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NEARLY HALF OF BMI VARIANCE IS EXPLAINED BY PERSONALITY TRAITS: A MULTIMETHOD STUDY OF PERSONALITY, EATING BEHAVIOUR, AND BODY MASS INDEX

Master's thesis

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Ligikaudu pool kehamassiindeksi varieeruvusest on selgitatav isiksuseomadustega: isiksuse, söömiskäitumise ja kehamassiindeksi mitme meetodi uuring

Kokkuvõte

Varasemates uuringutes on leitud, et isiksuseomadused on seotud söömiskäitumise ja kehamassiindeksiga (KMI), kuid need leiud põhinevad sageli vaid enesekohastel hinnangutel. Käesoleva töö eesmärk oli uurida isiksuse, söömiskäitumise ja KMI vahelisi seoseid, kasutades Eesti Geenivaramu enese- ja teisekohaseid hinnanguid. Isiksust hinnati 100NP küsimustikuga ning söömiskäitumist viie söömiskäitumise küsimusega. Enese- ja teisekohaseid hinnanguid (N = 15 571) kasutades arvutati korrelatsioonid isiksuse domeenide ja nüansside tasandil. Isiksuse ja söömiskäitumise ennustava ja vahendava rolli uurimiseks KMI suhtes kasutati struktuurvõrrandite modelleerimist. Isiksuse domeenide ja söömiskäitumise vahel leiti kõrgeimad korrelatsioonid neurootilisuse (r = .16) ja meelekindluse (r = −.24) puhul. Nüansitasandil ilmnesid tugevamad ja spetsiifilisemad seosed, mille efektisuurused ulatusid kuni r = −.54. Ootuspäraselt oli kõrgem KMI kõige tugevamalt seotud suurema kontrolli kaotusega söömise üle (r = .53) ning madalama täis kõhu tundlikkusega (r = −.48). Struktuurvõrrandite mudelid näitasid, et nii isiksus (β = .50) kui ka söömiskäitumine (β = .30) ennustasid oluliselt KMI-d ning selgitasid koos 46,8% selle varieeruvusest. Söömiskäitumine vahendas osaliselt isiksuse ja KMI vahelist seost (20,23%). Tulemused viitavad, et enese- ja teisekohaste hinnangute ühendamine aitab esile tuua tugevamaid ja täpsemaid seoseid isiksuse, söömiskäitumise ja KMI vahel.

Märksõnad: Suure Viisiku isiksuseomadused, söömiskäitumine, kehamassiindeks, enese- ja teisekohased hinnangud, isiksusenüansid, mitme meetodi lähenemine, struktuurvõrrandite modelleerimine.

Nearly Half of BMI Variance Is Explained by Personality Traits: A Multi-Method Study of Personality, Eating Behaviour, and Body Mass Index

Abstract

Previous research has shown that personality traits are associated with eating behaviour and body mass index (BMI), but these findings are often based only on self-reports. The present study investigated the associations between personality, eating behaviour, and BMI using combined self- and informant-reports from Estonian Biobank. Personality was assessed with the 100 Nuances Personality Questionnaire and eating behaviour with five eating behaviour items. Combining self- and informant reports (N = 15 571), correlations were calculated at domain and nuance levels. Structural equation modelling was applied to examine the predictive and mediating roles of personality and eating behaviour on BMI. Highest correlations between personality domains and eating behaviour were found for neuroticism (r = .16) and conscientiousness (r = −.24). However, stronger and more specific associations emerged at the nuance level, with effect sizes up to r = −.54. Higher BMI was most strongly associated with loss of control over eating (r = .53) and lower satiety responsiveness (r = −.48). In the structural equation models, personality (β = .50) and eating behaviour (β = .30) both significantly predicted BMI and explained 46.8% of its variance. Eating behaviour partially mediated the association between personality and BMI (20.23%). These findings suggest that combining self- and informant-reports helps reveal stronger and more precise links between personality, eating behaviour, and BMI.

Keywords: Big Five personality, eating behaviour, BMI, self–informant reports, personality nuances, multi-method design, structural equation modelling

Introduction

Each year, at least 2.8 million people die as a result of being overweight or obese (WHO, 2014). Since 1980, the global prevalence of overweight and obesity has doubled, and nearly one-third of the world's population is now classified as overweight or obese (Chooi et al., 2019). The increase in global obesity rates has led to extensive research aimed at better understanding the underlying causes of obesity. Human behaviour reflects relatively stable individual differences in emotional, interpersonal, and motivational styles, which are captured by personality traits and influence how individuals act across different domains (McCrae et al., 1992), including health-related behaviours such as eating. One key area of this research is eating behaviour, as obesity largely results from overeating, creating a positive energy balance and contributing to weight gain (Murray et al., 2014). Accordingly, individual differences in personality may play an important role in shaping eating behaviour and, in turn, contribute to variation in body mass index (BMI).

Eating behaviour is an expansive term that includes food preferences and motivations, eating habits, dieting practices, and issues related to eating such as obesity, eating disorders, and feeding disorders. People make hundreds of food-related decisions every day that are influenced by a range of personal, social, cultural, environmental, and economical factors (LaCaille, 2020). Over the past few decades, many theoretical models have been developed to explain individual differences in eating behaviour. These constructs describe relatively stable eating styles or dispositions toward food consumption (Dakin et al., 2024). Eating behaviour traits are typically measured using self-report questionnaires and have been widely studied as potential causal factors of overeating and obesity (French et al., 2012). They have also been shown to represent reliable indicators of motivated behaviours related to food (Llewellyn & Wardle, 2015).

Different eating behaviour traits have been identified in the literature, including binge eating, emotional eating, external eating and food addiction (Vainik et al., 2013; Vainik et al., 2015). Research has shown that these constructs often overlap conceptually and empirically, as commonly used questionnaires measuring eating behaviour traits tend to correlate strongly with one another (Vainik et al., 2015). This suggests that different aspects of eating behaviour may reflect broader underlying tendencies related to appetitive motivation, self-regulation, and responses to food cues. Such tendencies have been associated both with patterns of

overeating as well as attempts to regulate food intake, and are associated with BMI and the risk of overweight and obesity (Papies et al., 2008; Vainik et al., 2015; Price et al., 2015).

Obesity, eating behaviour and personality traits

Eating behaviour has been consistently linked to personality, which reflects individuals' typical patterns of feeling, thinking, and behaving across life (Keller & Siegrist, 2015; Provencher et al., 2008). More broadly, personality traits have been linked not only to eating-related habits, but also to other health-relevant lifestyle behaviours, including physical activity, daily routines, and long-term health management (Sutin & Terracciano, 2016). Together, these behavioural tendencies contribute to differences in body weight, BMI, and overall health outcomes (Elfhag & Morey, 2008).

One of the major personality theories is the five-factor model of personality, also called "the Big Five". The five-factor model is based on research identifying five main personality domains: Neuroticism, Extraversion, Openness, Agreeableness and Conscientiousness (McCrae et al. 1992). Research has shown that certain personality traits are associated with various eating behaviour traits (Provencher et al, 2008; Keller & Siegrist, 2015; Mõttus et al. 2012) and BMI (Vainik et al. 2019).

Personality domains can be broken down into more specific facets. For example, Extraversion includes facets like warmth, assertiveness and positive emotions. Nuances go a step further, reflecting subtle personality differences often revealed through responses to single questionnaire items. Research suggests that BMI is connected more to these narrower traits than to broad domains (Vainik et al, 2019; Arumäe et al, 2022). Vainik et al (2019) conducted a meta-analysis to study the associations between BMI and Five Factor Model personality domains as well as 30 Five Factor Model personality facets. The results indicated that at the domain level, BMI had a small positive correlation with neuroticism and negative correlation with conscientiousness. However, a more detailed picture was revealed at the facet level, finding associations with 15 facets across all five personality domains, with only some neuroticism and conscientiousness facets among them (Vainik et al, 2019). Analyses at the nuance level confirm that BMI correlates with many specific personality characteristics and these correlations are often stronger than the ones at the domain or facet level (Arumäe et al, 2022). Arumäe et al (2022) found that the highest nuance level correlation with BMI was .21 compared to .11 for the broader domains, showing that focusing on nuances can reveal connections to BMI that might not be adequately represented by only analyzing domains.

Research has therefore examined how specific personality domains and their underlying facets relate to eating behaviour and BMI.

Neuroticism, characterized by emotional instability and anxiety, is commonly related to cognitive dietary restraint, disinhibition and susceptibility to hunger (Provencher et al, 2008). Mõttus et al. (2012) found that individuals with higher levels of neuroticism tend to choose less healthy diets, opting for more convenience foods and consuming fewer fresh fruits and vegetables. Given the unhealthier eating behaviours associated with neuroticism, the domain has also been linked to higher BMI. This relationship is found to be particularly driven by the impulsiveness facet (Vainik et al. 2015), which reflects difficulties in controlling cravings and is closely associated with uncontrolled eating.

Higher conscientiousness, defined as being organized, goal-oriented, and capable of self-regulation (John & Srivastava, 1999), has been associated with reduced external and emotional eating as well as healthier food choices. This reflects stronger impulse control and the ability to delay gratification, supporting more deliberate and mindful eating patterns and, in turn, more successful weight management (Keller & Siegrist, 2015). More detailed evidence suggests that these associations are primarily driven by specific conscientiousness facets related to planning, organization, and self-discipline, as higher BMI has been linked to lower levels of orderliness, dutifulness, deliberation, and self-discipline (Vainik et al. 2019). Together, these findings highlight the central role of self-regulatory capacity in shaping both eating behaviour and BMI.

Unlike the consistent findings for neuroticism and conscientiousness, research on the connection between extraversion and eating behaviour has shown mixed results. Extraversion appears to be associated with the selection of healthy foods and higher awareness of a healthy diet (Mõttus et al. 2012). Multiple studies have found that extraversion is linked with higher consumption of fruit and vegetables (Mõttus et al. 2012; Tiainen et al. 2013), supporting the finding that higher extraversion is related to restrained eating (Elfhag & Morey, 2008). However, Keller and Siegrist (2015) found that extraversion is associated with greater consumption of sweets, savory foods, meat, and soft drinks due to its influence on external eating behaviour traits, which suggests that while extraversion is often seen as a health-beneficial trait due to its link with sociability, it may also have health-adverse effects in the context of diet (Keller & Siegrist, 2015). The mixed findings may reflect the complex nature of extraversion, as different facets appear to relate to eating behaviour and BMI in distinct ways. Facets reflecting positive emotionality and friendliness have been found to be

associated with higher BMI (Vainik et al. 2019), potentially due to their link with greater reward sensitivity (Sutton et al. 2022). In contrast, activity-related facets of extraversion show an opposite pattern, being associated with lower BMI (Vainik et al. 2019).

Higher agreeableness and openness have been associated with healthier food choices, particularly increased consumption of fruit, vegetables, and other fiber-rich foods (Mõttus et al., 2012). However, despite these associations with food selection, previous studies have found that the associations between the two domains and broader eating behaviour patterns are weak and inconsistent (Gerlach et al., 2015). At a narrower trait level, specific agreeableness facets related to politeness have been negatively associated with BMI, potentially reflecting greater adherence to social norms and consideration for others. Similarly, openness facets capturing willingness to engage in new experiences and reconsider values have shown negative associations with BMI, suggesting that greater cognitive flexibility and openness to change may support healthier behavioural patterns (Vainik et al., 2019).

However, it is important to point out that although correlations between personality and eating are typically small, such effect sizes are common in individual differences research and can still be meaningful (Gignac & Szodorai, 2016; Funder & Ozer, 2019). For instance, in the Vainik et al., (2019) meta-analysis, most significant correlation coefficients between personality facets and eating behaviour were mostly $r \leq 0.06$. The strongest association was found between BMI and neuroticism facet Impulsiveness, with a correlation of $r = 0.13$. However, this particular association is likely exaggerated because the impulsiveness scale in NEO inventories contains two items directly addressed to overeating and appetite control, which are closely associated with BMI (Vainik et al. 2015; Vainik et al., 2019). These findings show that although the associations are small at the individual level, they are consistent with typical effect sizes in this field and may still reflect meaningful patterns (Funder & Ozer, 2019).

Hierarchy in domain-specific vs domain-general behaviour

While broad personality traits have consistently been associated with eating behaviour and BMI, research suggests that these associations may be explained by more direct, domain-specific processes. Contemporary personality research increasingly views personality traits as broad and relatively stable tendencies that shape behavioural patterns across different life domains (Schwaba et al., 2025). At the same time, theoretical models of impulsivity suggest

that general self-regulatory tendencies may be expressed differently across behavioural contexts, including food-related behaviour (Tsukayama et al., 2011). Research has also suggested that more specific behavioural tendencies may provide greater explanatory specificity than broad personality domains alone (Arumäe et al., 2022). Nevertheless, these eating-related tendencies remain systematically associated with broader personality traits, particularly Neuroticism and Conscientiousness (Vainik et al., 2013). Consistent with this hierarchical perspective, recent studies have found that impulsivity-related personality traits are associated with uncontrolled eating, whereas uncontrolled eating appears to be more directly linked to BMI outcomes (Garcia-Garcia et al., 2022). Together, these findings suggest that broad personality traits and eating-specific behaviours may represent different levels within a broader behavioural hierarchy related to body weight and health outcomes.

Self vs informant-report

However, the methods used in personality studies can influence the accuracy of the findings. A significant part of personality research has been based on self-reported data (Connelly & Ones, 2010; McCrae & Mõttus, 2019). Although self-reports are convenient and cost-effective, relying entirely on self-reported data in personality studies has many limitations (McDonald, 2008). One significant problem is the potential for response biases, where individuals may answer questions in a way that does not accurately reflect their true thoughts or behaviours. For instance, socially desirable responding can lead people to present themselves in a more favorable light, altering the data collected. Additionally, response tendencies, which refers to an individual's personal response style. Examples of response tendencies are acquiescent responding, where individuals tend to agree with statements, often without fully considering their content, as well as extreme responding, where people tend to use the endpoints of rating scales, such as "strongly agree" or "strongly disagree," rather than choosing more moderate or neutral responses (McCrae et al, 1998; McDonald, 2008; McCrae & Mõttus, 2019).

Another disadvantage is the subjectivity of self-reports. The accuracy of the information provided relies heavily on the individual's self-awareness and honesty. Small changes in question wording, format, or context can impact the responses. Furthermore, self-reports may not capture the complexity of personality constructs, as they often rely on individuals' perception of themselves, which can be limited or biased (McDonald, 2008).

One approach besides self-reports is gathering observer reports, in which personality traits are evaluated by people who know the target person, such as family members, friends, or acquaintances. Informant reports can be an additional source of personality information because they provide judgments based on the target person's observable behaviours across everyday situations (McDonald, 2008). As personality is multifaceted, it often benefits from being assessed from more than one perspective (McCrae et al., 1998; McDonald, 2008). However, agreement between self- and informant-ratings is typically only moderate, with average correlations for broad personality domains generally falling between .40 and .60 (Mõttus & Henry, 2025). Importantly, such inconsistencies do not necessarily indicate that self- and informants assess fundamentally different traits. Instead they may reflect differences in how raters interpret items, rely on behavioural examples, and use rating scales when forming their judgments (Mõttus & Henry, 2025). Nevertheless, recent evidence suggests that self- and informant-ratings measure highly similar personality constructs as measurement invariance has been demonstrated across nearly all Five-Factor Model domains and facets (Mõttus et al., 2020).

Studies on eating behaviour often use a variety of methods, including self-report inventories (Allison et al, 2009) and laboratory experiments (Robinson et al, 2014). For instance, laboratory experiments are often used to measure variables like meal size, with participants eating in controlled environments. Experimental and observational studies, while providing insights into behaviour, are time-consuming and can be affected by the observer's presence, potentially resulting in low external validity and invalid conclusions about eating behaviour (Robinson et al, 2014). While self-reports are commonly used due to their time- and cost-effectiveness (Allison et al, 2009), they can be subjective and may not always reflect individuals' true behaviour (McDonald, 2008). Many studies have collected information from multiple sources to help reduce bias and provide a wider clinical perspective (Bartholdy, 2017; Braet et al, 2007). However, it is important to note that agreement between self- and informant-reports about eating behaviour is often poor to moderate. Braet et al (2007) studied parent-child agreement on emotional, external and restrained eating. The correlation between parent and child ratings of emotional eating was found to be noticeably higher (r = .45) than for external (r = .35) and restrained eating (r = .36), suggesting that compared to observable behaviour, cognitive processes may be harder to assess (Braet et al, 2007). Research indicates that obtaining accurate informant ratings for covert behaviours like binge eating, fasting and

purging is particularly challenging, as informants may be unaware of such actions or interpret them differently (Braet et al, 2007; Swanson et al, 2014).

Despite the considerable effort psychologists have invested in developing personality questionnaires, validated instruments do not automatically guarantee high accuracy of the assessment when personality is measured from only a single source (McCrae et al., 1998; McCrae, 2013). McCrae, Kurtz, and their colleagues (2011) have shown that even highly reliable ($\alpha > .70$) NEO facets have low longitudinal stability, heritability and cross-observer validity ($r < .35$), suggesting that a substantial portion of source-specific variance is unrelated to the underlying trait. Consistently, Mõttus and Henry (2025) argue that only about half of the variance in single-method personality scores may reflect valid personality information, meaning that associations between personality traits and other variables can be inaccurately estimated when using a single assessment method.

To address these limitations, researchers have increasingly emphasized the importance of multi-method personality assessment (Connelly & Ones, 2010; McCrae, 2014; Mõttus & Henry, 2025). Combining self- and informant-ratings allows researchers to focus on the variance shared across rating sources, thereby reducing random error and idiosyncratic biases tied to any single source, such as differences in item interpretation, habitual response styles, and the behavioural examples raters rely on when judging the target person (Mõttus & Henry, 2025). Indeed, if only about 50% of single-method personality variance reflects valid trait information, correlations based on a single assessment source may differ considerably from the true relationships between personality and other variables (Mõttus & Henry, 2025). As a result, integrating self- and informant reports provides a more accurate estimate of underlying personality traits and their associations with relevant behavioural outcomes than relying on either source alone.

Present Study

The aim of the present study is to examine the associations between BMI and eating behaviour traits to personality, with particular attention to the agreement between self- and informant-reported data. Specifically, the study examines the associations between body mass index (BMI), eating behaviour traits, personality traits and nuances using the true correlations approach, which estimates trait–outcome associations by integrating cross-rater, cross-variable and cross-rater, same-variable correlations into a ratio that eliminates method-

specific variance (Mõttus et al., 2024). In addition, a machine learning approach is used to examine the extent to which personality and eating behaviour traits predict BMI.

The study addresses the following research questions:

1) How does the level of self–informant agreement vary between BMI, personality domains, personality nuances, and eating behaviour?

2) How are personality traits associated with BMI and eating behaviour traits?

3) How are personality nuances related to BMI and eating behaviour traits?

4) To what extent does personality predict BMI, and to what extent is this association accounted for by eating behaviour?

Based on prior literature, it is expected that eating behaviour traits are systematically associated with personality traits, particularly those related to self-regulation and impulsivity-related tendencies. Similar patterns are expected at the level of personality nuances. Furthermore, personality traits are expected to be associated with BMI and to predict BMI. This association is expected to be partly accounted for by eating behaviour traits, indicating both direct and indirect pathways.

Method

Participants

Participants in this study were drawn from the Second Estonian Biobank Personality Cohort (EstBB PS21), with data collected between November 2021 and April 2022. The self-report questionnaire, available in Estonian and Russian (5% completed in Russian), was completed by 80,116 individuals. After initial data cleaning, the baseline self-report sample consisted of 66,717 participants. At the beginning of the questionnaire, participants were also asked to nominate an informant (e.g., spouse, partner, relative, or friend) to provide ratings of their personality traits; invitations were sent to 32,272 informants, of whom 23,209 (72%) responded. Participation was voluntary, and no financial compensation was offered apart from optional feedback on participants' Big Five personality traits upon completion (Arumäe jt, 2025).

For the present analyses, participants with missing values on variables required for each model were excluded. As a result, the final analytic sample for the correlation analyses included 15,571 participants, while the structural equation models were conducted on 50,317 self-report cases and 16,400 informant-report cases. Descriptive characteristics of these

analytic samples are presented in Table 1.

Table 1

Descriptive characteristics of the analytic samples.

Variable	Correlation analysis	SEM analysis Self-report model	SEM analysis Self and informant model
Total sample size, n	15 571	50 317	16 400
Men, n (%)	5305 (34.1%)	14 706 (29.2%)	5578 (34.0%)
Women, n (%)	10 266 (65.9%)	35 611 (70.8%)	10 822(66.0%)
Age, *M (SD)*	45.46 (13.52)	48.48 (14.76)	45.4 (13.5)
Self-reported BMI, *M (SD)*	25.61 (4.75)	26.12 (5.45)	25.61 (4.76)
Medical record BMI, *M (SD)*	26.06 (5.06)	26.73 (5.39)	26.06 (5.06)
Years of education, *M (SD)*	13.89 (2.51)	13.11 (2.69)	13.88 (2.52)
Male informants, *n* (%)	5440 (34.9%)	-	5646 (34.4)
Female informants, *n* (%)	10 131 (65.1%)	-	10 754 (65.6)
Informant age, *M (SD)*	48.28 (13.52)	-	48.22 (13.52)
Informant years of education, *M (SD)*	15.09 (3.75)	-	15.07 (3.75)

Note. SEM = structural equation modeling; BMI = body mass index; *M* = mean; *SD* = standard deviation.

The activities of the EstBB are regulated by the Human Genes Research Act, which was adopted in 2000 specifically for the operations of the EstBB. Individual level data analysis in the EstBB was carried out under ethical approval 1.1-12/626, 13.04.2020 granted by the Estonian Committee on Bioethics and Human Research (Estonian Ministry of Social Affairs), using data according to release application 3-10/GI/11571 from the Estonian Biobank. Before beginning the data collection, participants were required to review and digitally sign an informed consent form to proceed.

Measures

Self- and informant-reports

Personality was assessed using the 100 Nuances of Personality (100NP) questionnaire, a publicly available 198-item inventory developed using a bottom-up approach based on the recommendations of Condon et al. (2021). The 100NP is designed to capture the broad spectrum of personality through domains and facets of the Five-Factor and HEXACO models, with a specific focus on the lower hierarchical layer of traits known as nuances. Although it differs from traditional personality inventories in that it was not developed with the primary aim of assessing broad-level traits, many of its items can nevertheless be mapped to the domains of the Five-Factor and HEXACO models. The 100NP is available in both self-report and informant-report forms, which are both used in the present study. The informant-report forms closely correspond to the self-report forms with first-person language ("I am", "I tend to") replaced with third-person language ("he/she is", "he/she tends to"; note that the Estonian language does not distinguish between genders). All items are assessed on a six-point Likert-type scale (1 = completely false, 6 = completely true).

The Big Five domain scores were computed using a previously established 60-item subset of the 100NP that had been derived through principal component analyses to represent the five broad personality domains with minimal overlap between scales. Following Anni et al. (2025), the resulting component loadings were applied to calculate Neuroticism, Extraversion, Openness, Agreeableness, and Conscientiousness scores separately for self- and informant reports.

Eating behaviour

Five items were selected to assess common eating behaviour, including perceived loss of control over eating, dietary restriction and pace of eating. These questions were intentionally chosen to be as distinct from one another as possible to capture a broad range of eating behaviour traits, while keeping the total number of items minimal. The final questionnaire items were:

1. E1-LossControl - *"Once I start eating, I find it very difficult to stop"* adapted from the RED scale (Epel et al., 2014) and the Three-Factor Eating Questionnaire (Stunkard & Messick, 1985), was used to assess perceived loss of control over eating;

2. E2-Restraint - *"I consciously restrict my food intake to avoid gaining weight*" taken from the Three-Factor Eating Questionnaire (Stunkard & Messick, 1985), was included to measure cognitive dietary restraint;

3. E3-Enjoy - *"I enjoy eating"* from Adult Eating Behaviour Questionnaire (Hunot et al., 2016), was used to capture enjoyment of food;

4. E4-Full - *"I feel full easily*" also form the Adult Eating Behaviour Questionnaire (Hunot et al., 2016) was intended to assess satiety responsiveness;

5. E5-Pace - *"I eat slowly*" taken from the Adult Eating Behaviour Questionnaire (Hunot et al., 2016), was used to measure eating pace.

BMI

To enhance the accuracy of body mass index (BMI) assessment, multiple measures of BMI available at the biobank across 20 years were merged together, and median estimates taken separately for self-reported BMIs (from survey questionnaires) and objectively measured data (from medical records) were used. BMI was calculated by dividing participants' body weight (in kilograms) by their height (in meters squared).

Data analysis

Data analysis was conducted in R (version 4.3.1) using RStudio (version 2023.12.1). Assistance from OpenAI ChatGPT was used in writing the code (OpenAI, 2026). All variables were residualized for age and gender prior to analysis.

The correlation analyses were conducted on participants for whom both self- and informant-reports were available for all variables (cases with missing data were excluded using listwise deletion), resulting in a final sample of $N = 15{,}571$ individuals. To estimate the true correlation between personality traits and eating behaviour traits, a cross-informant approach was used to minimize bias from single measurement methods. Pearson correlations were computed between self-reported personality scores and informant-reported eating behaviour traits, and vice versa, and the geometric mean of these two cross-rater, cross-variable correlations was calculated. Next, the geometric mean of the correlations between self- and informant-reports of the same variables (i.e., personality with personality, and eating behaviour with eating behaviour) was computed. The estimate of the true correlation between personality and eating behaviour was obtained by dividing the cross-variable geometric mean correlation by the same-variable geometric mean correlation.

To examine how personality statistically predicts BMI, a predictive modeling approach was used. First, the data were split into two subsamples. The training sample consisted of 50 317 participants with self-reported data only, while the test sample included 16 400 participants with both self- and informant-reports. Participants with missing BMI data were excluded from both samples. Elastic net regression was used to predict BMI from personality items in the training sample. Specifically, self-reported overall personality domain scores (residualized for age and gender) were used as predictors, and self-reported BMI served as the outcome variable. The model was estimated using 10-fold cross-validation to determine the optimal level of regularization. The mixing parameter was set to $\alpha = 0.5$. Representing a balance between ridge and lasso penalties, all predictors were standardized within the model. The optimal model was selected based on the minimum cross-validated mean squared error (λ_min). Regression coefficients from this model were extracted and these weights were subsequently applied to the independent test sample to compute individual personality-based BMI risk scores as weighted sums of the predictor variables. Separate risk scores were computed based on self-reported and informant-reported overall personality nuance scores, as well as self-reported and informant-reported overall eating behaviour trait scores. This resulted in two indicators of personality-based BMI risk and two indicators of eating behaviour-based BMI risk for each participant.

Results

Self-other agreement in BMI, personality and eating behaviour

Self–informant agreement varied considerably across the studied constructs (see Table 2). The highest correlation was found between self-reported and informant-reported BMI. For personality domains, self–informant correlations were moderate, ranging from r = .45 for agreeableness to r = .56 for extraversion. In contrast, agreement at the nuance level was lower, with an average self–informant correlation of r = .31 (SD = 0.09). Similar or higher agreement across raters was evident for eating behaviour items, with correlations ranging from r = .31 for enjoyment of food to r = .44 for dietary restraint. The eating behaviour measures were assessed at a level comparable to personality nuances, as each trait was represented by a single item.

Table 2

Correlations between self-informant ratings for BMI, personality domains and eating behaviour traits.

Variable	r	95% CI	p
BMI	.95	[0.95, 0.95]	<.001
Neuroticism	.50	[0.49, 0.51]	<.001
Extraversion	.56	[0.55, 0.57]	<.001
Openness	.50	[0.48, 0.51]	<.001
Agreeableness	.45	[0.44, 0.46]	<.001
Conscientiousness	.51	[0.50, 0.52]	<.001
E1-LossControl	.37	[0.36, 0.39]	<.001
E2-Restraint	.44	[0.42, 0.45]	<.001
E3-Enjoy	.31	[0.29, 0.32]	<.001
E4-Full	.35	[0.33, 0.35]	<.001
E5-Pace	.42	[0.41, 0.44]	<.001

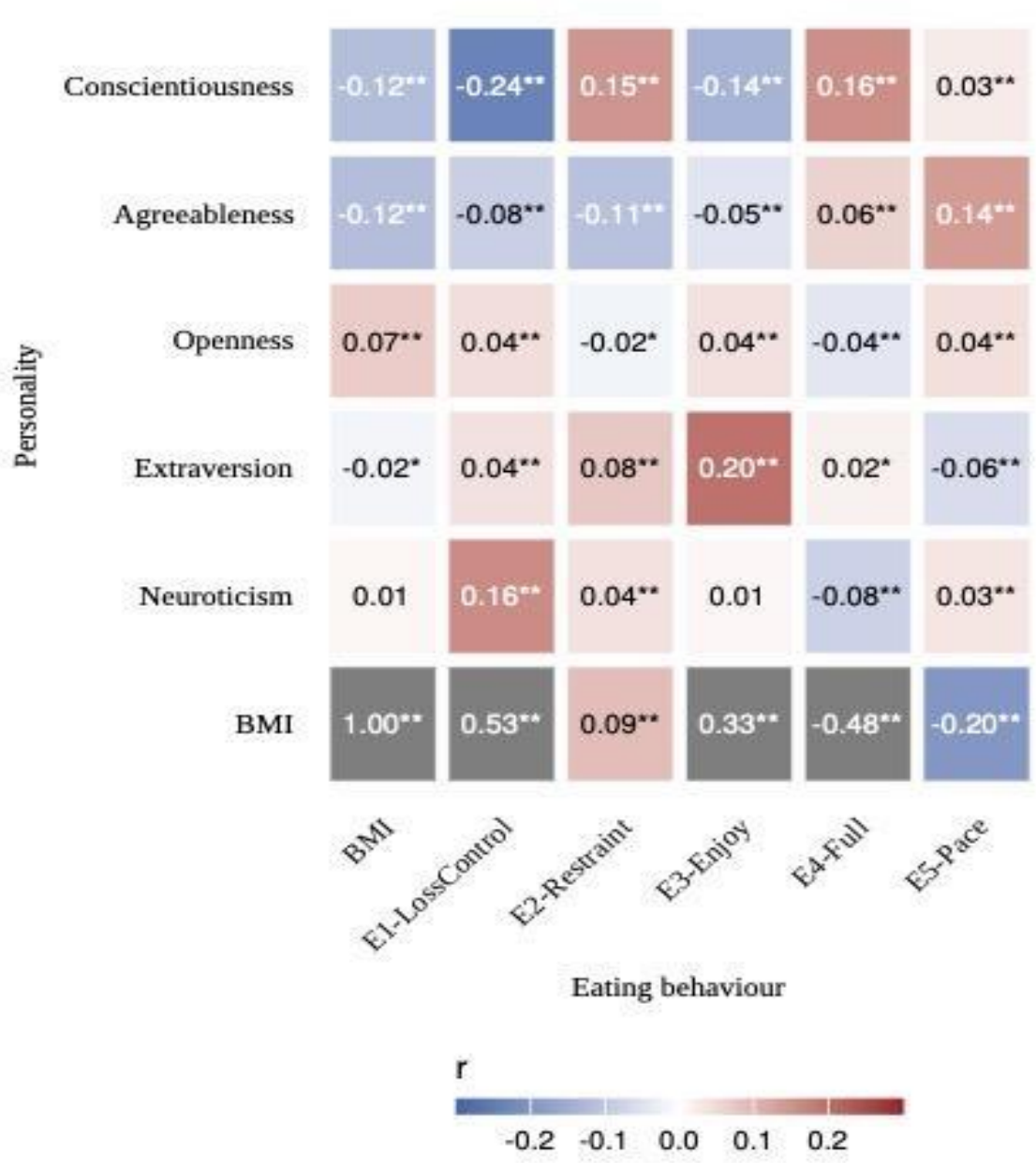
Correlations between personality, BMI and eating behaviour

The associations between eating behaviour traits, BMI, and personality domains were examined. Controlling for age and gender, residualized self- and informant-report data were used, and true correlations were computed to estimate convergence between self- and other ratings. The resulting correlation coefficients are presented in Figure 1.

Higher neuroticism was found to be associated with greater loss of control over eating and cognitive dietary restraint, whereas conscientiousness showed the opposite pattern, being related to lower loss of control and higher satiety responsiveness. Extraversion was positively associated with enjoyment of food and more rapid eating, while agreeableness was generally associated with lower loss of control and uncontrolled eating, but higher satiety responsiveness and slower eating pace. Openness showed only small and inconsistent associations with eating behaviour traits. BMI was weakly but significantly related to personality, being negatively associated with agreeableness and conscientiousness and positively associated with openness.

Figure 1.

True correlations (rtrue) between Big Five personality traits, BMI and eating behaviour traits.

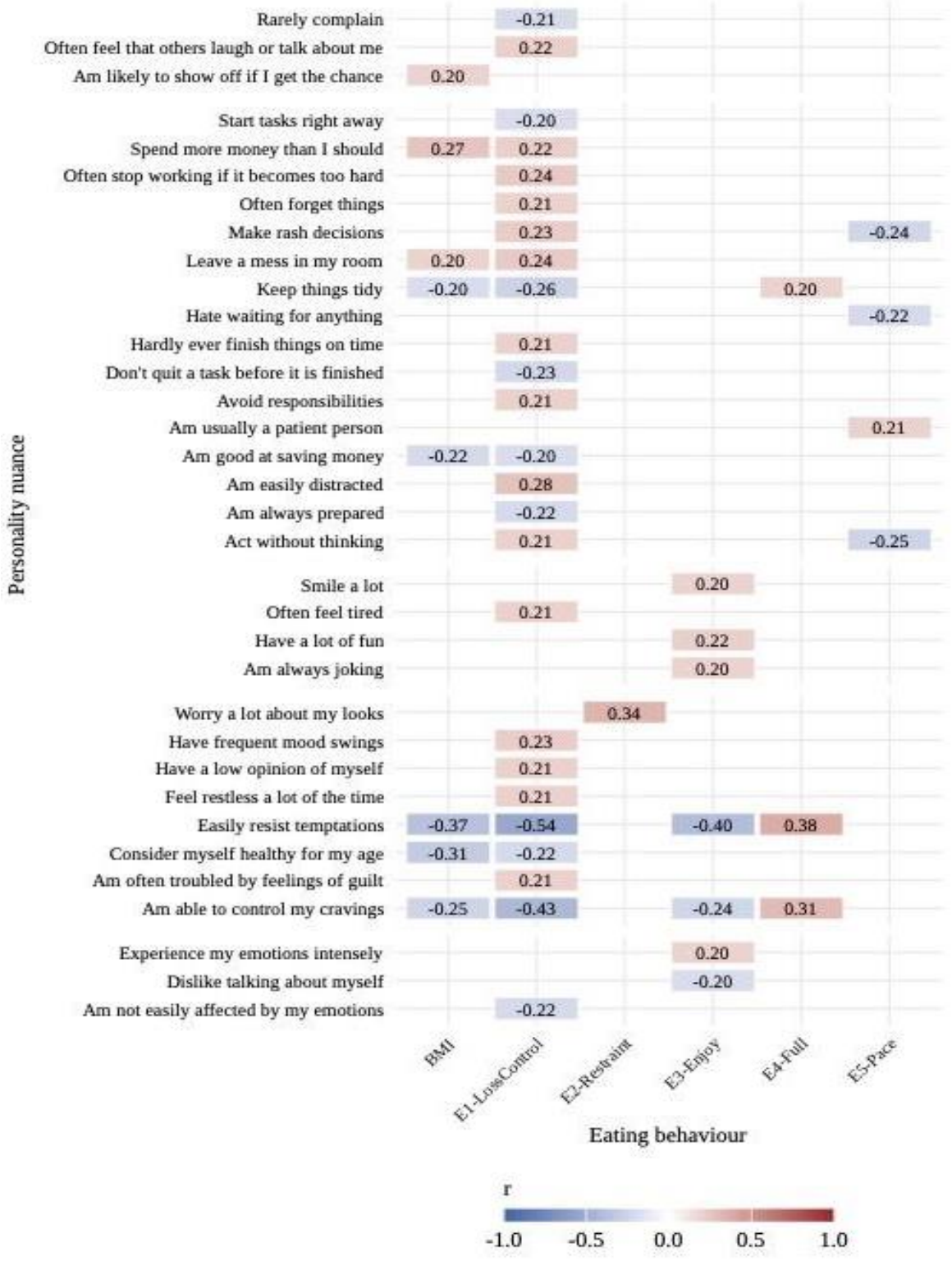


Note. Values are Pearson correlation coefficients. $p < 0.01$**, $p < 0.001$***

Given that broad personality traits consist of multiple underlying nuances, the strongest associations between eating behaviour traits and specific personality nuances were examined next. The statistically significant correlations above $r = .2$ are presented in Figure 2.

Figure 2.

True correlations (rtrue) between eating behaviour items and personality nuances (|rtrue| ≥ .20)



Associations between eating behaviour traits and personality nuances were not evenly distributed across traits but clustered within specific domains. Perceived loss of control over eating (E1) showed the largest number of associations, particularly with neuroticism and conscientiousness nuances reflecting self-regulatory capacity. The strongest negative correlations emerged for neuroticism nuances related to resisting cravings and temptations. E1 was positively associated with conscientiousness nuances where higher scores reflected lower conscientiousness, and negatively associated with nuances where higher scores reflected higher conscientiousness.

Enjoyment of food (E3) was associated with extraversion, openness and neuroticism nuances, whereas satiety responsiveness (E4) showed positive links with self-regulatory neuroticism nuances. Eating pace (E5) demonstrated a relatively small cluster of associations with conscientiousness nuances, showing negative associations with nuances reflecting impulsive tendencies (making rash decisions, acting without thinking, and hating to wait) and positive with patience. Overall, the pattern indicates that nuance-level effects were concentrated in facets related to affect regulation and impulse control rather than uniformly across all personality domains.

Structural equation models of personality nuance and eating behaviour risk scores predicting BMI

A series of structural equation models was estimated to examine the extent to which personality nuances and eating behaviour traits predict BMI. Three latent variables were specified - BMI, personality, and eating behaviour. Each latent variable was indicated by two measures - self / informant BMI, and self- and informant data based overall risk scores for BMI trained on either personality nuances, or eating behaviours. See Figure 3 for an overview of the final mediation model. First, separate models were specified to assess the predictive effects of personality and eating behaviour independently. Next, a combined model including both sets of predictors was estimated to evaluate their unique contributions. Finally, a mediation model was tested to examine whether the association between personality and BMI is mediated by eating behaviour.

All models demonstrated good to excellent fit to the data (see Table 3). The personality and eating behaviour models showed excellent fit, with fit indices indicating a near-perfect correspondence between the model and the observed data. The combined and mediation models also demonstrated acceptable to good fit, indicating a slight decrease in fit

compared to the simpler models, but still within recommended thresholds. Overall, the fit indices indicated that all specified models adequately represented the observed data.

Table 3

Model fit indices for structural equation models predicting BMI.

Model	χ^2 (df)	p	CFI	TLI	RMSEA	SRMR
Personality - BMI	0.28 (1)	.596	.00	.00	0.00 [0.00, 0.02]	0.00
Eating behaviour - BMI	25.08 (7)	.001	.00	.00	0.01 [0.01, 0.02]	0.01
Combined model	327.94 (6)	.001	.99	.99	0.06 [0.05, 0.06]	0.02
Mediation model	327.94 (6)	.001	.99	.99	0.06 [0.05, 0.06]	0.02

Regression analyses showed that both personality and eating behaviour were significant positive predictors of BMI when examined separately, with personality demonstrating a stronger association (Table 4). In the combined model, both predictors remained significant, but the effect of eating behaviour decreased substantially when controlling for personality, whereas the effect of personality showed only a minor reduction.

Table 4

Standardized regression coefficients for structural equation models predicting BMI.

Model	Predictor	β	p	R^2
Personality - BMI	Personality	0.63	<.001	0.395
Eating behaviour - BMI	Eating behaviour	0.51	<.001	0.263
Combined model	Eating behaviour	0.30	<.001	0.468
	Personality	0.50	<.001	

Note. β = standardized coefficients.

The mediation analysis indicated that eating behaviour partially mediated the association between personality and BMI (see Table 5). Personality was significantly associated with eating behaviour, which in turn was significantly related to BMI.

Table 5

Mediation model of the association between personality, eating behaviour and BMI.

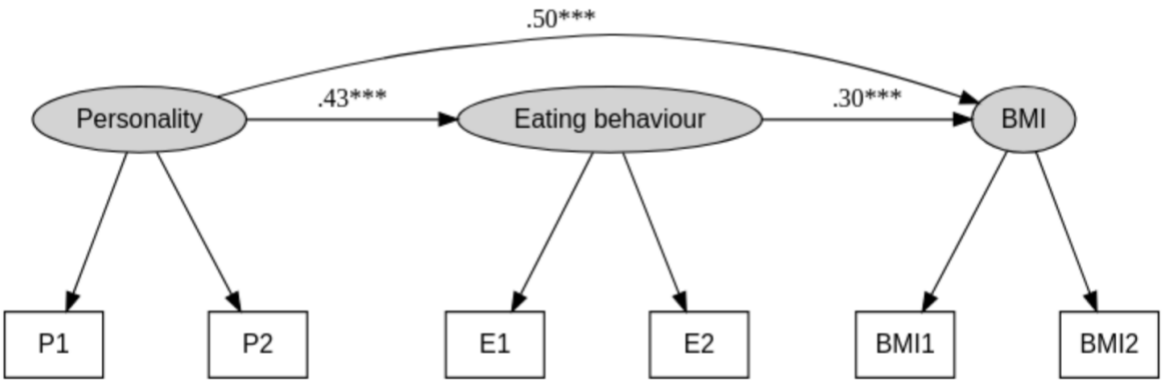
Path	β	95% CI	p
Personality – BMI (direct)	0.50	[0.48, 0.52]	<.001
Personality – Eating (a)	0.43	[0.41, 0.45]	<.001
Eating – BMI (b)	0.30	[0.28, 0.32]	<.001
Indirect effect (a x b)	0.13	[0.12, 0.14]	<.001
Total effect	0.63	[0.62, 0.64]	<.001
% mediated	20.23		

Note. β = standardized coefficients. Confidence intervals are based on bootstrapping (5,000 resamples).

Importantly, the indirect effect of personality on BMI through eating behaviour was statistically significant, suggesting that eating behaviour constitutes a meaningful pathway through which personality influences BMI (see Figure 3). However, the direct effect of personality on BMI remained significant after accounting for the mediator, indicating partial rather than full mediation.

Figure 3

Mediation model of the association between personality and BMI through eating behaviour.



Note. P1 - self-reported personality, P2 - informant-reported personality, E1 - self-reported eating behaviour, E2 - informant-reported eating behaviour, BMI1 - self-reported BMI, BMI2 - BMI from medical record.

Overall, these findings suggest that while eating behaviour explains part of the relationship between personality and BMI, personality also exerts an independent effect on BMI beyond eating-related mechanisms.

Discussion

The present study examined the associations between personality traits, eating behaviour, and BMI using both self- and informant-reports. Overall, the findings provide evidence that personality and eating behaviour are systematically related, and that both contribute to individual differences in BMI. Importantly, the results highlight the value of incorporating multiple informants, as well as examining personality at different hierarchical levels.

Self–other agreement in personality and eating behaviour

Agreement between self- and informant-reports varied across BMI, personality, and eating behaviour traits. The highest agreement was found for BMI, reflecting the relatively accurate self-reporting of height and weight compared to clinically measured values. Consistent with previous research on Big Five personality traits, agreement for broad personality domains was moderate (Mõttus & Henry, 2025). In contrast, agreement at the personality nuance level was lower, consistent with the idea that narrower and more context-dependent personality characteristics are harder to evaluate consistently across raters because different raters may rely on different behavioural cues and interpretations (Mõttus & Henry, 2025).

Self–informant agreement for eating behaviour items was generally comparable to agreement at the personality nuance level. However, some eating behaviour items showed slightly higher agreement across raters. This may reflect the relatively observable nature of many everyday eating behaviours, such as eating pace and loss of control over eating, which can often be noticed by close others in daily situations. At the same time, the moderate level of agreement suggests that eating-related cognitions and motivations are only partly accessible to informants, consistent with previous findings showing lower agreement for less observable eating behaviours (Braet et al., 2007; Swanson et al., 2014). Overall, these findings suggest that eating behaviour may be more behaviourally transparent to close others than certain lower-level personality characteristics.

Associations between personality, BMI and eating behaviour

Consistent with the view that eating behaviour traits reflect broader tendencies in appetitive motivation and self-regulation that are relevant for body weight (Vainik et al., 2015), clear associations were found between BMI and eating behaviour traits. Higher BMI was found to be most related to greater loss of control over eating and lower satiety responsiveness, indicating a tendency toward larger difficulties regulating food intake and reduced sensitivity to internal fullness cues. Smaller positive associations were also found with enjoyment of food and dietary restraint, while eating pace was negatively related to BMI. Overall, these findings suggest that body weight was more directly linked to everyday eating regulation than to broad Big Five personality traits.

At the domain level, BMI showed statistically significant but generally small associations with personality traits. Higher BMI was related to lower agreeableness and conscientiousness and slightly higher openness, whereas associations with neuroticism and extraversion were negligible. This suggests that broad personality domains capture only a limited proportion of individual differences related to body weight.

A more differentiated pattern was found at the nuance level, where BMI was associated with several specific personality nuances across all five domains. In line with Vainik et al. (2019), who demonstrated that BMI is often more strongly linked to narrower personality facets than to broad domains, the present findings showed that the largest associations were found in nuances reflecting self-control and impulsivity. Higher BMI was related to lower tendency to resist temptations, weaker perceived control over cravings, and lower self-perceived health. In addition, several conscientiousness-related nuances reflecting lower organization and self-discipline (such as spending more money than one should, leaving a mess in one's room, and being easily distracted) were positively associated with BMI. These results suggest that BMI may be more closely connected to specific self-regulatory tendencies than to broad personality domains.

In line with prior research (Provencher et al., 2008; Keller & Siegrist, 2015; Vainik et al, 2013), neuroticism and conscientiousness were found to be the personality domains most strongly associated with eating behaviours. At the domain level, higher neuroticism was linked to greater loss of control over eating and higher dietary restraint, supporting the view that higher emotional instability may reflect difficulties in self-regulation, which in turn contribute to dysregulated or compensatory eating patterns (Keller & Siegrist, 2015). Like found in previous studies (Garcia-Garcia et al., 2022), these associations became substantially

more pronounced at the nuance level, where traits reflecting poor impulse control, such as difficulty resisting temptations and reduced ability to control cravings. These nuances showed the strongest correlations with loss of control over eating (up to $|r| \approx .54$). This pattern indicates that the association between neuroticism and maladaptive eating is more specifically driven by self-regulatory deficits rather than the broader domain itself.

In contrast, conscientiousness showed a largely opposite pattern. At the domain level, it was negatively associated with loss of control and positively associated with satiety responsiveness, which indicates more regulated and structured eating behaviour. The nuance-level results revealed that traits related to impulsivity (e.g., acting without thinking, difficulty waiting) were negatively associated with eating pace, while traits reflecting orderliness and self-discipline (e.g., keeping things tidy, finishing tasks) were linked to better control over eating. Together, these findings align with theoretical perspectives emphasizing self-control and impulse regulation as central mechanisms linking personality to health-related behaviours (John & Srivastava, 1999; Keller & Siegrist, 2015).

At the domain level, extraversion was positively related to enjoyment of food and dietary restraint, but negatively related to eating pace, indicating a somewhat mixed pattern, which is also in line with previous literature (Mõttus et al. 2012; Tiainen et al. 2013; Keller & Siegrist, 2015). However, the nuance-level results revealed a more differentiated picture: nuances reflecting positive affect and sociability (e.g., “have a lot of fun,” “am always joking”) were positively associated with enjoyment of food, whereas other nuances showed little or no association. This supports the findings that the link between extraversion and eating behaviour may be driven specifically by reward sensitivity (Sutton et al. 2022) and positive emotionality (Evers et al. 2018) rather than the broader trait.

Consistent with previous literature (Gerlach et al., 2015), agreeableness and openness only showed limited associations with eating behaviour. At the domain level, agreeableness was negatively correlated with loss of control over eating and dietary restraint, and positively associated with satiety responsiveness and slower eating pace, suggesting lower tendency toward uncontrolled eating and higher responsiveness to internal satiety cues. At the nuance level, small associations were found with loss of control over eating. Openness showed similarly small and inconsistent associations on domain and nuance levels. For example, stronger emotional intensity was associated with greater enjoyment of food, whereas being less affected by emotions was associated with lower loss of control over eating.

The mediating role of eating behaviour in the personality-BMI association

To investigate how personality, eating behaviour, and BMI are connected, the structural equation modelling was used. Personality and eating behaviour were both significant predictors of BMI. However, personality remained the stronger predictor even when both constructs were entered together. This suggests that personality may capture a broader range of behavioural tendencies relevant to body weight than eating behaviour traits alone. While eating behaviour traits focus specifically on food-related habits, personality may additionally reflect broader differences in behaviour including self regulation, emotional reactivity and impulse control (John & Srivastava, 1999; Keller & Siegrist, 2015), all of which are likely to contribute to BMI over time.

The mediation model was based on a theoretical framework in which broad personality tendencies are conceptualised as higher-order dispositions that may shape more specific behavioural patterns, including eating-related behaviours (Schwaba et al., 2025; Tsukayama et al., 2011). Within this hierarchical perspective, eating behaviour may represent a more direct and domain-specific behavioural pathway linking personality to BMI-related outcomes (Garcia-Garcia et al., 2022). The analysis supported this interpretation - eating behaviour partially mediated the association between personality and BMI. This indicates that personality contributes to BMI through the patterns of eating. However, because the indirect effect accounted for only part of the total effect, eating behaviour does not appear to fully explain the association between personality and BMI. The direct effect of personality still remained after the effect of eating behaviour was considered. This suggests that additional behavioural and lifestyle factors like physical activity, daily routines, stress management, or adherence to long-term health goals (Sutin & Terracciano, 2016) may also play an important role.

A likely explanation for the relatively strong structural effects observed in the present models is the use of a multi-method assessment design. As discussed in the introduction, relying on a single source of assessment may lead to weaker observed associations due to stable method bias and random measurement error (McCrae, 2018; Mõttus et al., 2024). Self–informant agreement for eating behaviour items was comparable to and in some cases higher than the agreement for personality nuances, suggesting that everyday eating behaviours may be sufficiently observable to close others to support multi-informant assessment. The self- and informant-reports were therefore combined to reduce method-specific bias and provide a more robust representation of the underlying constructs than either source alone.

Consequently, the strong direct and indirect effects observed in the SEM models may partly reflect a clearer estimation of the true associations between personality, eating behaviour, and BMI.

Limitations

A few limitations of the present study should be acknowledged. First, the study relied on a convenience sample, which limits the generalizability of the findings. The participation was voluntary, so the sample may differ from the broader population.

Second, eating behaviour was measured using only five questionnaire items, with each eating behaviour trait represented by a single item. As a result, the assessed eating behaviour dimensions provide only a relatively narrow approximation of complex behavioural constructs that are typically captured using multi-item validated scales. In addition, the eating behaviour items were presented together with the personality questions rather than as a separate questionnaire block. This may have made participants answer both sets of questions from a similar general self-view, which could have made the associations between personality and eating behaviour stronger.

Third, all data were collected through an online questionnaire, meaning that the assessment conditions could not be standardized across participants. Differences in distractions, attentiveness and interpretation of questions may therefore have introduced additional measurement error that could not be controlled within the present design.

Fourth, extreme values were not removed from the analyses. As a result, participants with very high or very low BMI values were retained in the dataset, which may have influenced the strength of the observed associations and the estimation of the statistical models.

Finally, the study was based on cross-sectional correlational data, which does not allow causal conclusions to be drawn about the direction of the observed relationships. Although the mediation models suggest that eating behaviour may partly explain the association between personality and BMI, these analyses can not determine whether personality influences eating behaviour and body weight over time or if the observed associations reflect other unmeasured factors. However, mediation analyses remain informative because they allow the evaluation of whether the observed associations are consistent with theoretically proposed pathways (Garcia-Garcia et al., 2022) and help clarify how different constructs may be statistically related within a broader explanatory framework.

Future studies would benefit from using more representative samples, more extensive and validated eating behaviour measures, separate assessment blocks for personality and eating behaviour, and longitudinal designs that would allow stronger conclusions about causal pathways. It would also be useful to examine whether the present findings remain similar after controlling for extreme BMI values.

Conclusion

The present study demonstrated that personality is associated with both eating behaviour and BMI. Associations between broad personality domains and eating behaviour were generally modest, with the strongest associations found with neuroticism and conscientiousness. However, several stronger and more specific relationships emerged at the nuance level, indicating that narrower personality nuances may capture eating- and weight-related differences more precisely than broad domain scores. Higher BMI was strongly related to eating behaviour traits reflecting difficulties in eating regulation. The structural equation models further demonstrated that both personality and eating behaviour significantly predicted BMI, with personality accounting for almost half of the variance in BMI. Eating behaviour partially mediated the association, suggesting that personality is linked to body weight both through eating patterns and through additional pathways not fully explained by eating behaviour alone. Combining self- and informant-reports helped reduce single-source bias and allowed the associations to emerge more clearly.

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