intuitive eating subscales

Our results found that the profiles that had high levels of self-determination, integrated regulation, and/or identified regulation scored significantly higher in the EPR and RHSC subscales of the IES compared with profiles that were low in the autonomous forms of behavioral regulation. Interestingly, the *conflicted* and *amotivated* profiles differed in these subscales despite both having similarly high levels of amotivation and external regulation, suggesting that the presence of the more autonomous forms of regulation is critical to more positive eating behaviors. These results are consistent with previous studies that show RHSC and EPR to be positively related to identified regulation, integrated regulation, and intrinsic motivation (Carbonneau et al., 2015; Carraça et al., 2019; Román et al., 2021).

The UPE subscale, which represents an individual's willingness to eat when they are hungry and eat what they desire, rather than staving off their hunger and avoiding foods labelled "forbidden" (Tylka, 2006), was significantly higher in the *unmotivated* profile than all others. In intuitive eating, UPE is given because restricting food intake can lead to feelings of deprivation which increases the likelihood of becoming preoccupied with food (Polivy & Herman, 1999; Tribole & Resch, 2020). One possible interpretation is that women in this profile give themselves UPE because they are not overly concerned with eating healthily based on what they enjoy. The pattern of UPE scores between the other profiles are difficult to explain. UPE seems to be higher in profiles which have both high and low levels of self-determination, and high or average levels of external regulation and amotivation. Previous research has shown UPE to be negatively related to all six regulations (Carbonneau et al., 2015; Carraça et al., 2019; Román et al., 2021).

The Body-Food Choice Congruence (B-FCC) subscale in the revised versions of the IES measures the extent to which individuals match their food choices with their bodies' needs (Tylka & Kroon Van Diest, 2013) (Tylka et al., 2024). This study did not use the IES-2 or IES-3 because the scales had not been developed at the time the data was collected. The inclusion of the B-FCC subscale could help with the interpretation of the UPE scores. For example, if a profile has a high UPE score but a low B-FCC score, this could suggest that people in this profile are not choosing foods that support their body's functioning, and rather are primarily choosing food that tastes good. Whereas, if a profile has a high UPE score and a high B-FCC score, this could suggest that women in this profile eat in a more intuitive way; they primarily choose foods that will help their body to function but also refuse to label food as "good" and "bad" and avoid food in the latter category. Examining the UPE dimension alongside the other intuitive eating dimensions would be beneficial to provide a more holistic understanding of intuitive eating behavior in these profiles. Future research could conduct an LPA on the intuitive eating subscales to identify how the subscales group within individuals.

Only the *amotivated* profile scored low on all three dimensions of intuitive eating, while there were no profiles that scored high on all three subscales. The finding that there is no group of midlife women who scored highly on all three subscales of intuitive eating is very important and suggests that even in groups of midlife women who have a positive motivational profile with high levels of self-determination, integrated regulation, and/or identified regulation they still are practicing dietary restraint. This may suggest that the UPE aspect of intuitive eating is the most difficult to adopt. This may be a result of the fear that it will lead to overeating and weight gain, or that dietary restraint is the more well-known and trusted approach by people who are more self-determined in their eating (Barraclough et al., 2019).

4.3. Strengths, limitations, and future research

We relied on a disaggregation of midlife women's global self-determined eating motivation levels (i.e., women's global sense of volition) from their unique levels of specific behavioral regulations (Bureau et al., 2023; Ryan & Deci, 2017). This approach is a strength because it allowed us to address limitations of previous person-centered investigations by considering the multidimensional nature of motivation (Bureau et al., 2023). The data collection method of using a random sample from the electoral rolls is a strength, although it is likely that midlife women interested in the topic would have chosen to respond. As this was a nationally representative sample of New Zealand midlife women, the motivational profiles identified in this study are likely a fair representation of the profiles present in the general population of New Zealand midlife women. With 66% of the sample being New Zealand European, the results may be applicable to midlife women in other Western populations such as Australia, Canada, the United States, and the United Kingdom due to the similarities in weight related eating behaviors among these groups (Grogan, 2021). We acknowledge, several limitations evident in the current study. First, the design of the study was cross-sectional and therefore no causal explanation for the results is possible. The results are specific to New Zealand midlife women and may not be generalizable to people of other ages or men. Another limitation of the study is the measure of motivation. The stem of the REBS asks what your reasons are for eating the way you do, however, most of the items ask about reasons for eating healthily. Therefore, for those participants who do not routinely choose to eat healthily, their likely response option was to tick that the item does not correspond to them (1 on the response scale). If this interpretation is correct, then we would expect these participants to belong to the unmotivated profile. Future research could revise the items to focus on reasons for eating the way you do as the stem states, rather than on eating healthily. The updated IES-2 (Tylka & Kroon Van Diest, 2013), and just recently the IES-3 (Tylka et al., 2024), which include the additional B-FCC subscale, were not available at the time the study was initiated. Future research should include the most recent version. Future research could also include additional health outcome variables such as dietary data to examine which profiles have a healthier dietary intake. Lastly, future research should investigate the antecedents of the profiles to understand why an individual ends up in a particular motivational profile as opposed to another. One place to begin would be to examine how satisfaction or frustration of the basic psychological needs' influences profile membership. SDT suggests that satisfaction of the basic psychological needs for autonomy, relatedness, and competence are important for the development of autonomous forms of regulation, whereas the frustration of these needs facilitates controlled forms of regulation (Ryan & Deci, 2017).

4.4. Conclusions

The present study identified five motivational profiles that varied in levels of the different forms of autonomous and controlled behavioral regulation, and overall self-determination for eating defined by SDT. Midlife women belonging to motivational profiles higher in self-determination or identified and integrated regulations and lower amotivation and external and introjected regulations had higher intuitive eating scores. The results provide support for the importance of higher self-determination relative to controlled motivation in facilitating healthier eating behaviors in midlife women. Therefore, health professionals should work to enhance women's self-determined motivation by using techniques such as motivational interviewing.

Ethical statement

The study from which the data in this paper was derived was approved by the University of Otago Ethics Committee (reference number 08/103) and the Ngāi Tahu Research Consultation Committee. Participants were informed that by completing and returning the questionnaire they were giving their consent to take part in the study.

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CRediT authorship contribution statement

Hannah Martin: Writing – original draft, Methodology, Formal analysis, Conceptualization, Writing – review & editing. **Andreas Stenling:** Writing – review & editing, Supervision, Methodology, Formal analysis. **Elaine Anne Hargreaves:** Writing – review & editing, Supervision, Methodology, Conceptualization.

Declaration of competing interest

The authors have no conflicts of interest.

Data availability

The data that has been used is confidential.

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Appendix A. Supplementary data

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References

Asparouhov, T., & Muthén, B. (2014). Auxiliary variables in mixture modeling: Three-step approaches using M*plus*. *Structural Equation Modeling: A Multidisciplinary Journal, 21*(3), 329–341. https://doi.org/10.1080/10705511.2014.915181

Augustus-Horvath, C. L., & Tylka, T. L. (2011). The acceptance model of intuitive eating: A comparison of women in emerging adulthood, early adulthood, and middle adulthood. *Journal of Counseling Psychology, 58*(1), 110. https://doi.org/10.1037/a0022129

Babbott, K. M., Cavadino, A., Brenton-Peters, J., Consedine, N. S., & Roberts, M. (2022). Outcomes of intuitive eating interventions: A systematic review and meta-analysis. *Eating Disorders, 31*(1), 33–63. https://doi.org/10.1080/10640266.2022.2030124

Bacon, L., & Aphramor, L. (2011). Weight science: Evaluating the evidence for a paradigm shift. *Nutrition Journal, 10*, 1–13. https://doi.org/10.1186/1475-2891-10-9

Barraclough, E. L., Hay-Smith, E. J. C., Boucher, S. E., Tylka, T. L., & Horwath, C. C. (2019). Learning to eat intuitively: A qualitative exploration of the experience of mid-age women. *Health Psychology Open, 6*(1), 1–8. https://doi.org/10.1177/2055102918824064

Berlin, K. S., Williams, N. A., & Parra, G. R. (2014). An introduction to latent variable mixture modeling (part 1): Overview and cross-sectional latent class and latent profile analyses. *Journal of Pediatric Psychology, 39*(2), 174–187. https://doi.org/10.1093/jpepsy/jst084

Brownell, K. D., & Rodin, J. (1994). The dieting maelstrom: Is it possible and advisable to lose weight? *American Psychologist, 49*(9), 781–791. https://doi.org/10.1037/0003-066x.49.9.781

Bureau, J. S., Guay, F., Plamondon, A., Ratelle, C. F., Howard, J. L., & Gilbert, W. (2023). Empirical testing of an alternative modeling of the self-determination continuum. *Motivation and Emotion, 47*(1), 46–60. https://doi.org/10.1007/s11031-022-09976-9

Carbonneau, N., Carbonneau, E., Cantin, M., & Gagnon-Girouard, M.-P. (2015). Examining women's perceptions of their mother's and romantic partner's interpersonal styles for a better understanding of their eating regulation and intuitive eating. *Appetite, 92*, 156–166. https://doi.org/10.1016/j.appet.2015.05.020

Carraça, E. V., Leong, S. L., & Horwath, C. C. (2019). Weight-focused physical activity is associated with poorer eating motivation quality and lower intuitive eating in women. *Journal of the Academy of Nutrition and Dietetics, 119*(5), 750–759. https://doi.org/10.1016/j.jand.2018.09.011

Chen, C.-X., Zhang, J., & Gilal, F. G. (2019). Composition of motivation profiles at work using latent analysis: Theory and evidence. *Psychology Research and Behavior Management, 12*, 811–824. https://doi.org/10.2147/PRBM.S210830

Dillman, D. A. (2006). *Mail and internet surveys: The tailored design method* (2nd ed.). John Wiley & Sons.

DiStefano, C., & Kamphaus, R. (2006). Investigating subtypes of child development: A comparison of cluster analysis and latent class cluster analysis in typology creation. *Educational and Psychological Measurement, 66*(5), 778–794. https://doi.org/10.1177/0013164405284033

Emm-Collison, L. G., Sebire, S. J., Salway, R., Thompson, J. L., & Jago, R. (2020). Multidimensional motivation for exercise: A latent profile and transition analysis. *Psychology of Sport and Exercise, 47*, Article 101619. https://doi.org/10.1016/j.psychsport.2019.101619

Friederichs, S. A., Bolman, C., Oenema, A., & Lechner, L. (2015). Profiling physical activity motivation based on self-determination theory: A cluster analysis approach. *BMC Psychology, 3*, 1–12. https://doi.org/10.1186/s40359-015-0059-2

Godde, J. U., Yuan, T. Y., Kakinami, L., & Cohen, T. R. (2022). Intuitive eating and its association with psychosocial health in adults: A cross-sectional study in a representative Canadian sample. *Appetite, 168*. https://doi.org/10.1016/j.appet.2021.105782. Article 105782.

Grogan, S. (2021). *Body image: Understanding body dissatisfaction in men, women, and children* (4th ed.). Routledge.

Gustafsson, H., Carlin, M., Podlog, L., Stenling, A., & Lindwall, M. (2018). Motivational profiles and burnout in elite athletes: A person-centered approach. *Psychology of Sport and Exercise, 35*, 118–125. https://doi.org/10.1016/j.psychsport.2017.11.009

Howard, J. L., Gagné, M., & Morin, A. J. S. (2020). Putting the pieces together: Reviewing the structural conceptualization of motivation within SDT. *Motivation and Emotion, 44*, 846–861. https://doi.org/10.1007/s11031-020-09838-2

Howard, J., Gagné, M., Morin, A. J. S., & Van den Broeck, A. (2016). Motivation profiles at work: A self-determination theory approach. *Journal of Vocational Behavior, 95*, 74–89. https://doi.org/10.1016/j.jvb.2016.07.004

Leong, S. L., Madden, C., Gray, A., & Horwath, C. (2012). Self-determined, autonomous regulation of eating behavior is related to lower body mass index in a nationwide survey of middle-aged women. *Journal of the Academy of Nutrition and Dietetics, 112*(9), 1337–1346. https://doi.org/10.1016/j.jand.2012.04.018

Leong, S. L., Madden, C., Gray, A. R., & Horwath, C. C. (2013). A nationwide survey of weight control practices among middle-aged New Zealand women. *New Zealand Medical Journal, 126*(1386), 12–20. http://journal.nzma.org.nz/journal/126-1386/5909/.

Leong, S. L., Madden, C., Gray, A., Waters, D., & Horwath, C. (2011). Faster self-reported speed of eating is related to higher body mass index in a nationwide survey of middle-aged women. *Journal of the American Dietetic Association, 111*(8), 1192–1197. https://doi.org/10.1016/j.jada.2011.05.012

Linardon, J., Tylka, T. L., & Fuller-Tyszkiewicz, M. (2021). Intuitive eating and its psychological correlates: A meta-analysis. *International Journal of Eating Disorders, 54*(7), 1073–1098. https://doi.org/10.1002/eat.23509

Lindwall, M., Ivarsson, A., Weman-Josefsson, K., Jonsson, L., Ntoumanis, N., Patrick, H., Thøgersen-Ntoumani, C., Markland, D., & Teixeira, P. (2017). Stirring the motivational soup: Within-person latent profiles of motivation in exercise. *International Journal of Behavioral Nutrition and Physical Activity, 14*(1), 4. https://doi.org/10.1186/s12966-017-0464-4

Madden, C. E., Leong, S. L., Gray, A., & Horwath, C. C. (2012). Eating in response to hunger and satiety signals is related to BMI in a nationwide sample of 1601 mid-age New Zealand women. *Public Health Nutrition, 15*(12), 2272–2279. https://doi.org/10.1017/S1368980012000882

Marsh, H. W. (2007). Application of confirmatory factor analysis and structural equation modeling in sport and exercise psychology. In G. Tenenbaum, & R. C. Eklund (Eds.), *Handbook of sport psychology* (3rd ed., pp. 774–798). John Wiley & Sons. https://doi.org/10.1002/9781118270011.ch35.

Marsh, H. W., Lüdtke, O., Trautwein, U., & Morin, A. J. S. (2009). Classical latent profile analysis of academic self-concept dimensions: Synergy of person-and variable-centered approaches to theoretical models of self-concept. *Structural Equation Modeling: A Multidisciplinary Journal, 16*(2), 191–225. https://doi.org/10.1080/10705510902751010

Marsh, H. W., Morin, A. J. S., Parker, P. D., & Kaur, G. (2014). Exploratory structural equation modeling: An integration of the best features of exploratory and confirmatory factor analysis. *Annual Review of Clinical Psychology, 10*, 85–110. https://doi.org/10.1146/annurev-clinpsy-032813-153700

Moreno-Murcia, J. A., & Corbí, M. (2021). Social support by teacher and motivational profile of higher education students. *Psychology, Society, & Education, 13*(1), 9–25. https://doi.org/10.25115/psye.v1i1.2658

Morin, A. J. S., Myers, N. D., & Lee, S. (2020). Modern factor analytic techniques: Bifactor models, exploratory structural equation modeling (ESEM), and bifactor-ESEM. In G. Tenenbaum, R. C. Eklund, & N. Boiangin (Eds.), *Handbook of sport psychology: Exercise, methodologies, & special topics* (4th ed., pp. 1044–1073). John Wiley & Sons. https://doi.org/10.1002/9781119568124.ch51.

Muthén, L. K., & Muthén, B. O. (2017). *Mplus user's guide*, 1998 (8th ed.). Muthén & Muthén.

Ntoumanis, N., Ng, J. Y. Y., Prestwich, A., Quested, E., Hancox, J. E., Thøgersen-Ntoumani, C., Deci, E. L., Ryan, R. M., Lonsdale, C., & Williams, G. C. (2021). A meta-analysis of self-determination theory-informed intervention studies in the health domain: Effects on motivation, health behavior, physical, and psychological health. *Health Psychology Review, 15*(2), 214–244. https://doi.org/10.1080/17437199.2020.1718529

Nuss, K., Sui, W., Rhodes, R., & Liu, S. (2023). Motivational profiles and associations with physical activity before, during, and after the COVID-19 pandemic: Retrospective study. *JMIR Formative Research, 7*(1), Article e43411. https://doi.org/10.2196/43411

Nylund, K. L., Asparouhov, T., & Muthén, B. O. (2007). Deciding on the number of classes in latent class analysis and growth mixture modeling: A Monte Carlo simulation study. *Structural Equation Modeling: A Multidisciplinary Journal, 14*(4), 535–569. https://doi.org/10.1080/10705510701575396

Pelletier, L. G., Dion, S. C., Slovinec-D'Angelo, M., & Reid, R. (2004). Why do you regulate what you eat? Relationships between forms of regulation, eating behaviors, sustained dietary behavior change, and psychological adjustment. *Motivation and Emotion, 28*(3), 245–277. https://doi.org/10.1023/B:MOEM.0000040154.40922.14

Polivy, J., & Herman, C. P. (1999). Distress and eating: Why do dieters overeat? *International Journal of Eating Disorders, 26*(2), 153–164. https://doi.org/10.1002/(sici)1098-108x(199909)26:2<153::aid-eat4>3.0.co;2-r

Quinn, D. M., Puhl, R. M., & Reinka, M. A. (2020). Trying again (and again): Weight cycling and depressive symptoms in US adults. *PLoS One, 15*(9), Article e0239004. https://doi.org/10.1371/journal.pone.0239004

Román, N., Rigó, A., Gajdos, P., Tóth-Király, I., & Urbán, R. (2021). Intuitive eating in light of other eating styles and motives: Experiences with construct validity and the Hungarian adaptation of the Intuitive Eating Scale-2. *Body Image, 39*, 30–39. https://doi.org/10.1016/j.bodyim.2021.05.012

Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist, 55*(1), 68–78. https://doi.org/10.1037/0003-066X.55.1.68

Ryan, R. M., & Deci, E. L. (2017). *Self-determination theory: Basic psychological needs in motivation, development, and wellness*. Guilford Press.

Schaefer, J. T., & Magnuson, A. B. (2014). A review of interventions that promote eating by internal cues. *Journal of the Academy of Nutrition and Dietetics, 114*(5), 734–760. https://doi.org/10.1016/j.jand.2013.12.024

Slof-Opt Landt, M. C., van Furth, E. F., van Beijsterveldt, C. E., Bartels, M., Willemsen, G., de Geus, E. J., Ligthart, L., & Boomsma, D. I. (2017). Prevalence of dieting and fear of weight gain across ages: A community sample from adolescents to the elderly. *International Journal of Public Health, 62*(8), 911–919. https://doi.org/10.1007/s00038-017-0948-7

StataCorp. (2023). *Stata statistical software*. StataCorp LLC.

Statistics New Zealand. (2006). Census 2006. Retrieved from https://www.stats.govt.nz/census/previous-censuses/2006-census/.

Stenling, A., Martin, H., & Hargreaves, E. (2023). Factor structure, criterion-related validity, and longitudinal measurement invariance of the regulation of eating behavior scale (REBS): A bifactor S-1 exploratory structural equation modeling approach. *Measurement Instruments for the Social Sciences, 5*, 1–26. https://doi.org/10.5964/miss.11187

Teixeira, D. S., Pelletier, L., Encantado, J., Marques, M. M., Rodrigues, B., & Carraça, E. V. (2021). Adaptation and validation of the Portuguese version of the regulation of eating behavior scale (REBSp). *Appetite, 156*, Article 104957. https://doi.org/10.1016/j.appet.2020.104957

Tóth-Király, I., Morin, A. J. S., Litalien, D., Valuch, M., Bőthe, B., Orosz, G., & Rigó, A. (2022). Self-determined profiles of academic motivation. *Motivation and Emotion, 46*(2), 152–170. https://doi.org/10.1007/s11031-021-09918-x

Tóth-Király, I., Morin, A. J. S., Bőthe, B., Rigó, A., & Orosz, G. (2021). Toward an improved understanding of work motivation profiles. *Applied Psychology, 70*(3), 986–1017. https://doi.org/10.1111/apps.12256

Tribole, E., & Resch, E. (2020). *Intuitive eating: A revolutionary anti-diet approach* (4th ed.) St. Martin's Essentials.

Tylka, T. L. (2006). Development and psychometric evaluation of a measure of intuitive eating. *Journal of Counseling Psychology, 53*(2), 226–240. https://doi.org/10.1037/0022-0167.53.2.226

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., Maïano, C., Fuller-Tyszkiewicz, M., Linardon, J., Burnette, C. B., Todd, J., & Swami, V. (2024). The intuitive eating scale-3: Development and psychometric evaluation. *Appetite, 199*, Article 107407. https://doi.org/10.1016/j.appet.2024.107407

Vallerand, R. J. (1997). Toward a hierarchical model of intrinsic and extrinsic motivation. *Advances in Experimental Social Psychology, 29*, 271–360. https://doi.org/10.1016/S0065-2601(08)60019-2. Academic Press.

Van Dyke, N., & Drinkwater, E. J. (2014). Relationships between intuitive eating and health indicators: Literature review. *Public Health Nutrition, 17*(8), 1757–1766. https://doi.org/10.1017/s1368980013002139

Vansteenkiste, M., Sierens, E., Soenens, B., Luyckx, K., & Lens, W. (2009). Motivational profiles from a self-determination perspective: The quality of motivation matters. *Journal of Educational Psychology, 101*(3), 671–688. https://doi.org/10.1037/a0015083