Associations of Personality Trait with Body Mass Index in Midlife

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Abstract. Midlife people tend to gain weight with age, contributing to poor health. Personality traits are often linked to health outcomes that have adverse effects. The ways of thinking, feeling, and acting summed up by broad personality traits may make people more likely to become obese. The results of previous studies on the relationship between body weight and personality traits got different results. We determined the association between personality traits and BMI in males and females using large cross-sectional data from IFLS5. Body mass index was calculated by weight and height (kg/m^2). BMI was categorized into two groups; normal (BMI 18.5–24.9 kg/m^2) and overweight/obese (BMI $\geq$ 25 kg/m^2). We excluded underweight participants. We use the Big Five Inventory 15 (BFI 15), a set of 15 adjectives representing all 5 of the big five personality groups, including extraversion, agreeableness, openness, conscientiousness, and neuroticism. We adjusted the model with socioeconomic factors, health status, and behavioral factors. We used binary logistic regression to determine the association between personality traits and obesity. Data from 4,655 males and 5,154 females who participated in this study were included in the analysis. After being adjusted with potential confounders, Extraversion was significantly associated with obesity in males (AOR: 1.22; 95% CI 1.05–1.41) and females (AOR: 1.24; 95% CI 1.10–1.40). Conscientiousness was a protective factor for being overweight/obese in males (AOR: 0.83; 95% CI 0.72–0.95), and agreeableness was a protective factor for being overweight/obese in females (AOR: 0.88; 95% CI 0.78–0.99). The current results show how important it is to include phycological intervention in overweight/obesity therapy.

Keywords: overweight · obesity · personality traits · midlife

1 Introduction

Obesity is a problem over the world in the twenty-first century. It is a serious, chronic disease that significantly impacts individual health, quality of life, and societal burden [1, 2]. In 2016, more than 1.9 billion adults 18 years and older were overweight. Of these, over 650 million were obese. The worldwide prevalence of obesity nearly tripled between 1975 and 2016 [3]. The risk of developing metabolic diseases, cardiovascular diseases, musculoskeletal diseases, Alzheimer's disease, depression, and certain types of

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cancer is significantly increased in obese people. The American and Canadian Medical Associations and the World Obesity Federation have said that obesity is a chronic, progressive disease, not just a risk factor for other diseases [4].

Obesity is caused by many different factors, from genes to government policies. BMI and weight gain also have been linked to various psychological factors, including depressive symptoms and personality [5, 6]. However, several previous studies on the association between body weight and personality traits got different results. There is some evidence of a positive relationship between neuroticism and BMI and some evidence of no significant relationship. Other parts of psychological functioning, like depressive symptoms and neuroticism, are linked to a higher BMI [7–9]. Previous studies found that extraversion is positively associated with BMI but negatively in others, with no association [10, 11]. Finally, Openness and Agreeableness have either a negative relationship with BMI or none. This inconsistency may be because the link between personality and body mass index differs for males and females [7].

Most dimensional models of general personality structure use the five-factor model (FFM). The FFM comes from the lexical paradigm, which says that the language encodes what is most important, interesting, or meaningful to a person. One of the most exciting things about the FFM is its robustness. This is because it considers almost every trait term in the language. We know much about other-dimensional models of general personality in the FFM's domains and aspects [12]. In the Five-Factor Model (FFM), personality traits can be summed up along five broad dimensions: Neuroticism (the tendency to feel bad emotions), Extraversion (the tendency to be social and active), Openness (the tendency to be creative and different), Agreeableness (the tendency to be trusting and modest), and Conscientiousness (the tendency to be organized and disciplined) [13, 14]. The present study aims to contribute to the topic of obesity by analyzing the association between personality traits (according to the Five-Factor-Model (FFM) of personality) and overweight/obesity using large cross-sectional data in Indonesia.

2 Material and Methods

Participant and Procedure

We use data from the fifth wave of the Indonesian Family Life Survey (IFLS5) conducted in 2014/2015. The sample of IFLS5 is representative of about 83% of the Indonesian population and contains over 30,000 individuals living in 13 provinces in Indonesia. The survey collects data on individuals, families, households, communities, and health and education facilities. The household survey includes individual-level data. A few household members provided information. The interviewers then tried to interview everyone over 11 years old. We used subset data at household and individual levels. The household survey questionnaire was divided into topical modules or sections [15]. In this study, we restricted midlife participants aged 40–65. We just included participants with normal, overweight/obese BMI. We also excluded underweight participants.

Measure

Body Mass Index

IFLS5 collected weight and height measurements data for all household individuals. The outcome of interest in this study was body mass index. Body mass index was calculated by weight (kg) per height quadratic (m^2). We divided body mass index into two categorized, normal (BMI $\leq$ 25 kg/m^2) and overweight/obese (BMI $>$ 25 kg/m^2).

Personality Trait

Personality was a new section in IFLS that only IFLS5 provided personality information. We used the Big Five Inventory (BFI 15), a widely used metric of the FFM. BFI is a subset of the BFI 44, a set of 15 adjectives representing the big five personality groups, with three statements for each of the 5. The big five personality traits are extraversion, agreeableness, conscientiousness, neuroticism, and openness. A five-point ordinal scale was used to represent how well the respondent believed that attribute represented them. Survey Meter staff did the initial translation of the 15 statements into Indonesian. Then two independent outside translators were hired and re-translated back into English. The re-translations agreed except for two or so cases. For these, the Survey Meter staff translated them into Indonesian and then returned those translations to the two outside translators who re-translated them into English.

Confounding Factors

We adjusted the model with socioeconomic, health status, and behavioral factors. Socioeconomic factors include participants' age, type of residence, education, working status, marital status, and wealth index. Health status variables include depressive symptoms, sleep disorder, and self-reported health. Behavioral factors include smoking habitually, unhealthy food consumption, and physical activities.

Statistical Analysis

Descriptive statistics were used to investigate participants' characteristics. Associations of personality with BMI were investigated in logistic regression models using a binary overweight/obesity variable as the outcome. In line with previous studies, all analyses were therefore conducted separately for males and females. We performed all statistical analyses using STATA SE 15.1 [16].

Ethical Consideration

The IFLS surveys and their procedures were adequately reviewed and approved by IRBs (Institutional Review Boards) in the United States (at RAND) and in Indonesia at the University of Gadjah Mada (UGM) for IFLS5. Thus, all requirements for consent for adults and children were met and approved by those IRBs before fieldwork could begin. The reference for ethical clearance from Gadjah Mada University was KE/FK/710/EC/2015, dated June 17, 2015. All data was collected from Survey Meter by first registering personal data on the RAND website.

3 Result

A total of 4,655 males and 5,154 females includes in the analysis. The obese percentage was 32.6% in males and 54.2% in females. The participant characteristics of this study

are presented in Table 1. More than half of the participants lived in rural areas (59.0 for males and 60.3% for females). Both males (48.8%) and females (62.4%), most education levels were primary or less. Almost one-fifth (17.3%) of males had depressive symptoms. However, 20.5% of females had depressive symptoms.

The personality distribution is shown in Fig. 1. We divided the percentage of personality traits based on gender. Conscientiousness was the highest percentage of personality traits in males (65.7%) -, while agreeableness was the highest in females (65.8%) - Neuroticism was the lowest personality trait in males (1.3%) and females (2.9%).

Table 1. Characteristics of the participants

Covariate		Male		Female	
		n	%/mean	n	%
Age*		4,655	49.7	5,154	49.9
Residence					
	Rural	2,747	59.0	3,106	60.3
	Urban	1,908	41.0	2,048	39.7
Education					
	Primary or less	2,271	48.8	3,214	62.4
	Secondary	796	17.1	705	13.7
	Higher	1,588	34.1	1,235	24.0
Working status					
	Did not work	605	13.0	2,471	47.9
	Work	4,050	87.0	2,683	52.1
Wealth index					
	Poorest	665	14.3	781	15.2
	Poorer	958	20.6	1,090	21.2
	Middle	1,061	22.8	1,183	23.0
	Richer	851	18.3	908	17.6
	Richest	1,120	24.1	1,192	23.1
Marital status					
	Married/separate/cohab	4,390	94.3	4,135	80.2
	Single	77	1.7	94	1.8
	Divorced	75	1.6	208	4.0
	Widowed	113	2.4	717	13.9
Depressive symptoms					
	No	3,851	82.7	4,096	79.5
	Yes	804	17.3	1,058	20.5

(*continued*)

Table 1. (*continued*)

Covariate		Male		Female	
		n	%/mean	n	%
Sleep disorder					
	None-slight	3,610	77.6	3,752	72.8
	Mild	496	10.7	584	11.3
	Moderate	431	9.3	598	11.6
	Severe	118	2.5	220	4.3
Smoking					
	Non smoking	1,645	35.3	4,959	96.2
	Currently smoking	3,010	64.7	195	3.8
Self-reported health					
	Very healthy	840	18.1	827	16.1
	Somewhat healthy	2,756	59.2	2,782	54.0
	Somewhat unhealthy	998	21.4	1,460	28.3
	Very unhealthy	61	1.3	85	1.7
Unhealthy food*		4,655	5.7	5,154	5.8
Physical activities*		4,655	80.9	5,154	59.0

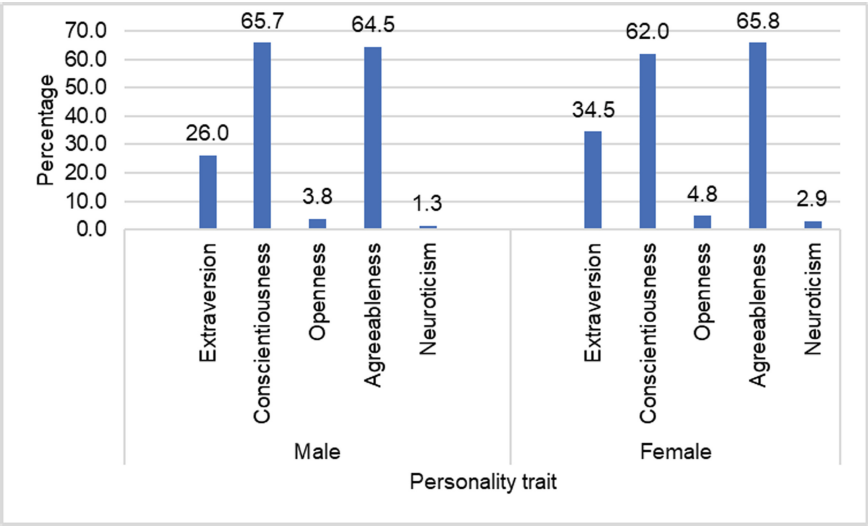

Fig. 1. Percentage of personality traits

Table 2 shows the association between personality traits and overweight/obesity. After adjusting for some potential confounders, we found that extraversion was positively associated with body mass index in males and females. Extraversion males and females were 22% more likely to be overweight or obese than others. Conscientiousness has a negative association with body mass index in males. Conscientiousness males were 17% less likely to be overweight or obese than others. While agreeableness has a negative association with body mass index in females. Agreeableness females were 12% less likely to be overweight or obese than others.

Table 2. Association of personality and body mass index

Covariate		Male		Female	
		AOR (95% CI)	p-value	AOR (95% CI)	p-value
Extraversion					
	Others				
	Extraversion	1.22 (1.05–1.41)	0.008	1.24 (1.10–1.40)	0.000
Conscientiousness					
	Others				
	Conscientiousness	0.83 (0.72–0.95)	0.008	1.06 (0.94–1.20)	0.305
Openness					
	Others				
	Openness	0.84 (0.58–1.20)	0.337	0.97 (0.75–1.25)	0.796
Agreeableness					
	Others				
	Agreeableness	0.89 (0.77–1.02)	0.086	0.88(0.78–0.99)	0.048
Neuroticism					
	Others				
	Neuroticism	0.70 (0.38–1.31)	0.266	0.90 (0.64–1.25)	0.524
Age		0.99 (0.98–0.99)	0.005	0.99 (0.98–0.99)	0.025
Residence					
	Rural	0.63 (0.54–0.72)	0.000	0.72 (0.64–0.81)	0.000
	Urban				
Education					
	Primary or less				
	Secondary	1.54 (1.28–1.85)	0.000	1.13 (0.95–1.35)	0.157
	Higher	1.72 (1.46–2.014)	0.000	1.04 (0.89–1.20)	0.639

(*continued*)

Table 2. (*continued*)

Covariate		Male		Female	
		AOR (95% CI)	p-value	AOR (95% CI)	p-value
Working status					
	Did not work				
	Work	0.10 (0.79–1.17)	0.724	0.93 (0.83–1.05)	0.242
Wealth index					
	Poorest				
	Poorer	1.22 (0.96–1.54)	0.101	1.19 (0.99–1.44)	0.068
	Middle	1.29 (1.03–1.63)	0.029	1.20 (0.99–1.44)	0.056
	Richer	1.51 (1.19–1.92)	0.001	1.35 (1.11–1.65)	0.003
	Richest	1.71 (1.36–2.15)	0.000	1.35 (1.12–1.64)	0.002
Marital status					
	Married/separate/cohab				
	Single	0.70 (0.42–1.16)	0.161	0.57 (0.37–0.88)	0.011
	Divorced	0.67 (0.37–1.19)	0.169	0.63 (0.47–0.84)	0.002
	Widowed	0.71 (0.45–1.11)	0.136	0.88 (0.74–1.04)	0.138
Depressive symptoms					
	No				
	Yes	0.75 (0.62–0.91)	0.003	0.88 (0.76–1.03)	0.112
Sleep disorder					
	None-slight				
	Mild	1.09 (0.87–1.35)	0.449	1.11 (0.92–1.34)	0.275
	Moderate	0.83 (0.65–1.06)	0.136	0.90 (0.75–1.09)	0.272
	Severe	1.02 (0.66–1.58)	0.926	0.72 (0.54–0.97)	0.030
Smoking					
	Non-smoking				
	Currently smoking	0.54 (0.47–0.61)	0.000	0.75 (0.56–0.99)	0.049
Self-reported health					
	Very healthy				
	Somewhat healthy	0.87 (0.73–0.08)	0.116	1.06 (0.91–1.24)	0.448
	Somewhat unhealthy	1.02 (0.82–1.25)	0.883	1.26 (1.05–1.50)	0.012
	Very unhealthy	0.60 (0.31–1.15)	0.126	1.76 (1.09–2.84)	0.020
Unhealthy food		1.00 (0.99–1.02)	0.621	1.02 (1.00–1.03)	0.010
Physical activities		0.99 (0.98–0.99)	0.000	0.99 (0.99–0.99)	0.001

4 Discussion

This study found that some personality traits were significantly associated with overweight/obesity. Extraversion males and females tend to be overweight and obese. A previous study in Korea and the US found similar findings to our study [17, 18]. Extraversion is a broad personality trait that includes several more specific traits, such as being friendly, assertive, active, happy, and impulsive. Extraversion males and females with a tendency to be outgoing and social. In contrast, a previous study in Australia found that extraversion was not significantly associated with body mass index [19]. These different results may be because different aspects of extraversion contribute to low and high BMI [14]. For example, "sensitivity to reward," a trait of extraversion related to an appetite-positive affect system, has been linked to being overweight, while other traits of extraversion, like being active and social, may be linked to a lower BMI [20, 21]. The importance of different BMI sub-factors may vary depending on the age of the population being studied. This may explain why studies with younger samples reported negative associations between extraversion and BMI and obesity, while positive associations were found among males and females in the present study and previous studies with midlife and older samples, suggesting a cumulative effect of extraversion on BMI through the adult lifespan [10, 14].

This study also found that conscientiousness was inversely associated with BMI in males. Two previous studies in Australia and America found similar findings. A previous study in Australia found that BMI was negatively associated with conscientiousness. This finding was because conscientious individuals were more likely to eat plant-based food. While a previous study in America found that conscientiousness was associated with nearly all of the health markers: Self-control, organization, industriousness, and responsibility were related to lower BMI, healthier metabolic, cardiovascular, and inflammatory markers, and better performance on physical assessments [19, 22]. In addition, individuals with a high level of conscientiousness have consistently been lower BMI and gained less weight over time, particularly during major life transitions [23]. It also suggests that this trait is linked to healthier biomarker profiles and improved physical functioning [24, 25]. The most essential health-related activities, particularly physical exercise habits and healthy eating behavior, are reliably predicted by conscientiousness. Conscientiousness is more likely to avoid risky behavior and manage disease symptoms well [26]. Females may have power issues as a result of these non-significant associations. According to a recent meta-analysis of personality traits and obesity, people with higher levels of conscientiousness had a nearly 40% lower risk of being overweight than those with lower levels of conscientiousness, measured across 78,931 people [11].

One of the pathways of personality traits and overweight/obesity was physiological dysregulation. People who are obese tend to have higher levels of inflammatory markers in their blood, such as tumor necrosis factor-alpha (TNF), soluble TNF receptor II (sTNF-RII), interleukin 6 (IL-6), fibrinogen and C-reactive protein (CRP). Several studies have found that personality is linked to biomarkers linked to weight [27–29]. Physical activity is an important factor in the Health Behavior Model of personality, and it helps explain some of the links between personality and inflammation. According to a meta-analysis, conscientiousness was consistently linked to lower levels of inflammation even after

controlling for various other variables [22, 28]. In contrast, Extraversion was positively associated with IL-6 levels [30].

Agreeableness was inversely associated with BMI in females. Agreeableness is more likely to put the needs of others ahead of their own. The ability to empathize and enjoy helping others and working with those in need is a particular strength of those who are more agreeable than others. A previous prospective study conducted on midlife people found similar findings [8]. We have no precedent for this finding, but middle-aged people's trusting and compliant nature may make them more likely to follow health-related guidelines. As a result, they may be more likely to follow the advice of doctors and family members when it comes to diet and exercise. However, the ability to maintain weight loss is closely linked to agreeableness. Study after study has found that more conformist people consume less fat and sodium [31].

This study has several limitations. First, due to a cross-sectional study, this study cannot describe the causal association between personality traits and BMI. Second, we did not include biological factors associated with being overweight/obese such as genes, prenatal, and early life conditions.

5 Conclusion

We found that some personality traits had an association with BMI. Extraversion was positively associated with BMI both in males and females. While conscientiousness was inversely associated with BMI in males, and agreeableness was inversely associated with BMI in females. Therefore, phycological intervention in overweight/obesity therapy can be considered.

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