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## The Relationships Among Personality Traits, Food Consumption, And Anthropometrics In Healthy People

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**THE RELATIONSHIPS AMONG PERSONALITY TRAITS, FOOD CONSUMPTION,  
AND ANTHROPOMETRICS IN HEALTHY PEOPLE**

by

**CHELSEA A. SCHWARTZ**

**THESIS**

Submitted to the Graduate School

of Wayne State University,

Detroit, Michigan

in partial fulfillment of the requirements

for the degree of

**MASTER OF SCIENCE**

2021

MAJOR: NUTRITION AND FOOD SCIENCE

Approved By:

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Advisor

Date

## **DEDICATION**

I dedicate this thesis to my parents, David and Susan. Thank you for your unwavering support.

And to Brent, thank you for pushing me forward. I could not have done this without you all.

## **ACKNOWLEDGEMENTS**

I want to thank Dr. Paul Burghardt for his tremendous amount of help throughout my research and thesis writing. He was patient with me, challenged me, and helped me grow not only academically, but professionally. Paul taught me everything I know about the ins and outs of clinical research, and for that, I cannot thank him enough.

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**Table 1.** Study and National Demographics

<u>Demographic</u>	<u>Study (%)</u>	<u>National (%)</u>
Sex <sup>a</sup>		
Male	57.89	49.2
Female	42.11	50.8
Race & Ethnic <sup>a</sup>		
White	71.05	76.9
African American	2.63	13.3
Asian	13.16	5.7
Other	13.16	4.1
Population Body Mass Index <sup>b</sup>		
Normal weight	63.16	29.8
Overweight	28.95	32.5
Obesity	7.89	37.7
Women Body Mass Index <sup>b</sup>		
Normal weight	81.25	33.1
Overweight	12.5	26.5
Obesity	6.25	40.4
Men Body Mass Index <sup>b</sup>		
Normal weight	50.00	26.3
Overweight	40.90	38.7
Obesity	9.10	35

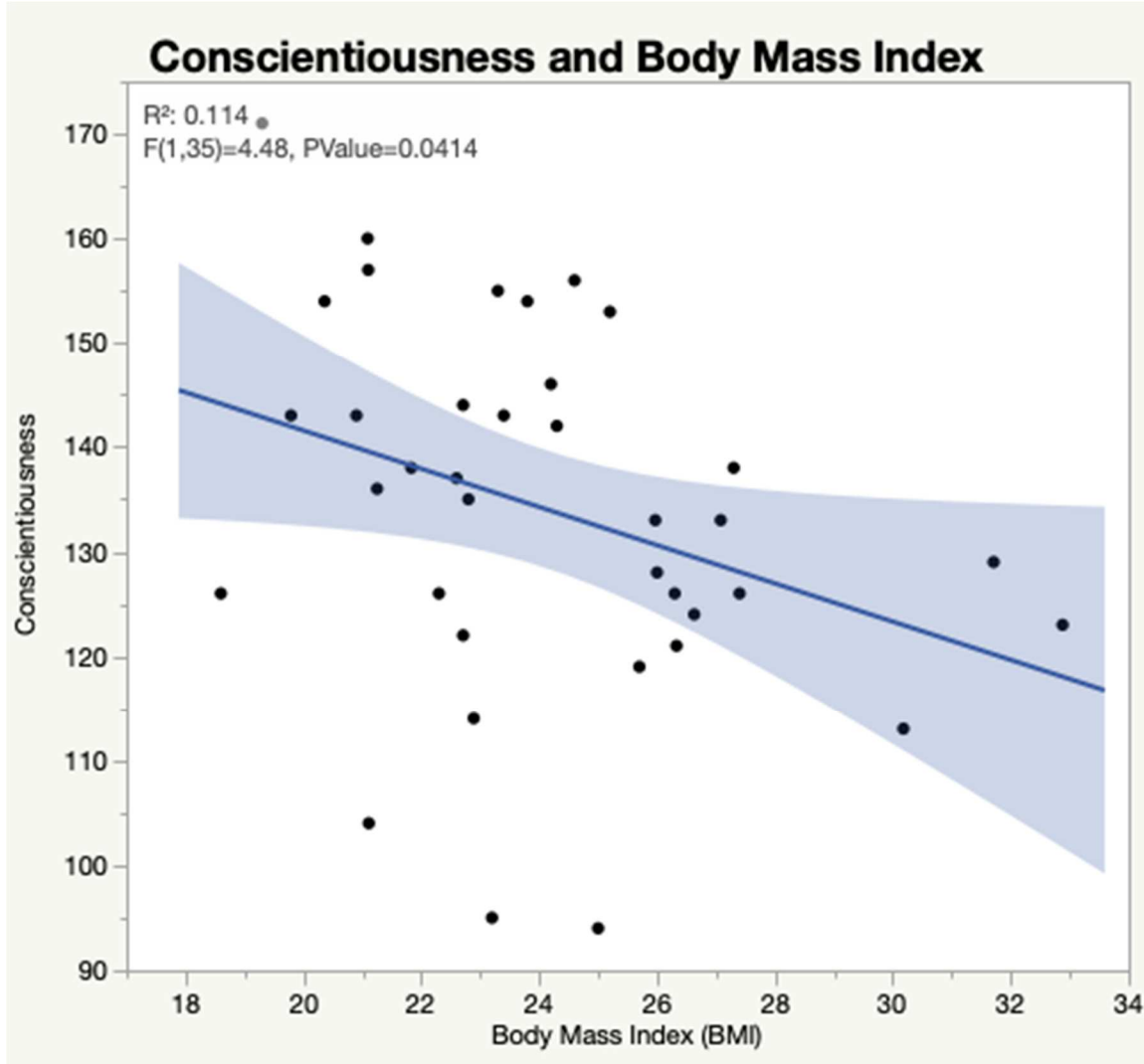
<sup>a</sup>National estimates from the United States Census updated 2016. <https://www.census.gov/quickfacts/fact/table/US/PST045216>; Retrieved September 18, 2017.

<sup>b</sup>Overweight & Obesity statistics derived from NIH. <https://www.niddk.nih.gov/health-information/health-statistics/overweight-obesity>; Retrieved September 18, 2017.

**Table 2.** Personality Traits and Anthropometrics between Men and Women

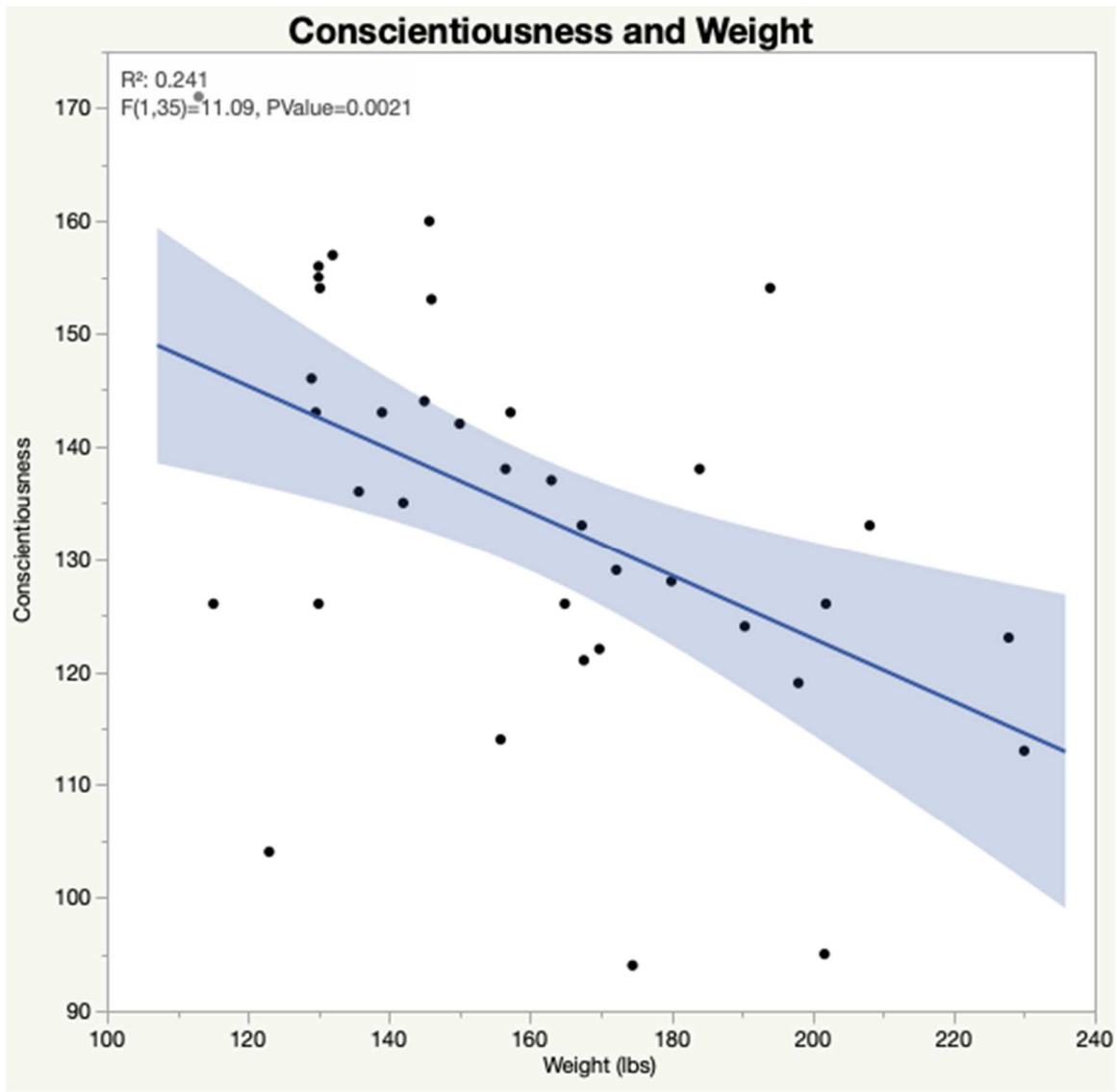
	<b>Total Sample</b>			<b>Men</b>			<b>Women</b>		
	<b>N</b>	<b>M</b>	<b>SD</b>	<b>N</b>	<b>M</b>	<b>SD</b>	<b>N</b>	<b>M</b>	<b>SD</b>
<b>Neuroticism</b>	38	69	21.71	22	69.73	25.41	16	68	16.03
<b>Extraversion</b>	38	127.24	15.50	22	126	12.93	16	128.94	18.80
<b>Openness</b>	38	126.68	18.24	22	125.14	18.93	16	128.81	17.36
<b>Agreeableness</b>	38	127	17.22	22	122.45	16.34	16	127.81	18.68
<b>Conscientiousness</b>	38	124.71	17.79	22	127.41	16.42	16	141.81	16.60
<b>Body Fat (%)</b>	37	23.02	7.21	21	18.97	4.65	16	28.34	6.54
<b>Waist to Hip Ratio (%)</b>	37	81.63	7.14	21	85.21	6.66	16	76.94	4.68

## LIST OF FIGURES

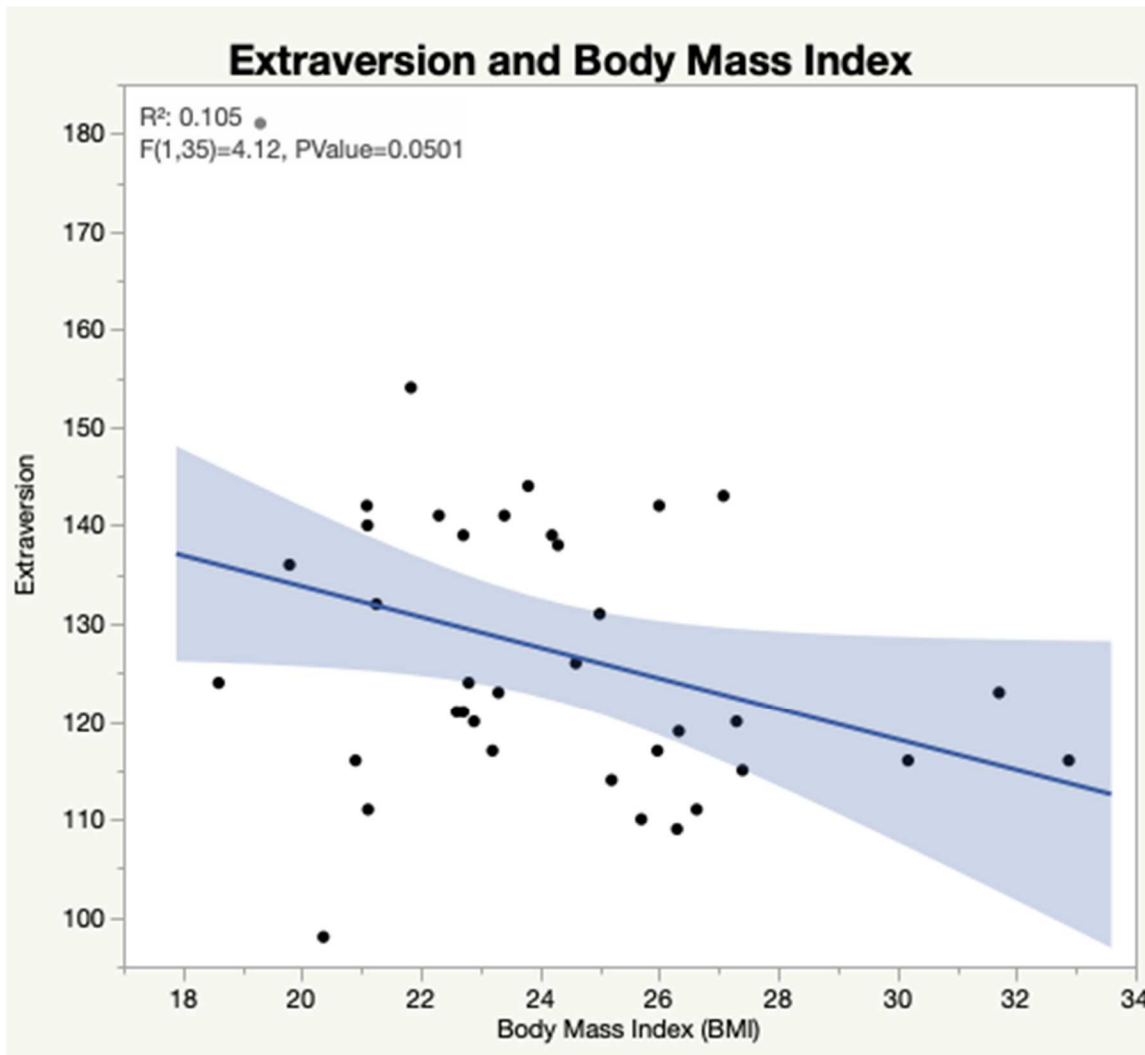


**Figure 1.** Conscientiousness vs body mass index

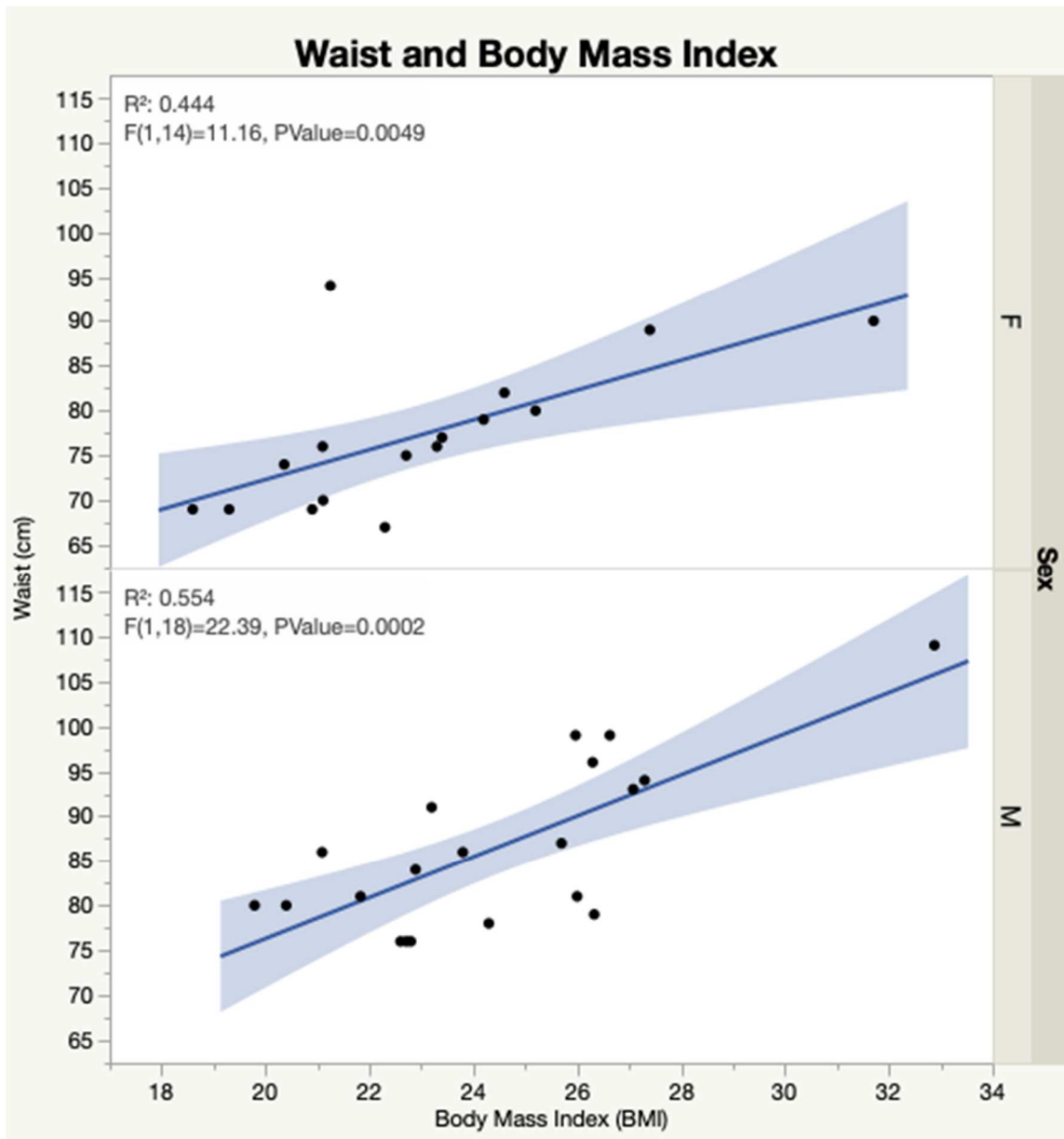




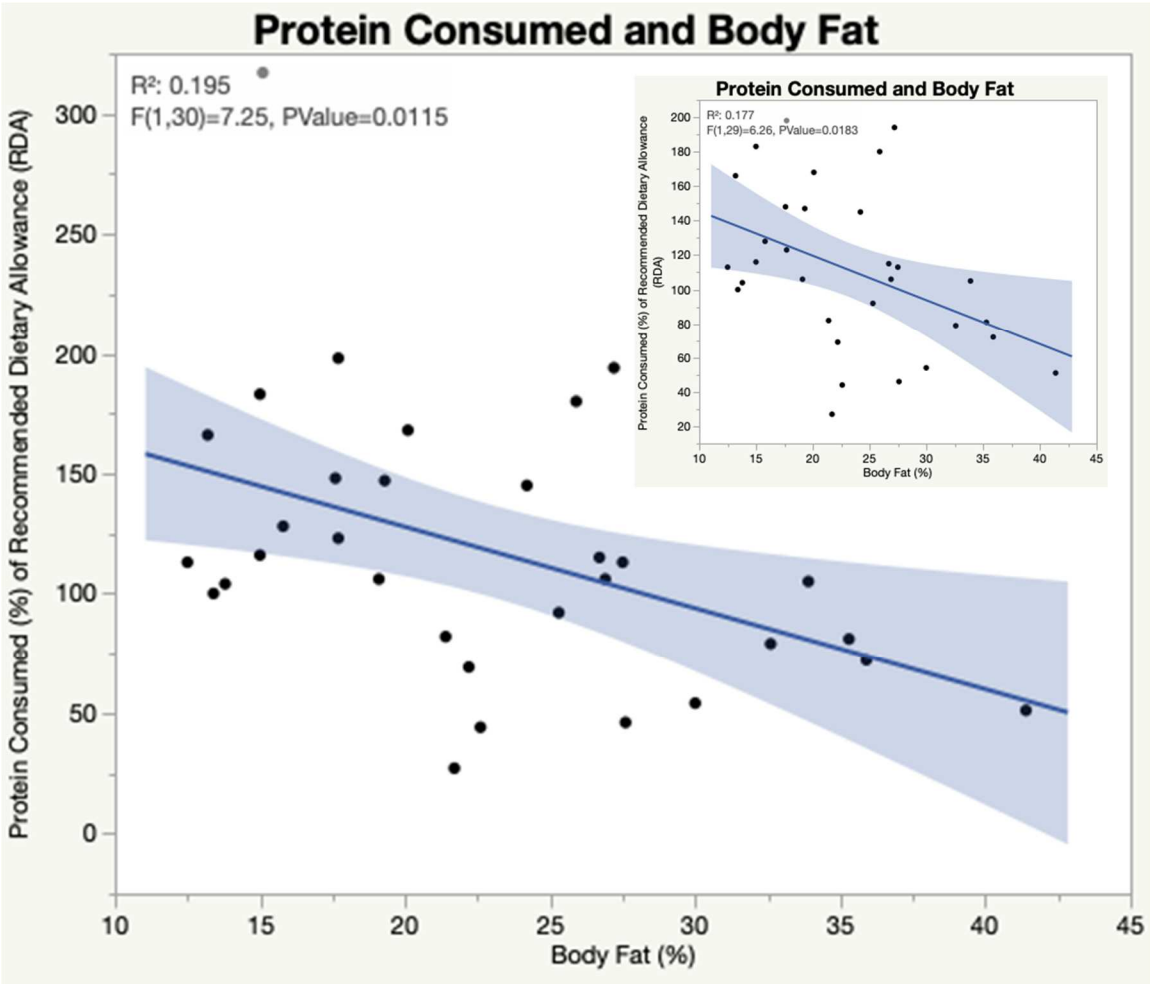
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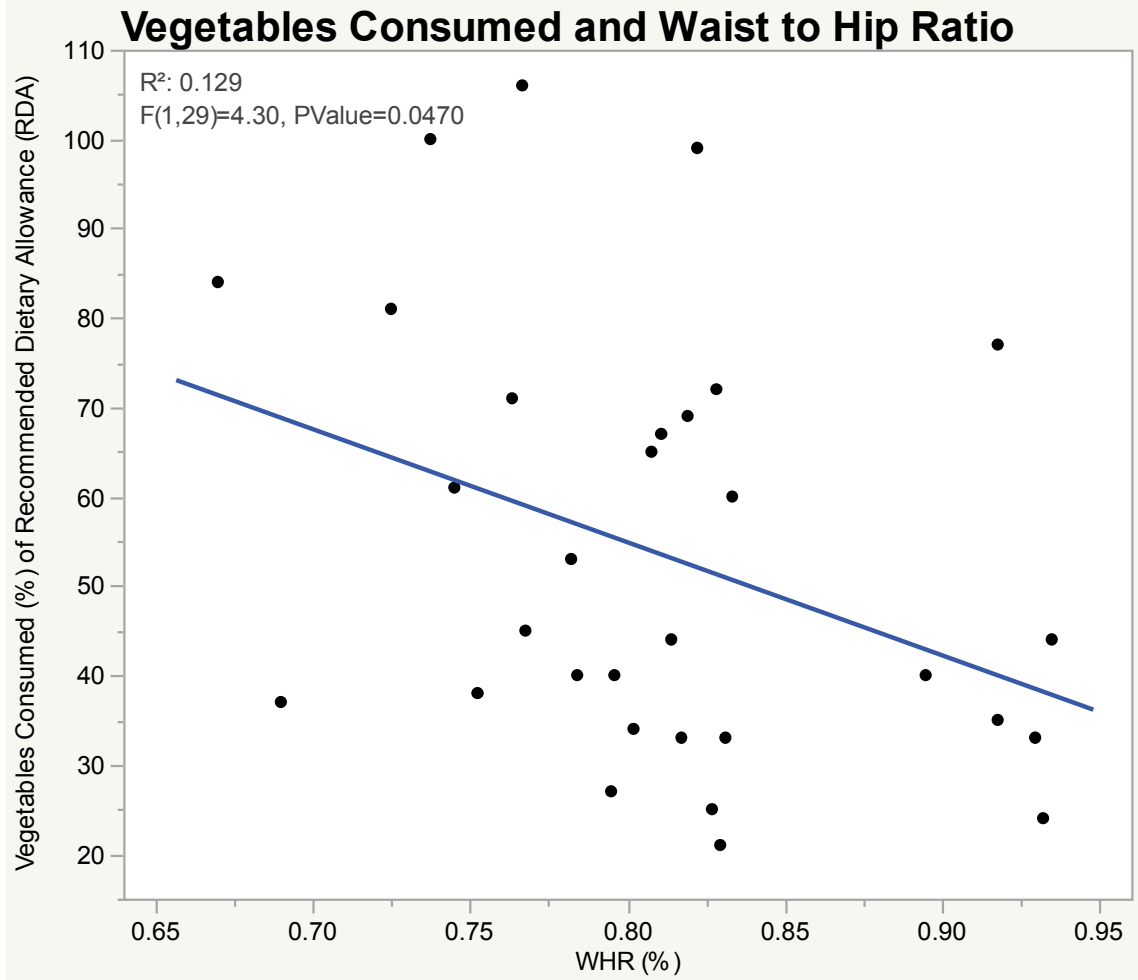
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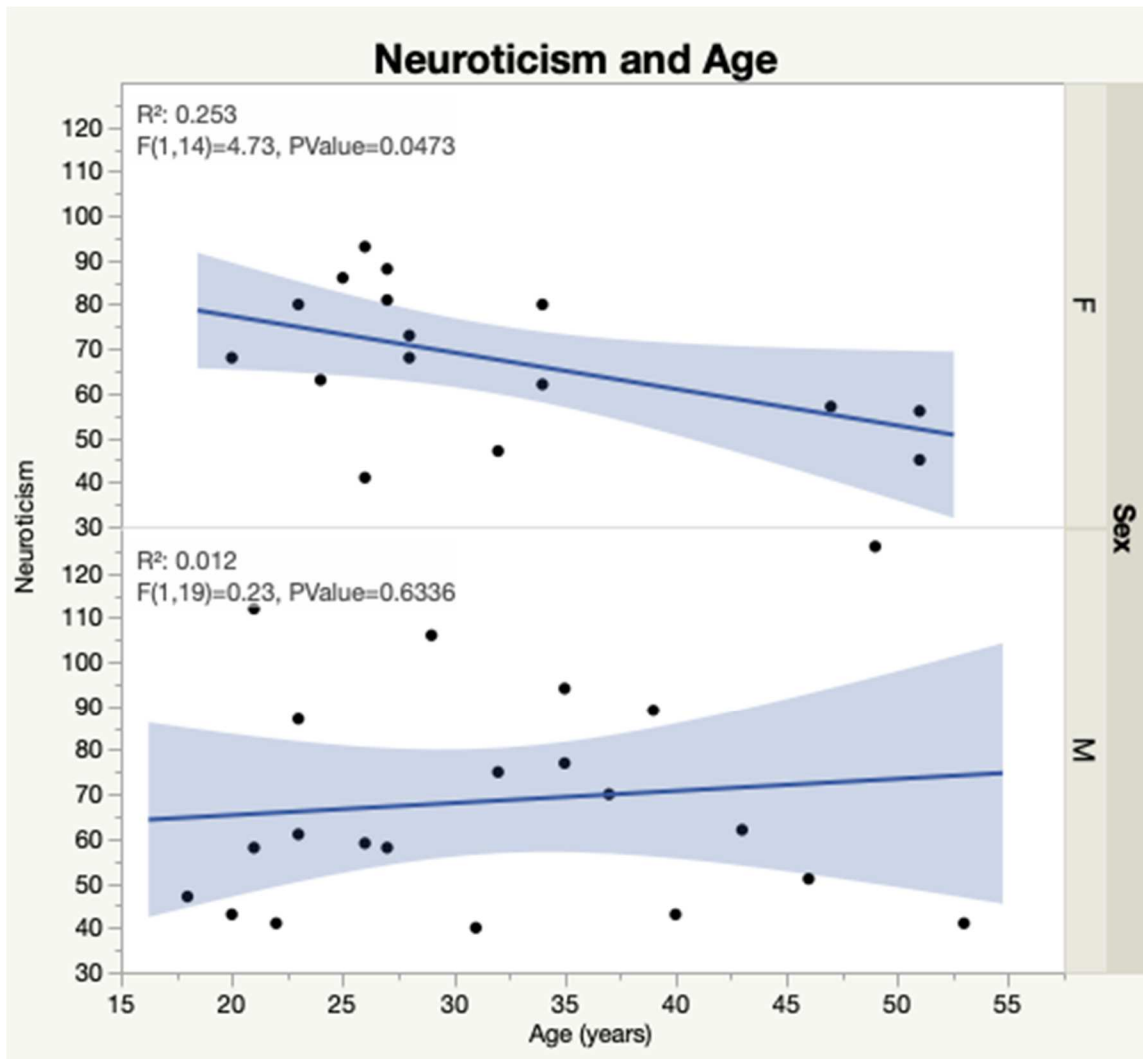
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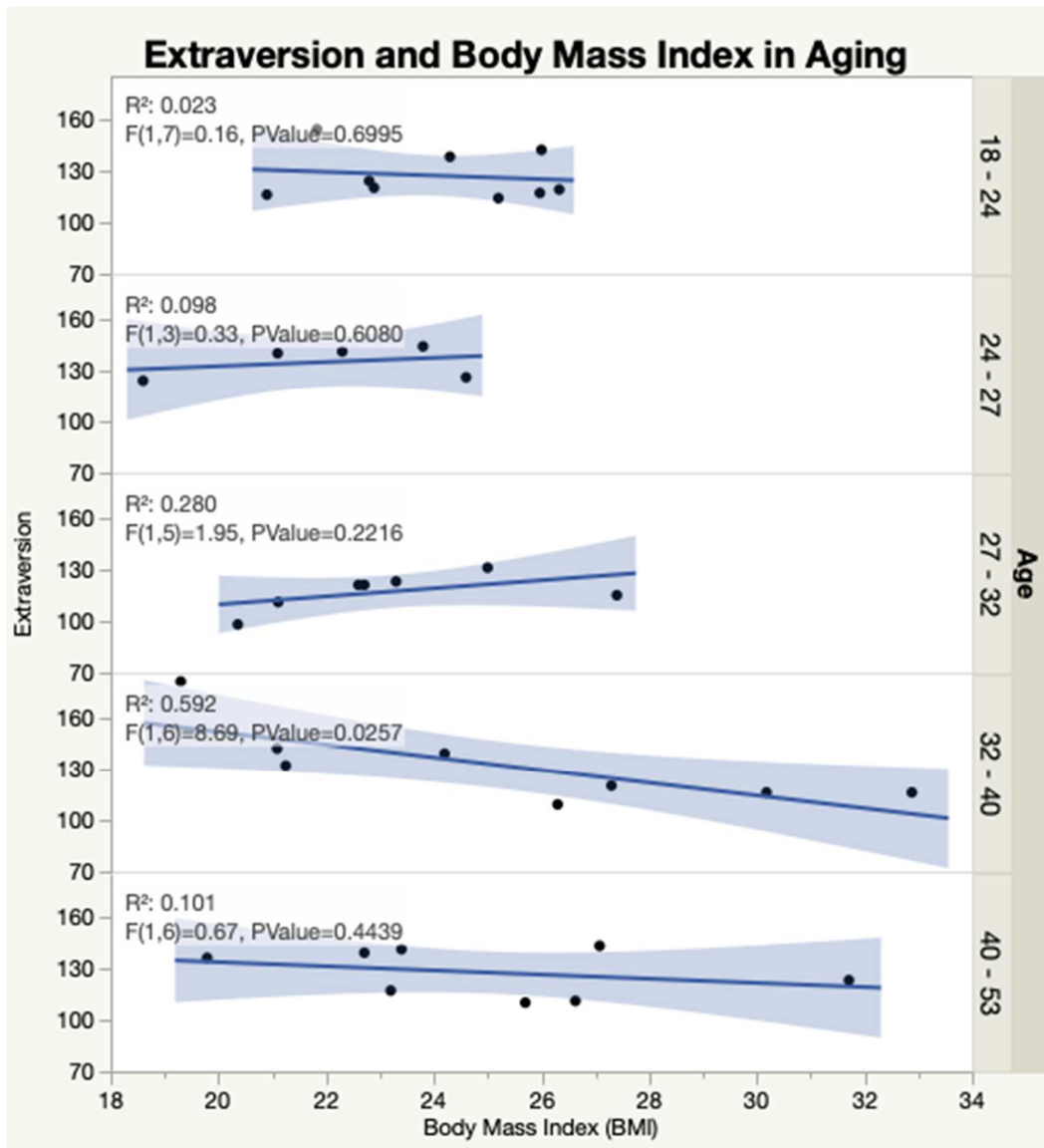
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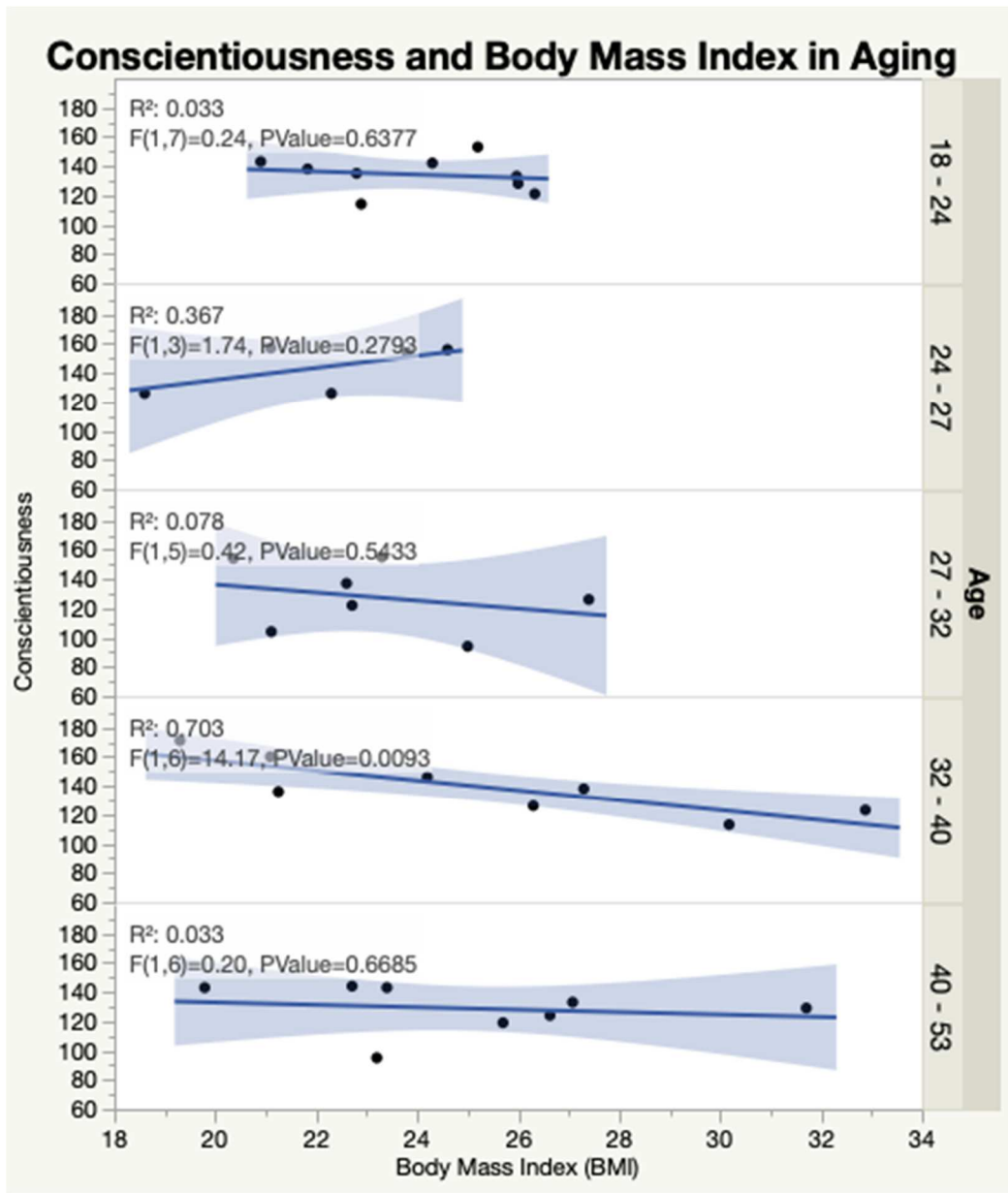
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**Figure 9.** Conscientiousness and body mass index in aging.



## **Introduction**

In the last 40 years, obesity has nearly tripled around the world due to multiple factors, but largely based on diet (CDC 2017b). Obese individuals put themselves at risk for many preventable diseases, including type 2 diabetes and cardiovascular disease, which ultimately leads to a shortened life. Personality traits are stable psychological processes that result in habitual patterns of thought, emotion, and behavior. These traits have been associated with cognitive, emotional, and behavioral aspects of food consumption. With further research, the Big Five personality traits may inform preventative medicine by predicting weight gain in those at high risk.

Personality traits impact health outcomes and have been shown to influence food consumption using NEO Personality Inventory (NEO-PI) (Brummett et al. 2006, Chapman et al. 2010, Donnellan and Lucas 2008, Magee and Heaven 2011, Pfeiler and Egloff 2020, Shim et al. 2014, Sutin and Terracciano 2016). This 240-item questionnaire is used in literature to assess the Big Five personality traits. These traits consist of neuroticism, tendency to experience negative emotions; extraversion, likely to be social and assertive; openness, willing to try new experiences; agreeableness, friendly and cooperative; and conscientiousness, disciplined and goal oriented (McCrae 1992). Each trait is further broken down into six more descriptors. For example, neuroticism includes anxiety, angry-hostility, depression, self-consciousness, impulsiveness, and vulnerability. Eating style and amount of food consumed can be affected by response to environmental cues including mood, stress, distractions, lighting, and odor (Wansink 2004). Other factors include cultural differences and social norms depending on origin. Consequently, the correlations among food consumption, and personality traits have both negative and positive health outcomes that may be predetermined.

In 2017~2018 the obesity rate in the United States was 42.4% (Hale et al. 2020) and this number continues to rise. As obesity rates trend up, so does the prevalence of chronic diseases, and as a byproduct, healthcare costs increase. Research suggests that following a nutritious and balanced diet may result in positive health outcomes (Bogg and Roberts 2013). This poses the question, are individuals with strong personality traits predisposed to healthy or unhealthy lifestyle choices? This could be a useful tool for health professionals if they were able to predict consummatory behavior by understanding personality traits, and therefore assist individuals in reaching health goals. Further research investigating the Big Five personality traits and food consumption may help determine why people consume certain foods and make specific lifestyle choices.

Excessive calorie intake and decreased energy expenditure increase the risk for chronic disease. This is seen in a number of industrialized nations, especially in the United States. The risk can be mitigated by making healthy lifestyle choices including proper nutrition, hydration, adequate sleep, physical activity, and low stress levels. In times of stress, cortisol levels are increased and may cause individuals to overeat, which will likely result in negative health outcomes if done habitually. Cognitive restriction of energy intake can impair external cues and lead to consumption of less than desirable food choices. When cortisol levels are high, individuals might reach for unhealthy, calorie dense foods to satisfy cravings. Although hunger and satiety are controlled by the hypothalamus, sugary and fatty foods promote eating and provoke a stimulus and reward type behavior (Volkow et al. 2011). In times of overeating, hunger and satiety cues are ignored or overridden by external cues (Groesz et al. 2012) and may lead to obesity if occurring regularly.

*Personality Traits and Food Consumption*

Relationships between food consumption and personality traits have been reported all around the world, including the United States (Mottus et al. 2013, Sutin and Terracciano 2016), Canada (Provencher et al. 2008), Europe (Tiainen et al. 2013), Australia (Jacka et al. 2014, Pursey et al. 2014), and Asia (Sutin et al. 2015, Shim et al. 2014). This research exhibits positive and negative relationships among the Big Five, food consumption, and body mass index (BMI), however, cultural and sex differences effect the correlations across populations.

The Big Five personality traits have influenced eating styles and overall food consumption. Most studies conducted have found statistical significance for the personality traits neuroticism and conscientiousness, whereas the other three traits have differing conclusions depending on the demographic of the study. Conscientiousness is most supported in its positive relationship with healthy lifestyle choices and eating habits, leading to a lower weight and BMI (Sutin 2011). In a random sample from the general population, restrained eating was promoted through conscientiousness and linked to an increase in fruit consumption, decrease in soft drink consumption, and decreased consumption of sweet and savory foods (Keller and Siegrist 2015). Conscientiousness has also been seen to have a positive association with eating plants and fish, and a negative association with eating meat (Pfeiler and Egloff 2020). In a study of 583 college students, those with high conscientiousness scores also had associations with health-promoting factors such as an increase in exercise and an increase in regular fruit and vegetable consumption (Raynor and Levine 2009). Conversely, a cohort study of 1,681 subjects found men with high conscientiousness scores to consume a high intake of soft drinks, and sugar and confectionaries, while women had high intakes of fruit (including berries and fruit juice) (Tiainen et al. 2013). Individuals with self-control and organizational skills, both characteristics of conscientiousness, were leaner and at a lower risk for obesity (Jokela et al. 2013). This is supported by a diverse,

cross-sectional study using logistic regression, where every standard deviation higher for neuroticism or lower for conscientiousness resulted in more than a 20% increase in obesity (Sutin and Terracciano 2016).

While conscientiousness is associated with healthy behaviors, neuroticism is known for its negative behavioral outcomes. Individuals who score high in neuroticism tend to experience negative emotions, which can promote emotional eating with excess calories (Keller and Siegrist 2015). Consequently, this increases preference for high fat and salty foods as individuals are unlikely to avoid food flavored with fat (Brummett et al. 2008). This is further supported by a cross sectional study of 5,150 people who had high neuroticism scores that were associated with higher BMI and therefore risk for obesity (Sutin and Terracciano 2016). On the contrary, a study of 1,691 Estonians suggested lower neuroticism scores were correlated with self-aware diets (meaning they consume more fruits, vegetables, fish, and cereal products) (Mottus et al. 2012) and positive relationships were seen between neuroticism and BMI (Armon et al. 2013). In an Australian population, neuroticism was negatively associated with carbohydrate consumption and positively associated with consumption of plants and fish (Pfeiler and Egloff 2020). While Estonian and Australian populations may reflect healthy choices, Western cultures reflect positive relationships with unhealthy eating behaviors and neuroticism (Walker et al. 2014).

#### *Sex, Personality Traits, and Food Intake*

Many studies demonstrate neuroticism's positive correlation with BMI, which appears to be stronger in women than in men (Armon et al. 2013, Brummett et al. 2008, Sutin and Terracciano 2016). This suggests women who experience negative emotions are less likely to resist tempting food and more likely to be overweight with a high BMI. On the other hand, a different study found

women to consume more fruits and vegetables, less meat, and fewer sugary drinks, all of which were influenced by emotional and restrained eating (Keller and Siegrist 2015).

When investigating the other three personality traits, results are inconsistent across studies. In 470 college students, participants who scored high in agreeableness and low in extraversion were more receptive to learning about healthy behaviors (Kikuchi and Watanabe 2000). On the contrary, a random sample of 951 men and women suggested that high extraversion scores promoted consumption of sweet and savory, calorie dense foods (Keller and Siegrist 2015). Additionally, extraversion promoted meat consumption and soft drink consumption by external eating, which had an indirect negative effect on fruit consumption (Keller and Siegrist 2015). These individuals are more likely to be social and more vulnerable to consume excess food and drink when surrounded by other people.

In 938 women, extraversion and openness have been linked to unhealthy habits, whereas agreeableness has been linked to healthy habits. Women who scored high in extraversion were associated with higher meat and vegetable consumption (Tiainen et al. 2013). Meat consumption tends to be associated with an unhealthy diet in some studies, but in this instance, it was also associated with high vegetable consumption. Consequently, extraversion was also associated with higher protein and lower carbohydrate consumption. As for the 743 men, significant findings were scarce, except for conscientiousness's association with higher intake of sugar and soft drinks (Tiainen et al. 2013). This trait is typically related to health-conscious decisions, but was associated with higher sugar, confectionary, and soft drink intake in men.

Individuals who scored higher in openness were more likely to consume less meat (Pfeiler and Egloff 2020) and consume recommended amounts of fruits and vegetables that pertain to a healthy diet (Keller and Siegrist 2015, Tiainen et al. 2013). These individuals were also less likely

to prefer salty foods and consumed lower amounts of animal fat, which can contribute to chronic diseases when consumed in large amounts and regularly (Kikuchi and Watanabe 2000). Overall, most studies indicate high openness scores to be a predictor of health-conscious food choices.

#### *Aging, Personality Trait, and Food Intake*

Outcomes between personality traits and food consumption vary depending on sex, origin of study, and aging populations. As aging occurs, it is common for conscientiousness scores to increase and lower scores to be reflected in neuroticism, openness, and extraversion (Donnellan and Lucas 2008). A cohort study of older people who scored high in neuroticism were found likely to consume a convenience diet as opposed to a healthy diet. This indicated that their dietary habits were more related to low emotional and social adjustments (Mottus et al. 2013). When sexes were isolated, women scored higher than men in all personality traits except conscientiousness, which is known for its health promoting factors. Despite these associations with conscientiousness, older populations might be eating healthier due to the personality trait openness and the willingness to try new experiences. Additionally, personality traits may shift throughout the aging process as individuals go through major roles in life including occupation, partnership, parenting, etc. (Donnellan and Lucas 2008). Through these experiences, perspective may change and therefore, shift personality traits. Some speculate conscientiousness increases with age due to maturation, while others believe it to be preprogramming (Donnellan and Lucas 2008). Patterns in this study indicate that older people's food choices are associated with their personality traits. Those who are more open are more likely to modify their diet or adopt healthy dietary habits, when compared to the other personality traits. As a result, openness could have the biggest influence on food choices in older populations, but further research is needed to understand this growing age group.

When factoring time of day and dietary habits, people who prefer the morning over the evening are more likely to eat a nutritious breakfast and partake in physical activity (Kanerva et al. 2012). These individuals tend to be more conscientious and agreeable. In contrast, people with a night preference are associated with greater sugar and alcohol consumption, as well as decreased intake of whole grains, fruits, vegetables, and fish, all of which contribute to a well-balanced diet (Kanerva et al. 2012). This cross-sectional study of 4,493 subjects found men to have a positive relationship between morningness (those who prefer daily activities in the morning hours) and vegetable consumption, as well as an inverse relationship between morning preference and beer consumption (Kanerva et al. 2012). In women, there was a positive relationship between morning preference and sodium intake, as well as an inverse relationship between morning preference and spirit consumption. These findings indicate that people who prefer the morning consume nutritious foods and those who prefer the evening consume poor quality foods and intake more alcohol.

#### *BMI, Sex, and Culture*

In many studies, there were differences between men and women in the effect personality traits had on BMI (Brummett et al. 2008, Sutin and Terracciano 2016). In an Australian sample with 13,892 participants, women reported a lower BMI and consumed more plants and fish than men, as well as fewer carbohydrates and less meat (Pfeiler and Egloff 2020). BMI also had negative associations with conscientiousness and openness, but positive associations with agreeableness. Additionally, cross sectional study found a positive relationship between BMI and neuroticism in women, but non-significant in men (Brummett et al. 2006). A positive relationship between BMI and extraversion was significant in men, but non-significant in women. These findings suggest that neuroticism's negative characteristics might have a greater influence on

women, resulting in poor eating habits and a higher BMI. As for men, a sociable, outgoing personality may influence food consumption, and therefore, a greater BMI.

While literature using Western samples report similar results regarding neuroticism and conscientiousness, studies of Asian culture show opposing results. Neurotic women in Asian countries were more likely to have a lower body weight because neuroticism tends to coincide with food restriction and the desire to be thin (Shim et al. 2014). Furthermore, negative associations with overweight and obesity were found in neuroticism's facets anxiety, self-consciousness, and vulnerability (Shim et al. 2014). Conscientiousness was found unrelated to BMI, despite its positive association in Western cultures. This study shows how eating disorders and thinness could be reduced as research increases awareness of those predisposed to neurotic behavior. As a result, personality traits may be a risk factor for an unbalanced diet because they significantly and directly influence eating styles, and indirectly influence food choices (Keller and Siegrist 2015).

Similar to Asian culture, a Canadian study found associations between women with high neuroticism scores and a BMI classified as underweight, which has previously been identified in women with eating disorders. The risk of disordered eating symptoms was investigated in undergraduate women by looking at interactions between the combination of neuroticism and extraversion. Results indicated the combination of high neuroticism and low extraversion increased vulnerability to anorexia nervosa and bulimia nervosa; however, extraversion alone was unrelated when women scored low on neuroticism (Miller et al. 2006). High neuroticism has been associated with problematic eating patterns, but the combination of the two traits influences eating problems likely because of personality dimensions. Undergraduate women are already at risk for disordered eating as this time period is likely the first time they have lived on their own, created



new habits, and balanced responsibilities. Additionally, there is a heightened pressure to be thin, especially in Asian culture, so this is a vulnerable time for women.

Overweight and obese Korean men have similar personality trait and BMI associations as Western men. Low conscientious men had a higher BMI and outgoing men had positive associations with BMI and waist circumference (Shim et al. 2014). When compared to normal weight groups, openness scores were higher for overweight and obese men. Conversely, openness in Western culture has been negatively associated with BMI, and conscientiousness has been known to promote healthy behaviors (Sutin and Terracciano 2016). This contradicting data shows how the association between conscientiousness and health is non-universal due to social norms and attitudes towards eating.

Western cultures are preoccupied with the nutritional content of food rather than gathering as a group and savoring the culinary experience, like Japanese cultures (Rozin et al. 1999). Since Asia has some of the lowest obesity rates in the world, conscientiousness seems to exhibit health outcomes and protect against obesity (Sutin et al. 2015). Low openness to experience may lead to increased food cravings and weight gain due to stimulated production of stress hormones, like cortisol. In women in particular, low scores of openness significantly predicted obesity (Shim et al. 2014). This suggests that women scoring high in openness may better overcome stress and could be protected against inflammation and chronic disease.

Cultural norms may be one of the biggest environmental factors to influence personality and therefore, correlations with food consumption among populations around the world (Sutin et al. 2015). These opposing results reveal the variations in research for the Big Five personality traits, which can be influenced by external factors like eating patterns, culture, and social norms.

Further studies investigating personality traits may inform preventative care methods if able to determine which individuals are predisposed to weight gain and obesity.

Conscientiousness is most strongly linked with health promoting factors and neuroticism with negative health associations. On the other hand, extraversion, openness, and agreeableness are less understood and have supporting evidence for both healthy and unhealthy associations. The present research adds to existing knowledge regarding neuroticism and conscientiousness in a Western sample, identifies the role of extraversion with healthy eating and aging, and continues to investigate the roles of openness and agreeableness.

### **Present study**

The purpose of this study was to understand the correlations among the Big Five personality traits, sex, anthropometrics, diet, and age to identify personality traits roles with food consumption. As an attempt to prevent weight gain and obesity, researchers have investigated this relationship to discover what personality traits are associated with healthy eating and overeating. Predicting health in people with varying personality traits can be done using the anthropometric measures weight, height, BMI, waist to hip ratio (WHR), diet log analysis, and NEO-PI. This study is probing relationships among anthropometric measures and personality traits as they relate to eating behaviors as a precursor to quantifying these relationships on brain structure and function.

The overreaching aim was to review literature on the Big Five personality traits and their associations with food consumption and overall health before they are included in modeling of brain morphology and functional responses.

To address these questions, we addressed the following Specific Aims:

Aim 1: Assess the impact of sex on relationship among personality traits, anthropometric measures, and ‘healthy eating.’ We hypothesized that conscientiousness will correlate with

positive health factors in women, including normal BMI, lower WHR, and adequate fruit and vegetable consumption. Additionally, neuroticism will correlate with negative health factors in both men and women. This includes a higher BMI, higher WHR, and lower consumption of fruits and vegetables.

Aim 2: Assess the impact of age on the relationship between personality traits and BMI. We hypothesized that extraversion will correlate with a higher BMI and WHR, especially in men, and agreeableness will relate to healthy eating as aging occurs. Lastly, openness will have a negative relationship with BMI and a positive relationship with aging.

## **Method**

### *Participants*

A total of 38 healthy people living in the United States participated in a controlled Aerobic Capacity and Neural Function (ACNF) study. Participants' age ranged from 18 to 51 years (mean age =  $31.5 \pm 9.89$ ) and sex distribution was 57.89% male, 42.11% female (22 men, 16 women). See Table 1. The study was approved by the Institutional Review Board (IRB) at Wayne State University (WSU; IRB #030115M1F) and University of Michigan (UM; IRB #HUM00066079), and informed written consent was obtained from eligible participants.

### *Procedures*

Healthy people were recruited from 2013 to 2017 through various media including paper fliers, social media, and word of mouth. The study was held at the Michigan Clinical Research Unit, WSU Department of Nutrition and Food Science, WSU Integrative Biosciences Center, and the WSU Magnetic Resonance Research Facility. Participants were asked to complete four in-person visits. A phone screening was conducted to determine health and eligibility. Pregnant

women and individuals at an unhealthy weight were excluded, as well as any criteria that would deem them ineligible for a functional magnetic resonance imaging (fMRI) screening.

On the first visit, anthropometrics were measured, questionnaires were filled out, and participants were provided a four day diet log. On the second visit, participants came in after a 12 hour fast. Participants' aerobic fitness levels were determined by quantifying maximal oxygen consumption ( $VO_2\text{Max}$ ) using a TrueOne 2400 metabolic cart (Parvo Medics, Sandy, UT). This cart was connected to a Trackmaster treadmill (Full Vision Inc, Newton, KS), which measured oxygen consumption ( $VO_2$ ) and carbon dioxide production ( $VCO_2$ ) during incremental exercise using the Bruce Protocol. Additional questionnaires were filled out and diet log were returned. On the third visit, a TrueOne 2400 metabolic cart measured RMR by indirect calorimetry for thirty minutes. On the last visit, participants' brain activity measured responses to 54 images using fMRI and functional magnetic resonance spectroscopy; however, these data are not part of the following set of analyses. Study visits were completed within four weeks.

## **Measures**

### *Personality Questionnaire*

A 240-item questionnaire, NEO-PI (McCrae 1989, McCrae 1992) was administered to all participants in the study to assess the Big Five personality traits. Using a Likert scale from strongly agree to strongly disagree, responses were recorded to questions like, "I'm an even-tempered person." The Big Five consists of neuroticism, likely to experience negative emotions; extraversion, likely to be social; openness, lack of restriction; agreeableness, friendly and cooperative; and conscientiousness, to be careful.

### *Sex*

Sex was obtained from each participant. Table 2 summarizes the differences between sex for personality traits, body fat percentage, and WHR.

### *BMI*

On visit one, height and weight were obtained and used to calculate body mass index using the BMI calculator ( $\text{kg}/\text{m}^2$ ). BMI was then categorized into underweight (below 18.5), healthy weight (18.5 – 24.9), overweight (25.0 – 29.9), and obese (30.0 and above) as seen in Table 1 (CDC 2017a).

### *Body Fat Percentage*

At WSU, body composition was measured using model 310e version 8.0 body composition analyzer of bioelectrical impedance machine (Biodynamics Corporation, Seattle, WA). Two adhesive sensor pads, one on the right foot and one on the right hand, were linked to the analyzer by a set of cables. Test results were displayed on the screen of the analyzer. Results included percent body fat, fat body weight, and lean body weight all calculated in percentages. At UM, body composition was measured using dual energy x-ray absorptiometry (DEXA), which was done during the same visit as the resting energy expenditure.

### *Diet*

A four-day diet log, consisting of two weekdays and two weekend days, was completed by each participant. This information was input and analyzed using Food Processor Nutrition Analysis Software (ESHA, Version 11.2, Salem, Oregon). Using the reports tab, assessments were made using individual's nutrient reports and recommended dietary allowances (RDA) for grains, vegetables, fruit, protein, and dairy.

### *Waist to Hip Ratio*

A Gulick II measuring tape (Country Technology Inc, Gays Mills, WI) was used to measure waist and hip circumference to determine overall health risks. Women are recommended to have a waist measurement no greater than 35 inches and no greater than 40 inches for men.

Waist circumference was measured at the midpoint between the lower margin of the last palpable ribs and the top of the iliac crest. Hip circumference was measured around the widest portion of the buttocks, with the tape parallel to the floor (World Health Organization 2012). Waist and hip measurements were then used to determine WHR ( $W/H \times 100$ ). As a measurement of health, WHR is an indicator of abdominal obesity where women's ratio shouldn't be higher than 0.85 and 0.90 for men (World Health Organization 2008).

### *Age*

Date of birth was collected from each participant and age at time of visit was calculated. Age was used as a modifier with personality traits and anthropometrics.

### *Statistical Analysis*

Participant's personality traits were compared to BMI, WHR, percent body fat, and dietary intake for all participants and individual sex. Simple linear regression and multivariable linear regression were conducted using JMP (Version 14, Cary North Carolina). Age and sex were used as moderators and significance was set at  $\alpha = 0.05$  ( $p$ -value  $< 0.05$ ).

## **Results**

### *Personality traits*

The Big Five personality traits were used to predict healthy behaviors like eating fruits and vegetables, and unhealthy behaviors like consuming convenience foods. In Figure 1, conscientiousness was inversely correlated to BMI ( $R^2=0.114$ ,  $p=0.0414$ ) and in Figure 2, conscientiousness was inversely correlated to total body weight ( $R^2=0.241$ ,  $p=0.0021$ ). Although not statistically significant, BMI and openness were trending towards an inverse association ( $R^2=0.096$ ,  $p=0.0624$ ). Additionally, extraversion was trending towards an inverse association with BMI ( $R^2=0.105$ ,  $p=0.0501$ ) as seen in Figure 3, and this relationship was stronger in men than in

women ( $R^2=0.185$ ,  $p=0.0516$ ). Conversely, no moderate to strong associations were seen neuroticism or agreeableness.

### *BMI*

Height and weight were used to calculate body mass index using the BMI calculator. The mean BMI was  $24.01\pm 3.265$ , men had a mean of  $24.76\pm 3.124$  and women had a mean of  $22.97\pm 3.261$ . As presented in Table 1, Thirteen women (35.13%) and eleven men (29.73%) were at a healthy weight, two women (5.40%) and nine men (24.32%) were overweight, and one woman (2.7%) and two men (5.40%) were obese. A significant positive relationship existed between BMI and waist circumference in both men and women, but results were more significant in men ( $R^2=0.554$   $p=0.0002$ ) as seen in Figure 4.

### *Percent body fat*

Using bioelectrical impedance analysis (BIA), body fat measures were compared to the Big Five personality traits, but no moderate to strong associations were seen. However, percent body fat was inversely correlated to percent of recommended protein consumption ( $R^2=0.195$ ,  $p=0.0115$ ) as seen in Figure 5. Body fat was trending towards an inverse association with total caloric intake ( $R^2=0.116$ ,  $p=0.0570$ ) and this relationship was stronger in women ( $R^2=0.237$ ,  $p=0.0773$ ) when compared to men ( $R^2=0.005$ ,  $p=0.7759$ ), however, not statistically significant.

### *Diet*

The four-day diet logs were compared to RDA values set by the National Academy of Science. Significant values did not exist with the Big Five personality traits and diet, but relationships were conclusive with BMI and WHR. Percent of recommended vegetable consumption was inversely correlated to WHR ( $R^2=0.129$ ,  $p=0.0470$ ) as seen in Figure 6, but not when moderating for sex.

### *Aging*

Age was inversely correlated with neuroticism in women ( $R^2=0.253, p=0.0473$ ) as seen in Figure 7. Age and agreeableness were trending towards a positive association ( $R^2=0.086, p=0.0778$ ). Additionally, age and total vegetable intake were trending towards a positive association ( $R^2=0.119, p=0.0528$ ). When age was used as a modifier, extraversion and BMI were inversely correlated ( $R^2=0.592, p=0.0257$ ) as seen in Figure 8, but only for the age group 32-40 years old. Similarly, conscientiousness and BMI were inversely correlated ( $R^2=0.703, p=0.0093$ ) as seen in Figure 9, but only for the age group 32-40.

### **Discussion**

This study was designed to test the influence that the Big Five personality traits had on food consumption and anthropometric measures in a diverse sample of 38 adults. Findings from conscientiousness, neuroticism, and extraversion contributed to previous literature, but there were no significant findings for openness or agreeableness.

As expected, results from this study demonstrated that people who scored higher in conscientiousness tend to have a lower BMI, therefore lower risk for obesity, in comparison to those who have low scores of conscientiousness. On average, this personality trait was found to be stronger in women than in men as seen in Table 2. When using age as a modifier for conscientiousness and BMI, the age group 32-40 had the strongest relationship. This could be expected, but the next age group 40-53 did not have significant results. High conscientiousness scores were also inversely correlated to body weight, indicating that self-aware individuals are more conscious of food consumed. These findings contribute to previous literature suggesting high conscientiousness scores are positively related to healthy lifestyle choices, such as exercising regularly and consuming fruits and vegetables (Raynor and Levine 2009). However, this study did



not reflect a positive correlation between conscientiousness and fruit or vegetable consumption, especially in women. Reasoning for this could be due to small sample size that reflect very few participants meeting or exceeding the RDA for fruits and vegetables.

Depending on the personality trait, dietary restraint can be increased or decreased. In the case of neuroticism, these individuals are influenced by external cues that may override self-control when surrounded by food, especially when it is high in calories, sugar, and fat (Groesz et al. 2012). In comparison, conscientious people promote restrained eating by consuming more of what is recommended and reducing external eating (Mottus et al. 2012, Mottus et al. 2013).

Conscientiousness indirectly promotes restrained eating by choosing to eat healthier food options like fruits and vegetables, as opposed to sweet and savory foods or sweetened drinks (Keller and Siegrist 2015). These individuals are less likely to overeat or let external cues in the environment control food consumption. Some may argue that it is easier to change eating style than it is to change personality traits, while others argue personality traits can be changed through conditioning and therapeutic intervention.

The hypothesized association between neuroticism and BMI, as well as neuroticism and eating patterns, were not statistically significant. This could be attributable to the relatively small sample size and higher variability, which reduces ability to detect statistical significance. Other research found the association between low neuroticism scores and low body weight to be stronger in women than in men (Armon et al. 2013, Brummett et al. 2008), however, the current study did not show this. Furthermore, scores for neuroticism did not differ between sexes, despite women consuming more vegetables and less protein than men.

In contrast to literature (Chapman et al. 2010, Magee and Heaven 2011), there were no correlations between openness to experience and BMI, although recruiting more participants might

exhibit a statistical significance. Unexpectedly, there were no significant correlations among openness and healthy eating patterns, like consuming fruits or vegetables (Keller and Siegrist 2015, Mottus et al. 2013), which again may be due to small sample size.

A higher BMI was correlated with a higher waist circumference and as anticipated, this relationship was stronger in men than in women. Reasoning for this might be due to genetic makeup because men generally have a higher body mass than women and a lower percentage of body fat. When age was used as a modifier, the age group 32-40 years old had an inverse relationship between extraversion and BMI, but no other age groups were significant.

When comparing age and agreeableness, younger participants were less agreeable and the older participants were more agreeable. This supports previous research indicating that as time progresses individuals tend to become more sympathetic and cooperative. This study also found the older the age, the more likely these subjects were to consume the recommended number of vegetables. Reasoning for this may be a general attitude towards healthy eating, including more interest in health and wellbeing as aging occurs, whereas younger generations may not be as focused on long term outcomes. Another reason might be greater income and stability that comes with age, which can aid in making healthy lifestyle choices.

Participants who followed or exceeded the recommendations for vegetable consumption had a strong negative correlation with WHR. By adhering to dietary guidelines, participants are likely eating an overall nutritious diet and making other healthy lifestyle choices. However, no correlations were seen in vegetable consumption and personality traits. When scrutinizing the diet, participants who consumed more protein had a lower percent body fat, which could be due to eating an overall healthy diet or the high protein diet keeping participants full for a longer period. One participant consumed over 300% of the recommended protein consumption and had a low

body fat percentage. This outlier can be seen in Figure 5 and this person might be a bodybuilder, which explains the high protein consumption and low body fat percentage. The participant's data was taken out of the set because it appeared to skew the results, however, results were still inversely correlated.

This study had many strengths including a diverse sample with information on personality traits, diet, and anthropometric measures, but nonetheless, it included limitations. Recruiting more participants would increase reliability and validity. Healthy people were the target subjects, although some individuals were classified as overweight, and a couple classified as obese. BMI is used as a screening tool, but is not an accurate depiction of everyone, including bodybuilders and geriatric populations. This measurement does not accurately measure lean body mass or take percent body fat into account. Consequently, a bodybuilder will have high body mass, albeit lean mass, they appear to be overweight or obese per BMI. Although this study didn't include anyone about 51 years, BMI also underestimates body fat in those who have lost a significant amount of weight, which is common in elderly people. Despite these limitations, it is still a good tool to use for the general population.

As for the healthy people, the term healthy is subjective and may deter individuals who do not view themselves as healthy. Measures of dietary intake varied across studies depending on how healthy eating was defined and how nutrition was recorded. The current study used four-day diet logs, while others used Food Frequency Questionnaires (FFQ). Some of the questionnaires included vague diet descriptors like "follows a self-aware diet" or "consumes convenience foods, sugars, and high fat foods." Whereas others were more specific with fruits, vegetables, and types of carbohydrates. The variation in the definition of a healthy diet or a healthy subject makes it

challenging to adequately compare studies, but future research would be beneficial to encompass all aspects of health to define a healthy individual.

It is known that body fat percentage is associated with many chronic diseases such as hyperlipidemia, hypertension, diabetes mellitus, and heart disease. In addition to BMI, WHR, and waist circumference, BIA was used as a simple and quick method to measure body composition in a controlled environment. This non-invasive technique is inexpensive and useful in small clinical studies to predict a range of body measurements. It is not the most accurate tool because the human body is non uniform, and results can vary depending on calibration, ethnicity, environmental factors, exercise, and consuming food or drink prior (Dehghan and Merchant 2008). In the present study, environmental factors, like room temperature, were controlled because this can increase or decrease impedance. Participants were instructed to consume no food and little to no fluids prior to the study so the measurements would not be altered. BIA was performed on either visit one or visit three, but not visit two because the exercise portion would have affected results. While Caucasian was the predominant ethnicity in this study, there were still other diverse participants, resulting in varied fat distribution and body density. Overall, BIA was a useful tool to measure body composition, but it would not be as accurate in a larger study because it is not specific to ethnicity. The UM study utilized a DEXA machine to measure body composition on participants. This technique is the gold standard, but is not always accessible or feasible for all studies. A limitation of the present study includes mixing data from different measurements, which increased variability. Ideally, using DEXA or the same measurement tool would produce consistent results.

When it comes to age, the oldest subject in this study was 51 years old so the results do not accurately depict aging and excludes the geriatric population. However, if older participants were

recruited, this study may coincide with existing literature regarding aging and personality traits. This includes an increase in conscientiousness and agreeableness, and decrease in extraversion, openness, and neuroticism.

Many participants took interest in this study and unfortunately, some subjects dropped out, likely because they did not see enough incentive or lost interest during the study. A total of 38 participants completed the study, but only 32 subjects completed diet logs. The diet logs were supposed to represent a typical weekday and weekend of food consumption for participants; however, many factors may influence inaccuracy. These reasons include memory of foods consumed, over or underestimating portions, and over reporting of nutritious foods or under reporting of convenience foods.

Despite these limitations, the current study added to a body of evidence relating personality traits, food consumption, and overall health. Conscientiousness and neuroticism are well defined, but further research is needed to bridge the gap between inconsistencies of this topic. Using a randomized cohort study of a large population would be useful, although costly, to learn more about extraversion, agreeableness, and openness. With increasing interest in personality traits and food consumption, research may be able to predict health factors in those with strong personality traits and ultimately decrease the incidence of chronic disease.

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**ABSTRACT****THE RELATIONSHIPS AMONG PERSONALITY TRAITS, FOOD CONSUMPTION,  
AND ANTHROPOMETRICS IN HEALTHY PEOPLE**

by

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Two out of three people are obese in the United States, but Western culture isn't the only population suffering from obesity and comorbidities. Many factors contribute to this global epidemic and more recently various research suggests that personality traits can be used to predict eating behaviors. This study investigated the Big Five personality trait's influence on food consumption to determine what traits contribute to healthy eating and what traits are susceptible to overeating and therefore, poor health consequences. The Big Five personality traits, anthropometric measures, and diet logs were used to assess 38 individuals for health-related behaviors and obesity-related risk factors. Linear regression showed an inverse relationship with conscientiousness and weight, as well as with BMI. Other findings include an inverse relationship with extraversion and BMI in ages 32-40. Vegetable consumption was also inversely related to WHR, which suggest that people with a smaller WHR are consuming more vegetables and likely a healthier diet overall. These findings support a body of evidence relating personality traits' influence on anthropometrics and consummatory behavior. By understanding personality traits, preventative measures may be used for those at high risk for weight gain, obesity, and chronic diseases.

**AUTOBIOGRAPHICAL STATEMENT**

Chelsea Schwartz earned her Bachelor of Science in Dietetics at Michigan State University in 2015. She then completed her dietetic internship at Henry Ford Hospital in 2019. She now works as a Registered Dietitian in clinical dietetics in Indianapolis, Indiana. Chelsea is in the process of completing her Master of Nutrition and Food Science at Wayne State University. She is interested in community nutrition and enjoys giving back to the community by volunteering at food banks, urban farms, and teaching nutrition to all ages.