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Personality Traits and Body Weight: Evidence Using Sibling Comparisons

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Abstract

Rationale—Past research has shown that personality traits relate to body weight, but this relationship may be confounded by unobserved family-level characteristics such as genetic endowments.

Objective—The purpose of this study was to investigate whether the association between personality traits, as measured by the Big Five taxonomy, and body weight among young adults is spurious owing to shared family background.

Methods—Participants were drawn from the full (n = 14,366) and family (n = 2,813) samples of the National Longitudinal Study of Adolescent to Adult Health (Add Health). The study employed family-fixed effects to eliminate shared family background factors that might affect personality traits and body weight simultaneously.

Results—Among the Big Five personality traits, only conscientiousness showed a robust association with body weight, including body mass index (BMI) and obesity risk. These results were robust to adjustments for family-fixed effects, which indicates that the association between conscientiousness and body weight is generally not confounded by unobserved family-level characteristics shared by siblings. A one-standard-deviation increase in conscientiousness was associated with a decrease in BMI by 0.89 (equivalent to a 2.5 kg decrease in weight for an individual with an average height of the sample) and a 12% reduction in the probability of being obese. This study also found some suggestive evidence of gender and racial/ethnic differences. The association between conscientiousness and obesity was larger and statistically significant only for women, and conscientiousness was most strongly associated with obesity among Hispanic people.

Conclusion—Conscientiousness is associated with decreased body weight net of unobserved background characteristics that are shared by siblings. The results suggest that interventions that develop personality traits may have “spillover effects”; in other words, they may also help reduce obesity.

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Keywords

Personality; Big-Five; Body Mass Index; Obesity

Introduction

In the United States, obesity has been increasingly viewed as a major health concern and the focus of many public health efforts. In 2011–2012, more than one-third (34.9% or 78.6 million) of adults and 17% of adolescents were obese (Ogden et al., 2014). The prevalence of obesity in the general population is especially alarming since obesity is known to lead to enormous health burdens and increased costs of medical care. For example, obesity is linked to a number of adverse health outcomes such as diabetes, cardiovascular disease, cancer, depression, and overall mortality (Borrell and Samuel, 2014; Luppino et al., 2010). The estimated annual medical cost of obesity for the full non-institutionalized population of adults aged 18 and older was $190 billion in 2005 U.S. dollars (approximately 5% to 10% of health care spending); the annual medical expenditures per person with obesity were $2,741 (Cawley and Meyerhoefer, 2012). In addition to these health-related consequences, several studies have shown a negative relationship between obesity and labor market outcomes such as wages and employment status (Cawley, 2004; Han et al., 2009).

Discovering critical determinants of body weight has thus been a major focus for researchers across social sciences and medical fields. Many studies document that a number of factors determine overweight and obesity: genes (Locke, 2015), prenatal and postnatal experiences (Oken et al., 2008), unhealthy diet and eating habits (Mozaffarian and Hao, 2011), smoking (Chiolero and Faeh, 2008), physical inactivity (Pietiläinen et al., 2008), environmental factors (Papas et al., 2007), and so on. In addition to these genetic, dietary, behavioral, and social/environmental determinants of obesity, there has been recent growth in the examination of personality traits and body weight, and much of the research has found significant associations (e.g., Gerlach et al., 2015). However, this relationship is far from conclusive because little research to date has been able to control for family factors and genetic backgrounds that could affect both personality traits and body weight. Using a national sample with a large subsample of siblings, this study employs a family-fixed effects model to determine whether the association between personality traits and body weight is largely driven by unobserved family-level characteristics. In addition, the study examines whether the association varies by gender and race/ethnicity.

Background

The Big Five personality traits and body weight

The Big Five personality traits, also known as the five-factor model (FFM), comprise the most widely known and accepted taxonomy of personality traits. The five traits are openness, conscientiousness, extraversion, agreeableness, and neuroticism. The Big Five framework posits a hierarchical organization for personality traits, and each component summarizes a large set of personality descriptions (Almlund et al., 2011). Extraversion is characterized by positive affect and sociability. Those who show high scores on the

Extraversion scale are likely to be more energetic toward the outer world than the inner world. Neuroticism is a chronic level of emotional instability. Individuals with a high score on the Neuroticism scale often experience feelings like anxiety, hostility, depression, and worry. They respond poorly to stressors, often feel threatened by ordinary situations, and have a pessimistic view about life. Openness is the tendency to be intellectually curious, open to emotion, sensitive to beauty and willing to explore new things. Conscientious people are self-disciplined, organized, and hardworking. Individuals with high scores on the Conscientiousness scale show a strong preference for planned rather than spontaneous behavior. Finally, those who are agreeable tend to pursue social harmony. In general, those with high scores on the Agreeableness scale are considerate, kind, generous, trustworthy, and helpful.

Economists have recently attempted to formalize the conceptual and theoretical framework of the relationship between non-cognitive skills (including personality traits) and health (e.g., Almlund et al., 2011). For example, Michael Grossman's (2000) model of health capital suggests that an individual's health is determined by his endowment of health capital at birth and subsequent depreciation and investment. Investments include market goods and services (e.g., medical care) and non-market goods, such as time invested in health promoting behavior. Working within this framework, Chiteji (2010) argues that non-cognitive skills are as important as cognitive skills for enhancing the efficiency of health production in the non-market sector: they aid allocative efficiency (engagement in healthier behaviors) and productive efficiency (obtaining a larger health output from the same set of inputs).

In particular, the economic framework suggests several potential channels through which personality traits impact body weight. For example, as they are closely related to labor market outcomes (Almlund et al., 2011; Fletcher, 2013a), personality traits may affect body weight through an income effect: an increase in income would promote investments in healthy behaviors such as better eating habits and regular exercise. However, conversely, an increase in income may lead to a higher body weight due to increased opportunity costs of exercise and preparation of healthy foods. Lastly, since personality traits like impulsivity and self-control are likely related to the way in which an individual discounts time, people who value the future (i.e., those with lower rates of time preference) may be inclined to adopt a healthy lifestyle (e.g., Kessler and Maclean, 2015).

Psychologists have also studied the relationship between personality and body weight (e.g., Sutin and Terracciano, 2014; Sutin et al., 2011). This line of research has focused primarily on psychological dimensions of exercise (Hoyt et al., 2009) and eating behavior (Elfhag and Morey, 2008; Mõttus et al., 2013), which are often viewed as two of the most important proximate determinants of body weight. Self-discipline and activity are generally found to be key personality traits that are associated with the perceived ability to control exercise behavior (e.g., Hoyt et al., 2009). For example, those who are more conscientious tend to be more motivated to fulfill their exercise intentions because they are more goal-striving, organized, and self-disciplined (Almlund et al., 2011; Bogg and Roberts, 2004; Kern and Friedman, 2008). Moreover, temperamental factors (activity, positive affect, sociability, and

excitement seeking) serve to motivate extraverted individuals to follow through with their exercise intentions (Rhodes and Courneya, 2003).

Personality traits are also associated with multiple dimensions of eating behavior (e.g., Elfhag and Morey, 2008). For example, those with high scores on the Neuroticism scale are more likely to experience depressive features and an emotional vulnerability, and thus may regard overeating as a compensation and reaction to these negative emotions (Elfhag and Morey, 2008; Heaven et al., 2001). Their inability to control and resist desires also leads to emotional eating (Elfhag and Morey, 2008). Similarly, those who are less conscientious show low self-discipline, which may be prominent in emotional eating (Provencher et al., 2008). More organized and self-disciplined individuals (i.e., those who are more conscientious) show a high level of restrained eating since they are likely to have better control over calorie intake (Elfhag and Morey, 2008). Conscientious individuals with high levels of discipline, deliberation, and impulse control also tend to maintain healthy weight by seeking healthy eating habits (Mõttus et al., 2013). Finally, those who are intellectually open and curious more readily adopt novel healthy dietary habits (Goldberg and Strycker, 2002).

Evidence from the existing literature

In general, existing research suggests that personality traits are closely linked to body weight including body mass index (BMI) and obesity risk, though the results of previous studies are not consistent due to the differences in target samples, analytic models, and the set of personality traits used in the study. Many, but not all, past studies using Big Five personality traits have suggested that conscientiousness is protective against obesity while neuroticism serves as a risk factor in the development of obesity (Faith et al., 2001; Gerlach et al., 2015; Mõttus et al., 2013; Provencher et al., 2008; Sullivan et al., 2007; Sutin and Terracciano, 2014; Sutin et al., 2011). In contrast to conscientiousness and neuroticism, the relationship between the remaining three traits and body weight is less clear (e.g., Sutin and Terracciano, 2014). Only a few studies have examined gender differences in the relationship between personality traits and body weight. Studies generally suggest that while conscientiousness predicts lower BMI for both men and women, neuroticism among women and extraversion among men are positively associated with body weight (Faith et al., 2001; Gerlach et al., 2015; Sutin and Terracciano, 2014).

Despite increasing evidence that personality traits are associated with body weight, there are several noteworthy limitations to much of the previous research. The major limitation is that these studies tend to ignore the possibility that a third factor might affect both personality traits and body weight, resulting in omitted variable bias (Gerlach et al., 2015). In other words, the observed association between personality traits and body weight might be attributable to unobserved factors that influence the development of personality. Two major factors are family and neighborhood context during childhood and adolescence.

Past research has shown that personality traits are determined by a variety of family-level characteristics. For example, parental socioeconomic and health status and family structure are associated with non-cognitive skills (Khanam and Nghiem, 2016). Parenting styles and parental attachment and involvement also contribute to determining an individual's

personality traits (Schofield and Conger, 2012). Moreover, personality traits are known to have a large genetic component (Power and Pluess, 2015). Given that numerous family characteristics also influence body weight, failing to account for observed and unobserved family-level characteristics is likely to result in a spurious association between personality traits and body weight.

A great deal of neighborhood effects literature has suggested that growing up in disadvantaged neighborhood is strongly associated with a variety of child outcomes such as cognitive skills and mental health (e.g., Leventhal and Brooks-Gunn, 2000). Though no empirical research has explicitly investigated whether neighborhood contributes to the formation of personality traits, it seems reasonable to suspect that early childhood exposure to certain types of neighborhood impacts personality (Almlund et al., 2011; Kern and Friedman, 2011). Recent findings suggest that there is a great deal of regional variation in personality traits (e.g., Jokela et al., 2015), implying that neighborhood or environmental factors may also affect one's personality traits.

Given the possibility of these confounding factors, researchers must account for a wide set of variables to estimate the unbiased association between personality traits and body weight. However, fully accounting for these relevant family characteristics is practically impossible because they are difficult to operationalize, observe, and measure. For example, potential confounding factors such as genetic endowments, parental ability, and parenting styles are rarely available to researchers. Overall, the diversity and complexity of family background and environmental characteristics makes it difficult for researchers to obtain reliable estimates of the associations between personality and body weight using conventional ordinary least squares (OLS) methods.

The present study

The aim of this paper is to advance the literature by addressing several methodological and data limitations that most previous studies face. The study uses the National Longitudinal Study of Adolescent to Adult Health (Add Health), a nationally representative, longitudinal survey dataset with rich information on personality traits (Big Five personality traits) and reliably measured weight and height, as well as individual and family characteristics. In order to eliminate important unobserved heterogeneity that may confounds the relationship between personality traits and body weight (BMI and obesity risk), this paper employs high-school-of-origin and family-fixed effects models. Of key interest is whether and to what extent controlling for these fixed-effects changes the estimated coefficients of personality traits.

It is important to clarify the benefit of using a family-fixed effects model. Of the list of potential confounders (e.g., genetic endowments, parental ability, parenting styles, friends, schools, so on), family-fixed effects accounts for every part of each of components that is shared between siblings. For example, siblings have the same parents, similar abilities, similar friends, and go to similar schools. Therefore, this study rules out important family background and childhood experience that are shared between siblings. However, the study is unable to account for confounding characteristics that are idiosyncratic to each sibling. Even if siblings share many things, there are family-level factors that they do not share. For

example, parents may treat siblings differently. Siblings are not genetically identical unless they are identical twins. In school, they are in different grades and have similar but not identical teachers and friends. Again, while a family-fixed effects model removes all variation associated with measurable and unmeasurable family background characteristics shared by siblings, it will be unable to control for potential confounding factors that are child-specific. In this regard, the within-family estimates of this study do not necessarily reflect the "true" causal effects of personality traits on body weight.

In addition, this study extends the existing literature by exploring possible heterogeneity in the association between personality traits and body weight by gender and race/ethnicity. In the existing literature, surprisingly little is known about whether the relationship between personality traits and body weight differs by gender and race/ethnicity (Sutin and Terracciano, 2014; Sutin et al., 2011). Given gender and racial/ethnic differences in personality traits (Feingold, 1994) and body weight distribution (Ogden et al., 2014), it may be worth examining possible gender and racial/ethnic differences in the relationship between personality traits and body weight. Testing for differential association by gender and race/ethnicity is also motivated by its policy relevance. It is well documented that BMI is negatively related to labor market outcomes such as wage and employment status, primarily for white women (Cawley, 2004; Han et al., 2009). This suggests that there may be gender and/or racial/ethnic gaps in labor market penalties. In the marriage market, women with obesity status are shown to experience significant disadvantage: women with obesity (but not men) are less likely to be accepted into marriage (Mukhopadhyay, 2008). Therefore, considering large differences in penalties to BMI in labor and marriage markets by gender and race/ethnicity, understanding what determines BMI, and whether these predictors differ by gender and race/ethnicity, is policy-relevant.

Methods

Participants

Add Health is a school-based, longitudinal study of the health related behaviors of adolescents and their outcomes in young adulthood. Beginning with in-school and in-home questionnaires administered to a nationally representative sample of students in grades 7 through 12 in 1994–1995 (Wave 1), the study follows up with a series of in-home interviews of students approximately 1 year (1996; Wave 2), 6 years (2001–2002; Wave 3), and 13 years later (2007–2008; Wave 4). This study uses Wave 1 and Wave 4 data only. By design, the Add Health survey included a sample stratified by region, urbanicity, school type, ethnic mix, and size.

Of the 20,745 individuals who completed the Wave 1 in-home survey, 15,701 were followed longitudinally at Wave 4. A major benefit of Add Health is that it contains a sub-sample of siblings who have been followed over time. This sample comprises approximately 5,400 individuals in Wave 1, and 67% of them were successfully followed (along with their sibling) longitudinally into Wave 4. In the full sample, individuals with missing school identification numbers were dropped (n = 376). Additionally, 1,059 respondents were dropped due to non-responses to some of the individual and family characteristics (except family income and mother's education): the two major sources of missingness include ability

test score (n = 729) and BMI (n = 214). In order to maximize the available sample, Wave 1 family income and mother's education level were imputed for 3,376 and 1,423 individuals, respectively. Single imputation techniques were used, and a dummy variable reflecting this missingness was included in the estimation models. The following variables were used in the imputation for both variables: age, gender, race/ethnicity, test score, rural status, and parental socioeconomic status (if available). The analyses using other methods of imputing the data or without the imputation yield similar results as the ones reported in this paper (results available upon request). These exclusions result in a final sample size of 14,366 and 2,813 for full and sibling samples, respectively.

Measures

Dependent variables—The main dependent variables are BMI and obesity status measured at Wave 4, when the respondents were 29 years old on average. Height and weight were measured (not self-reported) at Wave 4, and these measurements were used to compute BMI. For all respondents who were capable of standing unassisted, height was measured to the nearest 0.5 cm, and weight was measured to the nearest 0.1 kg. BMI was calculated by dividing weight in kilograms (kg) by height in meters (m) squared. The study also considers a weight category of obesity as an outcome, as this is viewed as a major public health concern. Obesity status is a dichotomous indicator for those with a BMI of 30 or greater.

Independent variables—The key independent variables are a set of standardized personality traits (the Big Five measures) measured at Wave 4. As discussed by Almlund and colleagues (2011), the Big Five personality traits include openness, conscientiousness, extraversion, agreeableness, and neuroticism (acronym OCEAN). The complete list of questions used to construct the Big Five measures in this study is shown in Table S1 in supplementary files. Pairwise correlations between these personality traits are reported in Table S2 in supplementary files.

The following set of socio-demographic and individual characteristics are included as control variables: age, gender, race/ethnicity (non-Hispanic White, Black, Hispanic ethnicity, and others), ability test scores (measured by the Peabody Picture Vocabulary Test), number of older siblings, years of schooling, marital history (ever married), grade level, mother's education, family income, and rural status.

Analytic strategy

The study begins with OLS regression, then adds school-level fixed effects, and finally adds family-fixed effects to further reduce the potential for omitted variable bias. As a baseline empirical specification, this study estimates variations of the following OLS regression model:

$$Y_i = Personality \quad traits_i \alpha + X_i \delta + \varepsilon_i \quad (1)$$

where the outcome is either BMI or obesity status measured at Wave 4. The linear probability model is estimated when using a binary indicator of obesity status because it is

easy to interpret (probability changes) and compare coefficients across models with different sets of covariates (Norton, 2012). The error term may be correlated with personality traits, so individual and family controls are added in order to reduce this potential bias. The vector X_i includes those control variables.

Then, in order to examine the potential biases from unobserved heterogeneity at either the neighborhood or family level, the models are expanded to allow for high-school-of-origin fixed effects or family-fixed effects. High-school-of-origin fixed effects are used to control unobserved neighborhood characteristics because more precise indicators of neighborhood are unavailable in Add Health (Fletcher, 2013b).

$$Y_{is}=Personality \quad traits_{is}\beta+X_{is}\eta+\tau_s+\varepsilon_{is} \quad (2)$$

$$Y_{if}=Personality \quad traits_{if}\gamma+Z_{if}\lambda+\mu_f+\varepsilon_{if} \quad (3)$$

where τ_s is a set of school dummies and μ_f is a set of family dummies. Note that the vector Z_{if} in Equation 3 is limited to individual-level variables that vary within families (e.g., gender, age, cognitive ability, etc.). Comparing the coefficients for personality traits in Equation 1 with those in Equations 2 or 3 will indicate whether the association between personality and BMI that has been observed in many previous studies is driven by omitted variable bias at the neighborhood level or at the family level. Standard errors are allowed to be clustered at the school level in all regressions except family-fixed effects models, where standard errors are clustered at the family level.

Results

Summary statistics

Summary statistics for sibling and full samples appear in Table S3 in the supplementary files. There seems to be no discernable differences in observed characteristics for the sibling and full samples. In Wave 4, the average age in the sibling sample ranged from 24 to 34, with a mean of 28.43. Approximately 60% of the respondents were White. The mean BMI at Wave 4 was 28.86, and 34% of the respondents were obese. The respondents completed 13.30 years of schooling on average, and half of them had married at least once.

The fixed-effects model would not work as intended if there was a great deal of concordance between siblings (i.e., they did not differ in observed characteristics), but, consistent with prior research (Fletcher, 2013a), there is evidence of sufficiently discordant families. Table S4 in the supplementary files demonstrates that only 10–14% of the siblings in the sample have identical personality traits measures (Column 1) and approximately 40% of the siblings have quiet different personality traits (more than one standard deviation away from each other) (Column 2). Moreover, Column 3 suggests that a great deal of “unexplained” variation remains when family characteristics are controlled.

Results from the pooled sample

Table 1 presents the OLS estimates of the association between the Big Five personality traits and BMI. Only the coefficients for personality traits are presented throughout the paper. The full tables for all regression models can be found in the supplementary files (Tables S5–S9). First, the OLS results between the models using the full and sibling samples are compared (Models 1 and 2). In general, consistent with previous studies, Models 1 and 2 show that extraversion and conscientiousness are associated with BMI. While the results from the two samples appear to be similar, the coefficient for conscientiousness seems to be larger and an increase in standard errors reduces statistical significance of extraversion in the sibling sample. A joint Hausman test fails to reject the null hypothesis that the Big Five personality coefficients are equal in Model 1 and Model 2 ($p < .12$), whereas the single test of the coefficient for conscientiousness rejects the equality in the two models ($p < .01$).

However, these associations may be spurious due to unobserved factors at the neighborhood or family level. In order to control for neighborhood characteristics during adolescence, the study includes high-school-of-origin fixed effects. Joint and single Hausman tests indicate that the coefficients for the Big Five personality traits in Model 3 do not statistically differ from those in Model 1. These findings suggest that unobserved neighborhood factors do not confound the relationship between personality traits and BMI.

To address the possibility of shared unobserved heterogeneity at the family level, the study examines sibling comparisons by controlling for family-fixed effects. The results from within-sibling comparisons (Model 4) suggest that compared to the baseline results (Model 2), the coefficients for extraversion and conscientiousness are reduced by 15% and 20%, respectively. Although the coefficients using family-fixed effects differ in magnitude compared to the results without these controls, neither the joint Hausman test of the five personality coefficients nor the single test of the coefficient for conscientiousness is statistically significant ($p < .65$ and $p < .21$, respectively). These findings imply that unobserved family characteristics might play only a partial role in explaining the relationship between personality traits and BMI.

In addition, while extraversion loses significance with the inclusion of family-fixed effects, the coefficient for conscientiousness remains highly significant. These findings provide strong evidence that the association between conscientiousness and BMI is quite robust to controls for several sources of heterogeneity. To interpret, a one-standard-deviation increase in conscientiousness is associated with a decrease in BMI of 0.89, which is equivalent to approximately a 2.5-kg decrease in weight for an individual with an average height of the sample. Although interesting, the coefficients for neuroticism and agreeableness in the within-sibling analysis are hard to interpret because the coefficients are imprecisely estimated (they are “noisier”): The coefficients are statistically indistinguishable from zero, and they are not significantly different from those in the baseline model. Within-sibling estimates are often imprecise because within-sibling analysis relies on substantially reduced variations.

Table 2 presents the results for obesity risk. Overall, the results are similar to the ones in Table 1. Across all models, the association with conscientiousness is statistically significant

and persistent. There are no discernable differences between Model 2 and Model 3, which suggests that the relationship between personality and obesity status is not confounded by common environmental factors at the school or neighborhood level. In comparison to Model 2, Model 4 suggests that the coefficients for extraversion and conscientiousness are reduced by 54% and 31%, respectively, with the inclusion of family fixed effects. While a Hausman test fails to reject the equality of the five personality coefficients ($p < .55$) and the coefficient for extraversion is not significantly different in the OLS and fixed-effects specifications ($p < .37$), conscientiousness is significantly different ($p < .06$). This finding suggests that a one-standard-deviation increase in conscientiousness is associated with a 12% reduction in the probability of being obese (i.e., 4.1/34.2 = 0.12).

Results stratified by gender

Table 3 presents the results obtained from the separate models by gender. Using the sibling sample, Model 1 presents the baseline OLS results with no fixed effects. For males, extraversion is positively associated with BMI, and neuroticism and conscientiousness are negatively associated with BMI. For females, only conscientiousness is negatively associated with BMI. However, the difference in the conscientiousness coefficient for men and women turns out to be non-significant ($p <.25$). Similar to the models using the pooled sample, controlling for unobserved characteristics at the neighborhood level explains little of the association between personality traits and BMI for males or females. Although the coefficients for females appear different in Model 1 and Model 2, none of these differences are statistically significant (results not shown).

For males, the coefficients for extraversion and neuroticism are substantially attenuated when accounting for family-fixed effects (compare Models 1 and 3 in Table 3), whereas the coefficients for females change only slightly. It is important to note that the 84% reduction in the coefficient for neuroticism among males (from −0.68 to −0.11) is statistically significant ($p < .05$). Another important finding from sibling comparisons is that the association between conscientiousness and body weight is quite robust to controls for unobserved family characteristics for both men and women, though the magnitude of the coefficient is slightly reduced for women (a 20% reduction). These results demonstrate that a one-standard-deviation increase in conscientiousness is associated with a decrease in BMI by 0.85 for males and 0.96 for females. However, this gender difference is nonsignificant. In addition, while the signs of the coefficients for neuroticism and openness differ by gender, they are not statistically different from one another.

Table 4 presents the results for the association between personality traits and obesity for males and females. While the results with no fixed effects (Model 1) parallel the ones in Table 3, one noticeable difference is that agreeableness is positively associated with females' probability of being obese. In Model 2, which includes high-school-of-origin fixed effects, the coefficients barely change, suggesting that the relationship between personality and obesity is not driven by unobserved heterogeneity at the neighborhood level. However, the inclusion of family-fixed effects attenuates all of the observed associations found in Model 1, leading to statistical insignificance (the only exception is conscientiousness for females). To interpret, a one-standard-deviation increase in conscientiousness is associated with a 14%

reduction in women's obesity risk (i.e., 5.0/35.8 = 0.14), whereas conscientiousness is not significantly associated with men's obesity risk. It is interesting to note that the coefficients for openness in both the male and female samples are somewhat strengthened, but in opposite directions: men with a high score on the Openness scale are less likely to be obese while openness is positively associated with women's obesity. This gender difference in openness is found to be statistically significant ($p < .01$).

Results stratified by race/ethnicity

Table 5 presents the fixed-effects estimates, separately by race/ethnicity. Across both outcomes for all racial/ethnic groups, only conscientiousness is consistently significant. Separating the baseline results by race/ethnicity suggests that the association between conscientiousness and BMI appears to be stronger among Black and Hispanic people than White people (−1.38 vs. −1.63 vs. −0.84 [results not shown]). However, within-sibling comparisons suggest that the associations are substantially reduced among Black and Hispanic people (45% and 33%, respectively) (Models 2 and 3), whereas the magnitude of the association stays almost the same for White people (Model 1). The results are very similar when the outcome is obesity risk; these results suggest that the association between conscientiousness and obesity is strongest among Hispanic people: it is almost three times larger than it is for White people and twice as large as it is for Black people. Statistical tests suggest that the difference in the coefficients for conscientiousness for White and Hispanic people is significant ($p < .09$), but the difference between Black and Hispanic coefficients is not ($p < .20$).

Discussion

This study provides evidence that among the Big Five personality traits, only conscientiousness is consistently associated with BMI and obesity, even after controlling for shared neighborhood- and family-level confounders. More specifically, accounting for unobserved family-level characteristics attenuates the coefficients for extraversion and conscientiousness (compared to baseline models without family-fixed effects) by 15% and 20%, respectively. This reduction makes the coefficient for extraversion statistically nonsignificant, but conscientiousness remains significant. The preferred estimates suggest that a one-standard-deviation increase in conscientiousness was associated with a decrease in BMI by 0.89 (equivalent to a 2.5 kg decrease in weight for an individual with an average height of the sample) and a 12% reduction in the probability of being obese. In short, the associations between personality traits and body weight appear to be robust to statistical controls for both environmental factors and family background factors.

This study finds no evidence of gender heterogeneity in the relationship between personality traits and BMI: In the preferred models with family-fixed effects, conscientiousness is found to be negatively associated with BMI for both men and women. However, there is some evidence of gender differences in the relationship between personality traits and obesity risk. In the preferred model, the coefficient for conscientiousness is larger and statistically significant only for women, and the direction of the coefficient for openness differs by gender (negative for men and positive for women). There is also some evidence of racial

differences in the relationship between personality traits and obesity (but not BMI): conscientiousness is most strongly associated with obesity among Hispanic people. Because of relatively smaller sample size for gender and race/ethnic analysis, these results should be interpreted with caution. It should also be noted that the findings of the study may only be generalizable to relatively young adults. Since obesity risks increase over the life course, the relationship between personality traits and BMI might change as individuals age. Further research focusing on different age groups is thus warranted.

The results of the study are in line with previous research showing that among the Big Five personality traits, conscientiousness is the strongest and the most consistent predictor of lower BMI and lower risk of obesity (Jokela et al., 2013; Mõttus et al., 2013; Sutin and Terracciano, 2016; Sutin et al., 2011). However, the results also differ from those reported by most of these studies: Most prior studies have found that other personality traits are associated with body weight; in contrast, the current study finds other traits to be less influential. The most notable difference from these previous studies is that the present study accounted for unobserved family-level heterogeneity, which could explain the difference in results. Moreover, congruent with previous studies (Brummett et al., 2006; Jokela et al., 2013; Sutin et al., 2011), the present study found suggestive evidence that the association between conscientiousness and body weight is larger for women. Although this study suggests potential racial/ethnic differences in the relationship between conscientiousness and obesity risk, further research is required to confirm this finding.

A potential explanation of the association between conscientiousness and body weight is that individuals who are diligent, self-disciplined, and goal-oriented (i.e., high scores on conscientiousness) are likely to maintain physically active lifestyles (Hoyt et al., 2009; Rhodes and Smith, 2006). It is also possible that conscientiousness affects body weight through eating behavior. For example, conscientious individuals are less likely to show eating disorders (e.g., anorexia, bulimia, and binge eating disorder) (Brannan and Petrie, 2008; Tasca et al., 2009). Moreover, conscientious individuals tend to maintain a relatively high level of cognitive dietary restraint (i.e., conscious control of food intake with concerns about shape and weight) (Provencher et al., 2008).

Alternatively, as suggested by economic theory, conscientiousness may influence body weight through a labor market channel. Recent studies found that conscientiousness is positively associated with earnings and occupational attainment (Almlund et al., 2011; Mueller and Plug, 2004). According to Grossman's model (1972), an increase in income would promote investment in healthy lifestyles, so conscientious individuals may be more likely to maintain a healthy weight. This explanation may be complicated by the fact that higher-income earners have a higher opportunity cost of healthy behavior such as regular exercise and healthy eating (preparing own meals). Future research would benefit from investigating these potential labor market mechanisms through which personality traits impact body weight.

Limitations

This study has three limitations that should be considered when interpreting the results. First of all, the analytic strategy is unable to rule out the possibility of reverse causality.

Therefore, the results of the study should be interpreted as associational, rather than causal. Nonetheless, personality traits are often defined as the “enduring patterns of thoughts, feelings, beliefs, and behaviors” (Roberts, 2009, p. 140). For example, economists have recently shown relatively stable patterns in personality traits for the working-age population (Cobb-Clark and Schurer, 2012). If these are stable characteristics, then they should precede the onset of obesity.

Second, there are some issues associated with using a family-fixed effects model. Sibling models could possibly reduce exogenous as well as endogenous variation. If endogenous variation is a large portion of the remaining between-sibling variation, the estimates obtained from the sibling models could suffer as much endogeneity inconsistency as the baseline model (Bound and Solon, 1999). Moreover, a careful interpretation of the results is required because the approach focuses only on the population of siblings who have discordant values for the variables of interest (Moffitt, 2005).

Third, to the extent that other covariates (e.g., years of schooling) are influenced by personality traits, the estimates of the association between personality traits and BMI are underestimated due to over-controls in the statistical analysis. Nonetheless, the auxiliary analysis estimating the regression models with the inclusion of only exogenous variables yielded very consistent results (results not shown).

Conclusion

This study makes several contributions to our understanding of the relationship between personality traits and body weight. First of all, the study explores whether shared unobserved neighborhood- or family-level characteristics account for the apparent link between personality traits and body weight. Using high-school-of-origin and family-fixed effects models, this study finds that only the association between conscientiousness and body weight is robust to unobserved heterogeneity at the neighborhood- and family-level. Second, the study provides suggestive evidence of heterogeneity in the relationship between personality traits and body weight for different genders and races/ethnicities. Third, unlike the majority of past studies relying on convenience samples, the study draws on a nationally representative sample of young people, which enhances the generalizability of the findings.

The findings of the study could be policy relevant. Recently, there has been a growing interest in implementing interventions designed to promote pro-social and non-cognitive skills in children and adolescents (e.g., Diamond and Lee, 2011). Such interventions include computerized and non-computerized training and games, physical exercise including aerobic activity, martial arts and mindfulness practices, and classroom curriculum. The findings of this study suggest that such psychological or psychosocial interventions could produce important health benefits among young adults, though further evidence for the causal effects of personality measures on body weight will be required. In particular, interventions focusing on improving conscientiousness may effectively help individuals attain and maintain a healthy weight. Future studies should pay close attention to conscientiousness when assessing personalized treatment and prevention interventions for obesity, especially among young adults.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Highlights

- The study examines the relationship between personality traits and body weight.
- Family fixed effects model is employed to control for unobserved family background.
- Only conscientiousness shows a robust association with both BMI and obesity risk.
- Conscientiousness is more strongly associated with obesity risk among Hispanics.
- The association between conscientiousness and obesity is larger for women than men.

Table 1

Coefficients for the association between Big Five personality traits and body mass index

	Model 1		Model 2		Model 3		Model 4	
	β	(SE)	β	(SE)	β	(SE)	β	(SE)
Extraversion	0.204*	(0.082)	0.323+	(0.188)	0.298	(0.195)	0.273	(0.186)
Neuroticism	0.032	(0.074)	0.044	(0.165)	0.044	(0.162)	0.260	(0.170)
Agreeableness	−0.075	(0.063)	0.060	(0.165)	0.073	(0.171)	0.127	(0.217)
Conscientiousness	−0.710***	(0.067)	−1.107***	(0.168)	−1.109***	(0.165)	−0.897***	(0.169)
Openness	0.046	(0.075)	0.065	(0.144)	0.098	(0.146)	0.016	(0.191)
Sample	Full		Family		Family		Family	
Fixed-effects	None		None		School		Family	
n (individuals)	14366		2813		2813		2813	

Note. Models 1–3 include the following set of control variables: age, gender, race/ethnicity, ability test scores (standardized PVT score), number of older siblings, years of schooling, marital history (ever married), grade level, mother's education, family income, missing family information dummy, and rural status; Model 4 includes the following set of control variables: age, gender, ability test scores (standardized PVT score), number of older siblings, years of schooling, marital history (ever married), and grade level. In Models 1–3, robust standard errors SE are clustered at the school level; In Model 4, robust standard errors are clustered at the family level.

** $p < 0.01$

+ $p < 0.1$

* $p < 0.05$

*** $p < 0.001$.

Table 2

Coefficients for the association between Big Five personality traits and obesity status

	Model 1		Model 2		Model 3		Model 4	
	β	*SE*	β	*SE*	β	*SE*	β	*SE*
Extraversion	0.011*	0.004	0.018	0.012	0.014	0.012	0.008	0.012
Neuroticism	0.004	0.004	0.006	0.009	0.005	0.009	0.007	0.011
Agreeableness	−0.005	0.004	0.010	0.009	0.013	0.009	0.013	0.013
Conscientiousness	−0.039***	0.004	−0.060***	0.010	−0.061***	0.010	−0.041***	0.011
Openness	0.002	0.005	0.005	0.009	0.009	0.010	0.006	0.012
Sample	Full		Family		Family		Family	
Fixed-effects	None		None		School		Family	
n individuals	14366		2813		2813		2813	

Note. See Note for Table 1.

**$p < .01$.

*$p < .05$.

***$p < .001$.

Table 3

Coefficients for the association between Big Five personality traits and body mass index, by gender

	Model 1		Model 2		Model 3	
	β	*SE*	β	*SE*	β	*SE*
A. Males						
Extraversion	0.553^{+}	0.282	0.443	0.290	0.240	0.325
Neuroticism	−0.681**	0.235	−0.675**	0.241	−0.110	0.280
Agreeableness	0.213	0.275	0.265	0.300	0.587	0.359
Conscientiousness	−0.823**	0.252	−0.836**	0.271	−0.855**	0.286
Openness	−0.461	0.290	−0.408	0.327	−0.538	0.355
Sample	Family		Family		Family	
Fixed-effects	None		School		Family	
n (individuals)	836		836		836	
B. Females						
Extraversion	0.204	0.266	0.107	0.294	0.165	0.259
Neuroticism	0.319	0.250	0.293	0.269	0.235	0.257
Agreeableness	0.511	0.327	0.508	0.313	0.313	0.336
Conscientiousness	−1.211***	0.275	−1.070***	0.276	−0.964***	0.274
Openness	0.182	0.268	0.004	0.275	0.105	0.303
Sample	Family		Family		Family	
Fixed-effects	None		School		Family	
n (individuals)	965		965		965	

Note. See Note for Table 1.

$^{*}p < .05$.

$^{+}p < .1$.

$^{**}p < .01$.

$^{***}p < .001$.

Table 4

Coefficients for the association between Big Five personality traits and obesity status, by gender

	Model 1		Model 2		Model 3	
	β	*SE*	β	*SE*	β	*SE*
A. Males						
Extraversion	0.032	0.021	0.022	0.022	0.014	0.023
Neuroticism	−0.027^{+}	0.016	−0.035*	0.018	−0.004	0.022
Agreeableness	0.014	0.018	0.022	0.020	0.033	0.023
Conscientiousness	−0.034^{+}	0.019	−0.029	0.019	−0.021	0.021
Openness	−0.027	0.018	−0.025	0.019	−0.043^{+}	0.023
Sample	Family		Family		Family	
Fixed-effects	None		School		Family	
n (individuals)	836		836		836	
B. Females						
Extraversion	−0.005	0.016	−0.016	0.017	−0.018	0.017
Neuroticism	0.013	0.015	0.008	0.018	−0.013	0.018
Agreeableness	0.043*	0.018	0.051**	0.018	0.014	0.021
Conscientiousness	−0.065***	0.014	−0.057***	0.014	−0.050**	0.018
Openness	0.017	0.015	0.014	0.016	0.030^{+}	0.018
Sample	Family		Family		Family	
Fixed-effects	None		School		Family	
n (individuals)	965		965		965	

Note. See Note for Table 1.

$^{+}p < .1$.

$^{*}p < .05$.

$^{**}p < .01$.

$^{***}p < .001$.

Table 5

Coefficients for the association between Big Five personality traits and body weight, by race/ethnicity

Race/ethnicity	Model 1—White		Model 2—Black		Model 3—Hispanic	
	β	*SE*	β	*SE*	β	*SE*
A. Outcome: Body mass index						
Extraversion	0.131	0.233	0.081	0.397	0.233	0.461
Neuroticism	0.212	0.204	0.315	0.391	0.568	0.483
Agreeableness	0.433	0.272	0.398	0.381	−0.203	0.702
Conscientiousness	−0.856***	0.207	−0.752+	0.406	−1.094*	0.464
Openness	−0.057	0.229	−0.106	0.480	−0.378	0.704
Sample	Family		Family		Family	
Fixed-effects	Family		Family		Family	
n (individuals)	1628		600		341	
B. Outcome: Obesity status						
Extraversion	0.004	0.016	−0.004	0.024	0.027	0.032
Neuroticism	0.006	0.014	−0.003	0.025	0.038	0.038
Agreeableness	0.027	0.018	0.022	0.027	0.011	0.040
Conscientiousness	−0.034*	0.015	−0.041+	0.024	−0.089**	0.034
Openness	0.002	0.015	−0.008	0.026	−0.010	0.042
Sample	Family		Family		Family	
Fixed-effects	Family		Family		Family	
n (individuals)	1628		600		341	

Note. See Note for Table 1.

+ $p < .1$.

* $p < .05$.

** $p < .01$.

*** $p < .001$.