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**Conscientiousness and (un)healthy eating:  
The role of impulsive eating and age in the consumption of daily  
main meals**

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**Conscientiousness and (un)healthy eating: The role of impulsive eating and age in the consumption of daily main meals**

ABSTRACT

The present study aims to explore the relationship between conscientiousness and the consumption of healthy versus unhealthy main meals. Impulsive eating was tested as a mediator in this relationship, as well as direct effects of age on those constructs. A nationwide representative sample of 1006 Norwegian adults (18–70 years) within a prospective design was used to test a theoretical model. The structural equation model (SEM), in combination with bootstrapping procedures in AMOS, was the principal analytical method. Conscientiousness was negatively associated with unhealthy and impulsive eating. Impulsive eating was a partial mediator between conscientiousness and unhealthy eating and a full mediator between conscientiousness and healthy eating. Age was positively correlated with conscientiousness and this relationship had an inverted U-shape form. Finally, age was negatively associated with unhealthy and impulsive eating, and positively associated with healthy eating. This study confirmed the relevance of conscientiousness for healthy, unhealthy, and impulsive eating.

*Keywords:* conscientiousness, healthy and unhealthy eating behaviour, impulsive eating, age, structural equation model, SEM

## INTRODUCTION

Eating a healthy diet is one of the most important factors for a healthy life and longevity. Unhealthy eating is a major cause of obesity, being overweight, diabetes, and depression, has a negative effect on quality of life and may lead to high economic costs (Wang, McPherson, Marsh, Gortmaker, & Brown, 2011). Among the many drivers of food consumption (e.g., Bublitz, Peracchio, & Block, 2010), individuals' personality structure has been found influential, both in relation to problematic eating and eating disorders (e.g., Cassin & von Ranson, 2005) as well as in non-clinical contexts (e.g., Lunn, Nowson, Worsley, & Torres, 2014; Möttus, Realo, Allik, Deary, Esko, & Metspalu, 2012; Vainik, Dagher, Dubé, & Fellows, 2013). A particularly interesting personality trait is conscientiousness and an inverse facet of it, impulsiveness (e.g., John & Srivastava, 1999; Roberts, Lejuez, Kruger, Richards, & Hill, 2012). Conscientiousness is consistently found as a general factor associated with health-promoting behaviours and longevity (Bogg & Roberts, 2004; Friedman & Kern, 2014; Takahashi, Edmonds, Jackson, & Roberts, 2013). Impulsiveness has been particularly studied in relation to unhealthy food consumption and its consequences, such as increased weight and obesity (Guerrieri, Nederkoorn, & Jansen, 2007; Honkanen, Olsen, Verplanken, & Tuu, 2012; Nederkoorn, van Eys, & Jansen, 2004).

The present study aims to integrate and extend the literature by exploring how impulsive eating behaviour as a domain-specific construct (Tsukayama, Duckworth, & Kim, 2012), mediates the relationship between general conscientiousness and (un)healthy eating behaviour. In addition, the study focuses on the role of age, as the relationship between conscientiousness, age, and health-related behaviour is multifaceted and complex and is not well understood (Friedman, Kern, Hampson, & Duckworth, 2012; Shanahan, Hill, Roberts, Eccles, & Friedman,

2012). The study focuses on daily consumption of main meals, i.e., dinner. It has a prospective design; structural equation modelling will be used to test the hypothesized relations.

*Conscientiousness, impulsivity and (un)healthy eating*

Conscientiousness is one of the “Big Five” basic personality dimensions (e.g., John & Srivastava, 1999), and is defined partly by rashness, impulsiveness and lack of organization at the low end, versus being planful and deliberate at the high end (Roberts, Chernyshenko, Stark, & Goldberg, 2005). Typical facets of conscientiousness are, for instance, being efficient organized, dutiful, thorough, self-disciplined, and focused (John & Srivastava, 1999). This study defines and assesses conscientiousness as a global construct without differentiating more detailed facets.

The majority of existing studies on conscientiousness and health behaviour test the direct relationship between one facet of conscientiousness, such as impulse control, and health behaviour. Bogg and Roberts (2004) meta-analysed 194 studies of relationships between conscientiousness-related traits and nine different health behaviours. Conscientiousness appeared negatively correlated to all risky unhealthy behaviours and positively correlated to physical exercise. In a longitudinal study, Takahashi, Roberts, and Hoshino (2012) found that changes in conscientiousness were significantly and positively correlated with changes in preventive health behaviours and changes in self-perceived physical health. Most of the studies investigating the relationship between conscientiousness and health outcomes deal with direct effects (Bogg & Roberts, 2004; Roberts et al., 2012). To the best of our knowledge, relatively few studies dealt with moderators or mediators, or both, in this relationship (Conner, Grogan, Fry, Gough, & Higgins, 2009).

Evidence for relationships between personality and food consumption or eating habits in specific have been found in a number of studies (e.g., Bogg & Roberts, 2004; de Bruijn, Brug, & Van Lenthe, 2009; Goldberg & Strycker, 2002; Lunn et al., 2014; Vainik et al., 2013). These studies consistently point at conscientiousness as the personality trait which is most prominently related to healthy food intake, either directly (e.g., Goldberg & Strycker, 2002), or via a stronger capacity for self-control (Vainik et al., 2013). The latter suggests that control over impulsive unhealthy eating is an important factor in the relationship between conscientiousness and healthy eating.

We hypothesize that the relationship between conscientiousness and eating healthy meals is mediated by controlling impulsive unhealthy consumption choices. Impulsivity is thus conceptualized here as a domain-specific construct (Tsukayama et al., 2012). The rationale for this hypothesis is that controlling impulsive eating is the way conscientious persons may express this personality trait in the domain of food choice. Vice versa, those who are less conscientious are expected to have less control over their impulses to choose unhealthy food. Indeed, a host of studies have demonstrated a relationship between impulsivity and unhealthy eating or, vice versa, self-control and healthy eating (e.g., Bublitz et al., 2010; de Ridder, Lensvelt-Mulders, Finkenauer, Stok, & Baumeister, 2012; Guerrieri et al., 2007; Hofmann, Friese & Wiers, 2008; Honkanen et al., 2012; Nederkoorn, Houben, Hofmann, Roefs, & Jansen, 2010; Stadler, Oettingen, & Gollwitzer, 2010; Tam, Bagozzi, & Spanjol, 2010). These studies illustrate the conflict between impulsive and reflective processes: both processes can influence health behaviours, but their relative contribution can vary as a function of situational and dispositional factors (Hoffmann et al., 2008; Strack & Deutsch, 2004).

*The role of age*

Once adulthood is reached, the dominant perspective has been there is no, or at best a moderate, subsequent change in personality (Costa & McCrae, 2006; McCrae & Costa, 1997). A more recent perspective from both cross-sectional and longitudinal studies concludes that personality traits, conscientiousness included, change across the life course (Friedman et al., 2012; Roberts, Walton, & Viechtbauer, 2006; Shanahan et al., 2012). For example, Soto, John, Gosling and Potter (2011) investigated tracked age trends for the Big Five on a selection of different facets in very large cross-sectional samples of children, adolescents, and adults (ages 10–65 years). Results confirmed previous studies showing key changes in personality are most prominent during late childhood and adolescence. Conscientiousness showed a negative age trend from late childhood into adolescence, and a pronounced positive trend from adolescence through emerging adulthood (Donnellan & Lucas, 2008; Roberts et al., 2006; Soto et al., 2011).

Studies of age differences in impulsivity and impulsive behaviour are rare. We are only aware of less than a handful of studies (e.g., Gavlan, Hare, Voss, Glover, & Casey, 2007), but those concern adolescents and young adults under 30. These studies suggest a steady decline in impulsivity from early childhood through adolescence and into adulthood (Steinberg, Cauffman, Banich, & Woolard, 2008). Because impulse and self-control are facets of a more global conscientiousness, the relationship between age and impulsive eating can be expected to show the same patterns as conscientiousness-age consistency (Donnellan & Lucas, 2008; Roberts et al., 2006; Soto et al., 2011), i.e., older individuals are more conscientious in general and eat less on impulse compared to young adults.

The above may suggest that people eat healthier as they get older. While taste, preferences, cognitions, and consumption of food differ with age—and for different reasons

(Bublitz et al., 2010), some research suggests that there is a tendency across cultures that healthy eating perceptions and practices increase with age (Glanz, Basil, Maibach, Goldberg, & Snyder, 1998; Margetts, Martinez, Saba, Holm, Kearney, & Moles, 1997). Olsen (2003) found that age was positively associated with seafood consumption in Norway, and that this behaviour was associated with an increase in health involvement over age. However, not all evidence is consistent (e.g., Hall, 2012); cohort and life course effects may generate alternative explanations (e.g., Devine, 2005).

#### *A summary model of the present study*

This study proposes a model of the direct relationship between conscientiousness and healthy versus unhealthy eating behaviour but introduces impulsive eating as a mediator in a prospective designed study. In addition, this study explores how age is associated with conscientiousness, impulsive eating, and healthy and unhealthy eating behaviour. The hypothesized model is graphically depicted in Figure 1. Structural equation modelling (Anderson & Gerbing, 1988; Bollen, 1989) is used to simultaneously estimate the strength and direction of all relationships, as well as account for mediation effects (Baron & Kenny, 1986).

----- Figure 1 about here -----

## METHOD

### *Participants and procedure*

A national representative sample of 1644 respondents was recruited from the Norwegian adult (18+) population with respect to age, gender, and region. The sample was selected randomly from a pool of pre-recruited respondents by a professional research agency. The random selection increases the external validity of the findings. A summary analysis of the main characteristics of the sample shows that 50.5% of the participants were male and 68.5% were



living as a couple. Thirty-one percent had college or lower university education (1-3 years), while 26% had higher university education (4 years or more). The average age was 42 years (range: 18-74) and about 55% of respondents had an income level between 50.000€ and 110.000€ per year (Norwegian middle class). Participants completed an online survey answering questions about conscientiousness, perceived healthy eating tendency, demographics and some other constructs. The participants received a shopping voucher in exchange for their participation.

The data collection was conducted in two waves. At Wave One, the baseline questionnaire was filled out by 1644 respondents. A four-week diary report followed where participants were instructed to fill out two behavioural questions for each day after dinner or in the evening; one mark for dinners consumed each day and one for impulse. The research company contacted the participants regularly, and the diaries were returned at the end of each week. The use of weekly diaries to collect end-of-day data is well-established in the health psychology literature (O'Connor, Jones, Conner, McMillan, & Ferguson, 2008). The 1006 individuals that filled out all diary reports during all weeks comprised the final sample for the current study.

### *Measures of Interest*

*Healthy and unhealthy eating behaviour.* Studies of impulsive eating mostly deal with snacks and fruits (Nederkoorn et al., 2010; Stadler et al., 2010). About 81% of Norwegians have dinner every day; 91% of households have their main meals (dinner) at home and with their families (Bugge & Døving, 2000). For each consecutive day participants were asked to mark what they had as their main meal on a list with nine closed and one open (“other”) option. The dinner options were the most common meal categories in Norwegian households, for example,

seafood, red meat, chicken, home-made pizza, and ready-made pizza. We calculated an index for healthy eating by summing up all meals of seafood during the four-week period and an index of unhealthy eating by summing up all meals of ready-made pizza during the same four-week period. Seafood was chosen as an indicator for healthy food because Norwegian authorities recommend eating seafood (e.g., salmon, cod, saithe, or halibut) at least two times a week, about twice as much as the national average (Norwegian Directorate of Health, 2013). Seafood is at a high level of the food guide pyramid, and Norwegian consumers perceive seafood among the healthiest main meal (Bugge, 2012). Higher scores on the calculated index were indicative of higher levels of both healthy and unhealthy eating behaviour. In the same guidelines, people are recommended to limit their intake of trans- and saturated fat, sugar, salt, unhealthy snacks and meals. Pizza is perceived as unhealthy among most Norwegians (Bugge, 2012) and is used as an example of the “restricted” food category. Norwegians eat about 6 kilos of frozen pizza per capita per year, and pizza is a weekly meal in many households ( Bugge, 2010). Using two different kinds of food as indicators to assess degree of healthy eating, consumption, or shopping, previously occurs in several studies (O’Connor et al., 2008; Tam et al., 2010). For example, Prestwich, Hurling, and Baker (2011) used choice of chocolate versus fruit to indicate unhealthy versus healthy food shopping.

*Impulsive eating.* In the food diary, respondents indicated their answer to a question about the degree to which their choice of dinner that day was made on impulse or planned. The scale ran from (1) *totally impulsive* to (7) *totally planned*. Then we constructed a scale of four weekly items (average week 1, 2, 3 and 4) to give the average impulse-core over the four weeks. This scale is reversed in the analysis.

*Conscientiousness.* The measurement of conscientiousness was based on an extended version of the short form of the Big Five developed by Gosling, Rentfrow, and Swann (2003): the Ten-Item Personality Inventory (TIPI). TIPI has been validated (e.g., Herzberg & Brähler, 2006; Lang, John, Lüdtke, Schupp, & Wagner, 2011) against more comprehensive scales (e.g., BFI, NEO-FFI: John & Srivastava, 1999) and provides satisfactory convergent validity, test-retest reliability and patterns of predicted external correlates (predictive validity). Several authors (e.g., Hofmans, Kuppens, & Allik, 2008) have used this scale in an attempt to reduce the testing burden on participants. This study used the two initial items in the TIPI scale: *dependable, self-disciplined* and *disorganized, careless*. Similar items are used by Soto et al. (2011) to assess general conscientiousness. In order to cover a deeper part of the construct (especially order and self-discipline) and to reduce identification problems when using the structural equation model (Marsh, Hau, Balla & Grayson, 1998), we decided to extend this two-item scale by adding two new items (*punctuality, systematic* and *messy, inaccurate*) selected from the Norwegian version of the NEO-FFI (Martinsen, Nordvik, & Østbø, 2003). All four items were presented in accordance with Gosling et al. (2003: Appendix A) with the heading, “I see myself as,” and measured with a 7-point scale anchored at 1 (*disagree strongly*) and 7 (*agree strongly*). The items intend to cover the three most dominated facets of general conscientiousness: order, self-discipline/self-control, and reliability/achievement (Kern & Friedman, 2008; Roberts et al., 2012). Donnellan and Lucas (2008) used three items of BFI to assess general conscientiousness with a correlation of 0.88 of the full version of the BFI scale.

*Age.* Participants reported their actual age, which ranged from 18 to 74 years.

*Analytical strategy*

First, the study assessed the intended constructs to ensure the internal consistency and the convergent and discriminant validity of the constructs (Anderson & Gerbing, 1988) by performing confirmatory factor analysis using AMOS. Single indicators (i.e., age, healthy and unhealthy eating behaviour) were fixed to zero error. Second, the theoretical model (see Figure 1) was tested using structural equation modelling. Because we intended to test the nonlinear effect of age on conscientiousness, the quadratic part of age (i.e., age x age) was created after the original scale of age (actual age) was changed by mean-centering to reduce the correlations between age and its quadratic part (Aiken & West, 1991). Finally, the mediator role of impulsive eating in the relationships between conscientiousness and healthy and unhealthy eating behaviour was tested using a combination of piecemeal approach (Baron & Kenny, 1986), the likelihood ratio (chi-squared difference test: Bollen, 1989), and the product of coefficients approach (Sobel, 1982) based on a bootstrapping procedure in AMOS (e.g., Shrout & Bolger, 2002). This analytical strategy has an advantage compared with the ordinary least square method in allowing for the assessment of latent variables that are free of measurement error (Bollen, 1989). It also provides a necessary basic for partial and full mediator tests of impulsive eating (Baron & Kenny, 1986) as well as a strong statistical test for the indirect effect of conscientiousness on healthy and unhealthy eating behaviour via impulsive eating (Shrout & Bolger, 2002).

## RESULTS

### *Measurement model analysis*

A confirmatory factor analysis of the measurement model, including the five constructs in the theoretical model shown in Figure 1, resulted in a good fit with these data ( $\chi^2 = 148.4$ ,  $df = 37$ ,  $p < 0.001$ ;  $GFI = 0.97$ ;  $CFI = 0.97$ ;  $RMSEA = 0.05$ ) (Browne & Cudeck, 1992). Factor

loadings on conscientiousness and impulsive eating are statistically significant ( $p < 0.001$ ;  $t$ -value  $> 16.0$ ) with values ranging from 0.56 to 0.84, which shows the convergent validity of the constructs. The composite reliabilities, 0.75 (conscientiousness) and 0.88 (impulsive eating), exceed the minimum value of 0.60 (Anderson & Gerbing, 1988).

-----Table 1 about here-----

Table 1 displays the intercorrelations between the constructs in the theoretical model. All correlations are significant with the absolute values below 0.34 ( $p < 0.05$ , absolute  $t$ -values  $> 2.0$ ). This also implies that the absolute value of each correlation is less than 1.00 by an amount exceeding twice its respective standard error, which constitutes discriminant validity (Anderson & Gerbing, 1988).

#### *Direct effects*

The estimated results of the structural model only including direct and quadratic effects (see Figure 1) indicate a good fit with the data ( $\chi^2 = 149.4$ ,  $df = 47$ ,  $p < 0.001$ ;  $GFI = 0.98$ ;  $CFI = 0.97$ ;  $RMSEA = 0.05$ ) (Browne & Cudeck, 1992). The estimated results are shown in Table 2, Model 1.

-----Table 2 about here-----

The results in Table 2 indicate that the relationship between conscientiousness and healthy eating behaviour is not significant ( $\beta = 0.02$ ,  $t = 0.6$ ,  $p > 0.10$ ). Our expectations are supported by a significant, negative relationship between conscientiousness and unhealthy eating behaviour ( $\beta = -0.14$ ,  $t = -4.0$ ,  $p < 0.001$ ) and between conscientiousness and impulsive eating ( $\beta = -0.20$ ,  $t = -5.4$ ,  $p < 0.001$ ).

In addition, the data confirm that impulsive eating has a significant, positive effect on unhealthy eating behaviour ( $\beta = 0.15, t = 4.4, p < 0.001$ ) and a significant, negative effect on healthy eating behaviour ( $\beta = -0.14, t = -4.2, p < 0.001$ ).

Age is associated positively with conscientiousness ( $\beta = 0.18, t = 4.7, p < 0.001$ ), while the quadratics of age have a negative effect on conscientiousness ( $\beta = -0.10, t = -2.7, p < 0.01$ ). A combination of both effects shows a decreasing incremental effect of age on conscientiousness in an inverted U-shape form. In addition, age is negatively related to impulsive eating ( $\beta = -0.25, t = -7.7, p < 0.001$ ) and unhealthy eating behaviour ( $\beta = -0.16, t = -4.9, p < 0.001$ ) and positively related to healthy eating behaviour ( $\beta = 0.29, t = 9.3, p < 0.001$ ).

#### *Testing for mediation*

Our theoretical discussion expected that domain-specific impulsive eating could act as a mediator between general conscientiousness and healthy and unhealthy eating behaviour (Tsukayama et al., 2012). The result from a separate analysis of structural relationship only, including the direct effects of conscientiousness on healthy and unhealthy eating behaviour and the controlled effect of age (Model 3 in Table 2), gave a non-significant positive association between conscientiousness and healthy eating behaviour ( $\beta = 0.05, t = 1.5, p > 0.05$ ) and a significant negative association between conscientiousness and unhealthy eating behaviour ( $\beta = -0.18, t = -5.0, p < 0.01$ ). In addition, when impulsive eating is included (Model 2 in Table 2) and combined with a significant negative effect of conscientiousness on impulsive eating ( $\beta = -0.20, t = -5.4, p < 0.001$ ) and a significant negative effect of impulsive eating on healthy eating behaviour ( $\beta = -0.14, t = -4.2, p < 0.001$ ), then the relationship between conscientiousness and healthy eating behaviour is also non-significant ( $\beta = 0.02, t = 0.6, p > 0.10$ ). The elimination of the path from conscientiousness to healthy eating behaviour did not make the model a worse fit

( $\chi^2$  difference = 0.6,  $df = 1$ ,  $p > 0.10$ ). Furthermore, the product of two path coefficients (conscientiousness  $\rightarrow$  impulsive eating and impulsive eating  $\rightarrow$  healthy eating behaviour) is also significant ( $\beta = -0.20 \times (-0.14) = 0.03$ , *std. error* = 0.01,  $t = 2.8$ ,  $p < 0.01$ ). These findings imply that impulsive eating is a full mediator in the relationship between conscientiousness and healthy eating behaviour (Baron & Kenny, 1986; Shrout & Bolger, 2002).

Similarly, the estimated result from Model 3 also shows a significant negative effect of conscientiousness on unhealthy eating behaviour ( $\beta = -0.18$ ,  $t = -5.0$ ,  $p < 0.001$ ) and this effect is still significant when impulsive eating is included ( $\beta = -0.14$ ,  $t = -4.0$ ,  $p < 0.001$ ) (see Model 2 in Table 2). The elimination of the path from conscientiousness to healthy eating behaviour makes the model fit worse ( $\chi^2$  difference = 16.0,  $df = 1$ ,  $p < 0.001$ ). In addition, the product of two path coefficients (conscientiousness  $\rightarrow$  impulsive eating and impulsive eating  $\rightarrow$  unhealthy eating behaviour) is also significant ( $\beta = -0.20 \times 0.15 = -0.03$ , *std. error* = 0.009,  $t = 3.3$ ,  $p < 0.01$ ). These findings imply that impulsive eating is a partial mediator in the relationship between conscientiousness and unhealthy eating behaviour (Baron & Kenny, 1986; Shrout & Bolger, 2002).

## DISCUSSION

This study explores the relationship between conscientiousness and healthy and unhealthy eating behaviour. Domain-specific impulsive eating was tested as a mediator in this relationship, and the direct effects of age on those constructs were incorporated into a structural equation model (SEM). The analyses are based on data from a representative sample of more than 1000 Norwegian adults, and a simultaneous combination of procedures in SEM is used to test the relationships, thus providing an advantage compared with traditional estimated methods.

Based on the analytical results, the present study suggests that conscientiousness promotes healthy eating behaviour and decreases unhealthy eating behaviour. This result is consistent with previous studies in other contexts of health behaviour (Bogg & Roberts, 2004) and in studies between personality and eating habits (Lunn et al., 2014; Möttus et al., 2012; 2013; Goldberg & Strycker, 2002). However, the relationship between conscientiousness and healthy eating was found to be mediated by (control of) impulsive eating. Thus, highly conscientious individuals with high self-control tend to base their main meals on careful planning rather than impulsive action. This result is consistent with recent discussions suggesting that the relationship between conscientiousness and health behaviour may occur via motivational mediators (e.g., de Bruijn et al., 2009; Conner & Abraham, 2001; Hill et al., 2011). The degree of impulsivity of meal choices was assessed daily over a period of four weeks, which contributes to the validity of our conclusions.

This study extends previous findings about conscientiousness-impulsivity relationships (Bogg & Roberts, 2004; Roberts et al., 2005) into the area of regular impulsive behaviour, by confirming that people high in conscientiousness eat less on impulse and plan what they intend to eat as their main meal, compared to people low in conscientiousness. Our findings support the perspectives that individuals low in conscientiousness may have poorer self-regulatory processes than highly conscientiousness individuals (Bogg & Roberts, 2004; Roberts et al., 2005), which may lead to impulsive actions (Nederkoorn et al., 2004; 2010; Verplanken & Sato, 2011).

We found impulsive eating was negatively related to healthy eating behaviour in this study, but positive related to unhealthy eating behaviour. The results are consistent with most studies in the field of health and consumer psychology (Bogg & Roberts, 2004; Bublitz et al., 2010; Churchill & Jessop, 2010, 2011; Churchill, Jessop, & Sparks, 2008; Guerrieri et al., 2007;



Nederkoorn et al., 2010; Prestwich et al., 2011; Stadler et al., 2010; Tam et al., 2010). However, most previous studies in the area of impulsive eating focused on non-staple foods (e.g., potato chips, candy, chocolates, or snacks), whose availability and exposure easily can trigger a quick, unintended purchase and impulsive eating behaviour. In other words, unhealthy eating behaviours in those cases seem to be driven by individuals' pursuit of hedonistic goals to obtain short-term pleasure (Bublitz et al., 2010; Nederkoorn et al., 2010; Verplanken, Herabadi, Perry, & Silvera, 2005; Verplanken & Sato, 2011). Our study extends those results into an important eating context, namely the main meal, dinner.

As for the role of age, our findings are consistent with studies suggesting that conscientiousness increases with age (Friedman et al., 2012; Donnellan & Lucas, 2008; Roberts et al., 2006; Soto et al., 2011; Takahashi et al., 2013). The test of the nonlinear relationship confirmed an inverted U-shape: Conscientiousness seems to increase somewhat with age, peaks around 58 years, and decreases somewhat after 60 (Bogg & Roberts, 2004). The results also indicate that impulsive eating decreases with age. This is consistent with studies testing the impulsivity-age relationship (Gavlan et al., 2007; Steinberg et al., 2008). Implications of these results may focus on tailoring interventions to the different age groups. The results suggest that it should be easier to persuade middle-aged and older people to eat healthier due to their (slightly) higher levels of conscientiousness and less impulsive actions, making these cohorts the best targets for traditional healthy eating campaigns. Younger people may be less easy to convince through such campaigns, due to their higher level of impulsiveness, perhaps combined with less regular lifestyles. Other strategies may thus be needed to reach these cohorts. An interesting perspective in this respect was provided in recent work by Salmon, Fennis, de Ridder, Adriaanse, and de Vet (2014), who demonstrated that individuals with low self-control chose healthier food

by the use of heuristics, in this case by suggesting that the majority of participants had chosen the healthier options if they were available. In other words, such strategies make use of traits or individual differences, which are salient in that particular cohort.

Of lesser importance, this study also finds that older people have higher healthy eating tendency and behaviours and less unhealthy eating behaviours. These findings provide additional support for the general tendency across cultures that healthy eating motivations and practice increase with age (Glanz et al., 1998; Margetts et al., 1997; Olsen, 2003) and lead to longevity (Roberts et al., 2012).

Finally, a number of limitations should be noted. Firstly, conscientiousness was measured at a general level, using a short form (Gosling et al., 2003), and was not specifically focused on facet level analysis. Short forms of self-reported personality constructs prove robust across different assessment methods, across different age groups and over time (retest stability) (Lang et al. 2011). Future studies should investigate how the underlying structure of conscientiousness (e.g., order/achievement, self-control, order or responsibility) is related to healthy and unhealthy eating tendencies and behaviour and impulsive eating (Bogg & Roberts, 2004; Kern & Friedman, 2008; Roberts et al., 2012; Soto et al., 2011). Secondly, the exclusive use of self-reported data of constructs presents the possibility of measurement errors and biases. For example, observer rating of conscientiousness and behaviour could be used. In addition, our assessment of healthy and unhealthy eating could be improved by using a wider spectrum of food items (Margetts et al., 1997) or scales such as the Diet Quality Index-International (Kim, Haines, Siega-Riz, & Popkin, 2003); measures of self-reported impulsive behaviour could also be improved either by using a multi-item scale (Mishra & Mishra, 2010) or an implicit attitudinal approach (Nederkoorn et al., 2010). Finally, the design of the study posed some limitations on the scope of

our conclusions. For instance, in spite of using a prospective design, no causal conclusions can be drawn. Although it is reasonable to suggest that conscientiousness as personality trait causes more controlled and healthier food choices, causality cannot be determined. Also, the results concerning age may be due to cohort effects rather than effects due to ageing. True longitudinal studies, latent growth curve modelling, and controlled experiments may be better suited to confirm some of the causal relationships in this study.

Notwithstanding the limitations, the results from this study may help to provide a deeper understanding of antecedents and processes of healthy and unhealthy eating and potentially inform effective interventions for promoting healthy eating behaviour. With increasing evidence for the relevance of conscientiousness and self-control in explaining health-related behaviour, it is evident that personality dimensions, together with motivational and resource factors, should be included in developing health behaviour change interventions.

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Figure 1. Theoretical model

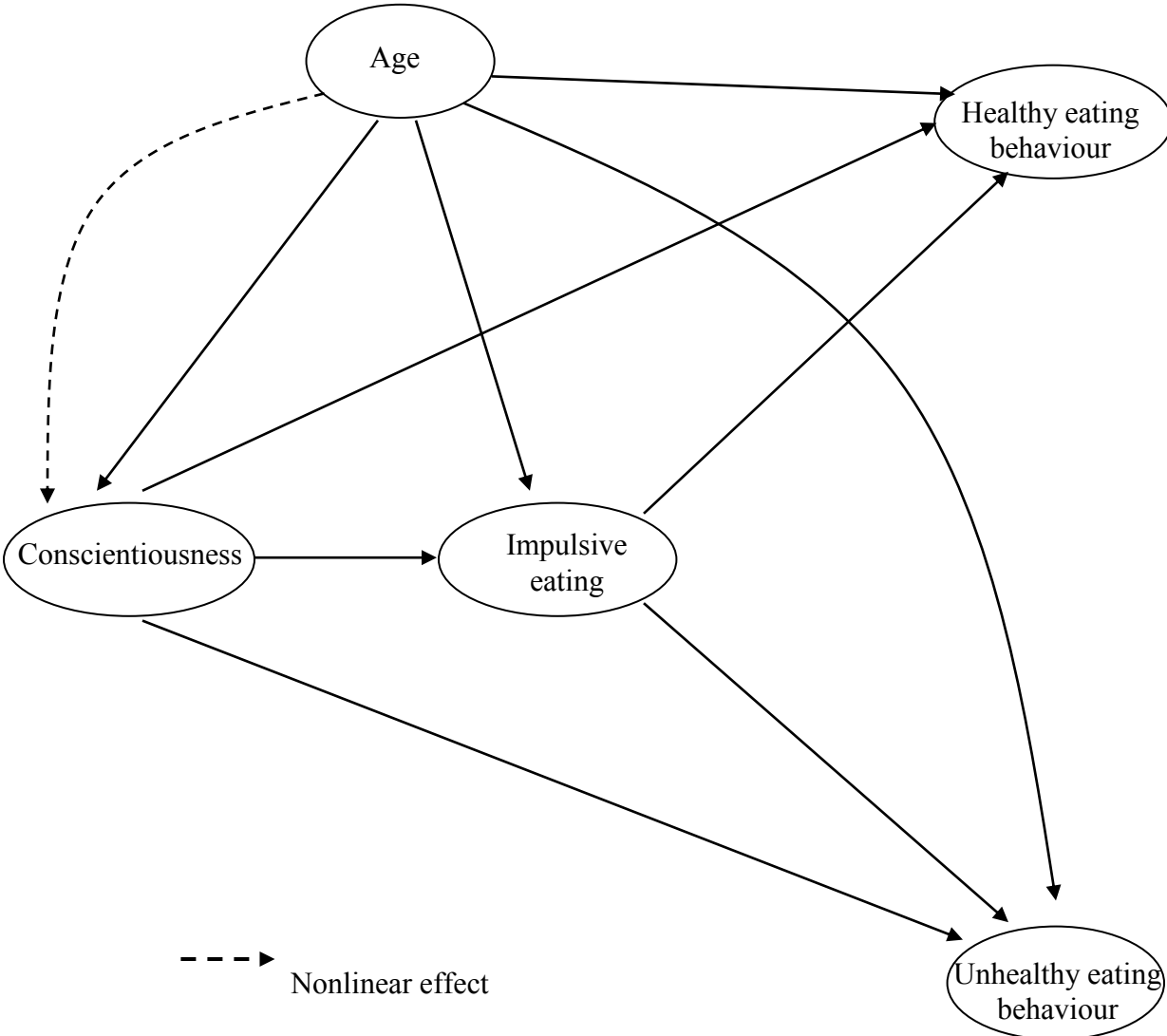


Table 1. Construct means, standard deviations, and correlations (N = 1006)

| Constructs                    | Mean | S.D.  | 1     | 2     | 3     | 4     |
|-------------------------------|------|-------|-------|-------|-------|-------|
| 1. Conscientiousness          | 5.26 | 1.02  | –     |       |       |       |
| 2. Impulsive eating           | 2.36 | 1.23  | –0.24 | –     |       |       |
| 3. Healthy eating behaviour   | 3.64 | 3.15  | 0.09  | –0.23 | –     |       |
| 4. Unhealthy eating behaviour | 1.26 | 1.80  | –0.21 | 0.23  | –0.24 | –     |
| 5. Age                        | 41.9 | 14.05 | 0.14  | –0.28 | 0.33  | –0.22 |

Note: All correlations are significant at  $p < 0.05$ ,  $t$ -values  $> 2.0$ ; Means of eating behaviours were averaged in week with the sample of 1006.

Table 2. Testing of effects

| Paths                    | Model 1       |                 | Model 2       |                 | Model 3       |                 |
|--------------------------|---------------|-----------------|---------------|-----------------|---------------|-----------------|
|                          | Std. Estimate | <i>t</i> -value | Std. Estimate | <i>t</i> -value | Std. Estimate | <i>t</i> -value |
| <i>Direct effects</i>    |               |                 |               |                 |               |                 |
| CON → HEB                | 0.02          | 0.6 ns          | 0.02          | 0.6 ns          | 0.05          | 1.5 ns          |
| CON → UEB                | -0.14         | -4.0***         | -0.14         | -4.0***         | -0.18         | -5.0***         |
| CON → IE                 | -0.20         | -5.4***         | -0.20         | -5.4***         | –             | –               |
| IE → HEB                 | -0.14         | -4.2***         | -0.14         | -4.2***         | –             | –               |
| IE → UEB                 | 0.15          | 4.4***          | 0.15          | 4.4***          | –             | –               |
| Age → IE                 | -0.25         | -7.7***         | -0.25         | -7.7***         | –             | –               |
| Age → HEB                | 0.29          | 9.3***          | 0.29          | 9.3***          | 0.33          | 10.8***         |
| Age → UEB                | -0.16         | -4.9***         | -0.16         | -4.9***         | -0.20         | -6.3***         |
| <i>Quadratic effect</i>  |               |                 |               |                 |               |                 |
| Age → CON                | 0.18          | 4.7***          |               |                 |               |                 |
| Age <sup>2</sup> → CON   | -0.10         | -2.7**          |               |                 |               |                 |
| <i>Indirect effects</i>  |               |                 |               |                 |               |                 |
| CON→ IE→HEB <sup>a</sup> | –             | –               | 0.03          | 2.8**           |               |                 |
| CON→ IE→UEB <sup>a</sup> | –             | –               | -0.03         | -3.3***         |               |                 |
| Fit statistics           |               | GFI = 0.98      | GFI = 0.98    | GFI = 0.97      |               |                 |
|                          |               | CFI = 0.97      | CFI = 0.97    | CFI = 0.93      |               |                 |
|                          |               | RMSEA = 0.05    | RMSEA = 0.05  | RMSEA = 0.08    |               |                 |

Notes: \*  $p < 0.05$ ; \*\*  $p < 0.01$ ; \*\*\*  $p < 0.001$ ; ns: non-significant;

CON: Conscientiousness; IE: Impulsive eating; HEB: Healthy eating behaviour; UEB:

Unhealthy eating behaviour.

<sup>a</sup> The indirect effects contain a product of regression coefficients, so must be tested with a procedure that takes into account the sampling distribution. A bootstrapping procedure in AMOS is used. In this way, the *t*-value is obtained from the ratio between the standardized coefficient and its standard error based on 95% bias-corrected confidence intervals (Shrout & Bolger, 2002).

