Original Article

Investigating the Association Between Neuroticism, Conscientiousness, and Metabolic Markers in Young Adults

Saif Imdad , Shahjehan Khan , Muneer Ahmed

ABSTRACT

Background: Personality traits are emerging as significant psychological predictors of physical health, yet their relationship with early metabolic risk remains underexplored in young adults. Understanding how stable traits such as neuroticism and conscientiousness influence metabolic outcomes can inform preventive strategies before chronic disease manifests.

Objective: This study aimed to investigate the association between specific personality traits, neuroticism and conscientiousness, and metabolic risk markers in younger adults.

Materials and Methods: A cross-sectional stud was conducted with 115 participants aged 18-35. Personality traits were assessed using the Big Give Inventory (BFI), while metabolic markers included body mass index (BMI), waist circumference, blood pressure, fasting glucose, and HDL cholesterol. Lifestyle factors (physical activity, sleep duration, and perceived stress) were also measured. Correlation analyses, multiple linear regressions, and tertile-based group comparisons were used to examine the relationships between personality and metabolic risk. The data was analyzed using SPSS 26.0. A p-value of <0.05 was considered as statistically significant.

Results: Higher neuroticism was significantly associated with elevated BMI, waist circumference, systolic and diastolic pressure, and fasting glucose ($p < 0.05$). In contrast, higher conscientiousness predicted lower diastolic blood pressure and higher HDL cholesterol. These associations remained significant after adjusting for age, sex, physical activity, sleep duration, and stress. Participants in the highest neuroticism tertile exhibited significantly worse metabolic profiles, while those with high conscientiousness showed more favorable outcomes.

Conclusion: Personality traits, particularly, neuroticism and conscientiousness, are independently associated with early metabolic risk in young adults. These findings underscore the relevance of integrating personality assessment into metabolic risk screening and support the development of personality-tailored preventing health interventions during early adulthood.

Keywords: Personality traits, neuroticism, conscientiousness, metabolic risk, young adults, metabolic syndrome

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1. Introduction

Metabolic disorders, including obesity, hypertension, dyslipidemia, and impaired glucose metabolism, represents a significant global public health challenge. Collectively referred to as metabolic syndrome (MetS), these conditions often co-occur and are associated with an elevated risk of cardiovascular disease, type 2 diabetes mellitus, and premature mortality (1). Although the physiological and behavioral risk factors for metabolic disease, such as poor diet, sedentary lifestyle, and genetic predisposition, are well established, there is growing interest in the psychological and personality-based underpinning of metabolic health. Among these personality traits have emerged as novel and increasingly relevant predictors of metabolic risk. The Five-Factor Model (FFM) of personality, also known as the "Big Give," categorizes individuals across five broad dimensions: openness to experience, conscientiousness, extraversion, agreeableness, and neuroticism (2). These traits have been shown to predict a wide range of behaviors, including health-related actions and stress reactivity, both of which are strongly linked to metabolic outcomes (3) . While these personality traits are considered relatively stable over time, their influence on lifestyle patterns, decision-making and physiological responses begins early and can shape long-term health trajectories.

Among the Big Five, neuroticism and conscientiousness appear particularly salient to metabolic health. Neuroticism, characterized by a tendency to experience negative emotions such as anxiety, irritability, and mood instability, has been associated with poor self-regulation, higher perceived stress, and maladaptive coping behaviors such as emotional eating and substance use (4). Individuals high in neuroticism often report lower physical activity, poorer sleep quality, and less dietary restraint, all of which are established contributors to metabolic dysfunction. Several studies have linked high neuroticism to elevated body mass index (BMI), increased waist circumference, high fasting glucose, and even systemic inflammation, suggesting that this trait may serve as a psychological risk factor for cardiometabolic diseases (5–7). In contrast, conscientiousness, which encompasses traits such as self-discipline, responsibilities, and goal orientation, has consistently been associated with favorable health outcomes. Individuals high in conscientiousness tend to adhere to structured routines, engage in regular exercise, avoid risky behaviors like smoking and excessive drinking, and are more likely to seek preventive healthcare (8,9). These protective behaviors have been shown to correlate with lower BMI, higher LDL cholesterol, better glycemic control, and overall reduced risk of metabolic syndrome. Notably, conscientiousness has been associated not only with improved physical health outcomes but also with greater longevity, making it a key psychological determinant of health across the lifespan.

While these associations have been well-documented in middle-aged and older adult populations, there is notable scarcity of research focused on young adults. Young adulthood, typically ages 18-35 years, represents a formative life stage where individual establish long-term behavioral patterns, transition to independent living, and are exposed to unique stressors related to academic, occupational, and social domains. Importantly, early markers of metabolic syndrome, such as elevated waist circumference or dyslipidemia, can emerge during this period, often asymptomatically. Thus, identifying psychological traits that influence these early markers could provide valuable insight for early intervention and health promotion strategies. Moreover, many studies that do examine personality and metabolic outcomes fail to account for the mediating role of lifestyle behaviors (e.g., diet, physical activity, sleep hygiene), which could serve as the behavioral pathway linking personality traits to physiological roots of metabolic risk and designing targeted interventions.

In light of these considerations, the present study aims to investigate the association between neuroticism and conscientiousness, two core dimensions of personality, and metabolic risk markers in young adults. Specifically, the study will examine whether higher levels of neuroticism are associated with increased waist circumference, systolic/diastolic blood pressure, and fasting glucose and whether higher levels of conscientiousness are associated with healthier metabolic profiles, including lower BMI, and higher HDL cholesterol. This study seeks to contribute to a growing body of interdisciplinary literature at the intersection of personality psychology, behavioral medicine, and metabolic health. By focusing on young adults and incorporating both psychological and physiological measures, this research will help clarity the extent to which stable personality traits can predict early metabolic risk, laying the groundwork for future interventions tailored to individual psychological profiles.

2. Materials and Methods

Study Design and Setting: This study employed a cross-sectional observational design to examine the relationship between personality traits and metabolic risk markers in young adults. The research was conducted at a tertiary care hospital for a period of 6 months (December 2024 to May 2025) following ethical approval by the Institutional Ethics Review Board, and in accordance with the Declaration of Helsinki.

Study Population: Participants were recruited using a combination of online advertisement, announcements, and email invitations. Eligibly participants were males and females aged 18 to 35 years. Exclusion criteria included the presence of known chronic metabolic disorder (e.g., type 2 diabetes mellitus, polycystic ovarian syndrome, or diagnosed hypertension), current use of medications that influence metabolism, such as corticosteroids, or lipid-lowering agents, pregnancy, or any diagnosed psychiatric illness. All participants provided informed written consent prior to participation.

Sample Size Determination: The minimum sample size was estimated using G*Power software, based on an expected medium effect size (f^2 = 0.15) for multiple linear regression, with an alpha level of 0.05, power of 0.80, and six predictors. This calculation yielded a required sample of approximately 115 participants.

Data Collection Procedures: Participants were invited where anthropometric measurements, blood samples, and questionnaire data were collected in a standardized sequence by trained research assistants. All procedures were conducted in the morning, following a minimum 8-hour overnight fast.

Personality traits were measuring using the Big Give Inventory (BFI-44), a validated 44-item self-report instrument that assesses five broad personality domains: neuroticism, conscientiousness, openness to experience, extraversion, and agreeableness (10). For the purpose of this study, only the neuroticism and conscientiousness subscales were analyzed. Participants rated their agreement with each item on a 5-point Likert scale ranging from 1 (“strongly disagree”) to 5 (“strongly agree”). Subscale scores were calculated by averaging the respective items, with higher scores reflecting greater trait expression. The BFI-44 has demonstrate strong internal consistency (Crohnbach’s α> 0.80) and construct validity across multiple populations, including young adults.

A trailed clinical examiner conducted all physiological measurements in accordance with World Health Organization (WHO) protocols. Waist circumference was measured at the midpoint between the lower margin at the last palpable rib and the top of the iliac crest, using a non-stretchable measuring tape of the nearest 0.1 cm. Blood pressure was recorded using an automated digital sphygmomanometer, with participant seated and rested for at least 5 minutes prior to measurement. Two readings were taken five minutes apart, and the average value was used in the analysis.

Body mass index (BMI) was calculated from height and weight measurements using the formula weight (kg) divided by height (m^2). Height was measured with a stadiometer to the nearest 0.1 cm, and weight was measured with a calibrated digital scale to the nearest 0.1 kg. Fasting blood samples were collected by a licensed phlebotomist. Serum glucose and lipid profiles, including high-density lipoprotein (HDL) cholesterol, were analyzed using enzymatic colorimetric methods at the laboratory. The metabolic parameters chosen, waist circumference, systolic/diastolic blood pressure, fasting glucose, BMI, and HDL cholesterol, represent key components of the metabolic syndrome and were selected based on their strong predictive value in cardiovascular and metabolic health literature. To account for potential confound variables, participants completed a structured lifestyle questionnaire assessing daily physical activity, dietary habits, smoking status, sleep duration, and perceived stress levels. Physical activity was quantified using the International Physical Activity Questionnaire (IPAQ-SF), which yields a continuous measure in metabolic equivalent minutes per week (MET-min/week) (11). Stress levels were measured using a Perceived Stress Scale (PSS-10) (12). These variables were included in the statistical models to adjust for lifestyle-related influences on metabolic risk.

Statistical Analysis: Data were entered and analyzed in SPSS version 26.0. Descriptive statistics were calculated for all demographic, metabolic, and personality variables. The normality of continuous variables were assessed using the Shapiro-Wilk test and visual inspection of histograms and Q-Q plots. Multiple linear regression analyses were conducted to examine the association between neuroticism and conscientiousness and each metabolic risk marker, controlling for age, gender, physical activity, stress, and sleep. Stratified analyses and tertile comparisons were also performed. Participants were grouped into low, medium, and high categories based on their neuroticism and conscientiousness scores. Between-group differences in metabolic outcomes were analyzed using one-way ANOVA for continuous variables and post hoc Tukey tests for pairwise comparisons. Effect sizes (Cohen's d) were calculated for significant associations. A significant level of <0.05 was used for all tests, and all analyses were two-tailed.

3. Results

The study included a total of 115 participants, with a higher proportion of females than males. Participants were predominantly young adults, with a mean age of approximately 23 years. Descriptive statistics indicated moderate levels of neuroticism and relatively higher levels of conscientiousness. The group reported modest physical activity levels and suboptimal sleep duration. Metabolic health markers such as BMI, waist circumference, and fasting glucose fell within the normal-to-borderline range for risk in most participants, indicating variation in cardiometabolic risk (Table 1). Bivariate correlation analysis revealed that higher neuroticism was significantly associated with increased BMI, waist circumference, blood pressure, and fasting glucose, and weakly associated with lower HDL cholesterol. In contrast, conscientiousness showed significant negative correlation with HDL cholesterol. These associations were consistent with theoretical expectations regarding stress-reactive and health-promoting personality traits (Table 2).

In multiple linear regression models adjusted for age, sex, physical activity, sleep, and stress, neuroticism emerged as a significant predictor of increased adiposity (BMI and circumference), elevated blood pressure, and higher fasting glucose levels. Meanwhile, conscientiousness was significantly associated with higher HDL cholesterol and lower diastolic blood pressure, suggesting a protective effect (Table 3). These results confirm that personality traits independently influence metabolic health, even after accounting for key behavioral and demographic variables. Group comparisons using tertiles of personality trait further demonstrated these trends. Individuals in the highest neuroticism group had significantly higher BMI, larger waist circumference, elevated systolic blood pressure, and increased fasting glucose compared to those in the lowest neuroticism group (Table 4). These results indicate a gradient pattern of increasing metabolic risk with higher emotional instability. Conversely, participants with higher conscientiousness exhibited more favorable metabolic outcomes, including lower BMI and waist circumference, lower diastolic blood pressure, and significantly higher HDL cholesterol, compared to those with low conscientiousness (Table 5). These patterns reinforce the interpretation of conscientiousness as a health-protective personality trait that may buffer early metabolic risk.

Table 1: Characteristics of Study Participants (m=115)

Variable	**Category/Unit**	**Value**
Age	Mean (years ± SD)	22.7 ± 31.
Sex	Male	48 (41.7%)
	Female	67 (58.3%)
Personality Traits and Lifestyle Variables		
Neuroticism score	BFI scale (1-5)	3.21 ± 0.68
Conscientiousness score	BFI scale (1-5)	3.79 ± 0.55
Perceived stress score	PSS-10 total score	21.3 ± 5.8
Physical activity	MET-min/week	1680 ± 830
Sleep duration	Hours/night	6.9 ± 1.2
Metabolic Health Markers		
Body mass index (BMI)	Kg/m^2	24.9 ± 4.2
Waist circumference	Cm	85.6 ± 9.8
Systolic blood pressure	mmHG	117.3 ± 11.5
Diastolic blood pressure	mmHg	76.2 ± 8.7
Fasting glucose	mg/dL	91.7 ± 11.3
HDL cholesterol	mg/dL	50.4 ± 10.6

Table 2: Correlation between Personality Traits and Metabolic Markers (n=115)

Variables	BMI	WC	SBP	DBP	Glucose	HDL
Neuroticism	0.24	0.30	0.28	0.21	0.34	-0.18
Conscientiousness	-0.27	-0.25	-0.19	-0.22	-0.16	0.29

Table 3: Regression Analysis Predicting Metabolic Markers from Personality (n=115)

Outcome Variable	Neuroticism (β, ρ)	Conscientiousness (β, ρ)	Adjusted R^2
Body mass index (BMI)	0.22, p = 0.024	-0.18, p = 0.047	0.19
Waist circumference (cm)	0.27, p = 0.009	-0.16, p = 0.058	0.21
Systolic BP (mmHg)	0.25, p = 0.015	-0.12, p=0.092	0.17
Diastolic BP (mmHg)	0.19, p = 0.048	-0.21, p = 0.034	0.20
Fasting glucose (mg/dL)	0.30, p = 0.004	-0.13, p = 0.072	0.22
HDL cholesterol (mg/dL)	-0.14, p = 0.069	0.26, p = 0.008	0.23

Table 4: Metabolic Profiles Across Neuroticism Levels (Tertiles) (n=115)

Metabolic Marker	Low N (n=38)	Medium N (=39)	High N (n=38)	p-value
BMI (kg/m^2)	23.2 (3.8)	24.6 (4.1)	26.4 (4.5)	0.018
Waist circumference (cm)	82.1 (9.3)	85.7 (9.1)	89.2 (10.1)	0.009
Systolic BP (mmHg)	114.6 (10.5)	116.8 (11.0)	120.3 (12.1)	0.045
Fasting glucose (mg/dL)	89.2 (10.3)	91.4 (11.1)	94.7 (11.6)	0.027

Table 5: Metabolic Profiles Across Conscientiousness Levels (Tertiles) (n=115)

Metabolic Marker	Low N (n=38)	Medium N (=39)	High N (n=38)	p-value
BMI (kg/m^2)	26.1 (4.3)	24.5 (4.0)	23.8 (3.7)	0.033
Waist circumference (cm)	88.2 (9.7)	84.3 (8.9)	82.7 (9.2)	0.041
Diastolic BP (mmHg)	78.2 (9.0)	75.6 (8.4)	73.8 (7.9)	0.046
HDL Cholesterol (mg/dL)	47.2 (10.4)	50.1 (9.9)	53.5 (10.1)	0.011

4. Discussion

The findings show that higher neuroticism is significantly associated with multiple adverse outcomes, while higher conscientiousness is associated with a more favorable metabolic profile. These associations remained significant even after adjusting for relevant behavioral and demographic covariates, highlighting the unique and independent role of personality traits in shaping early health trajectories. Our findings are consistent with and extend the existing literature, which increasingly recognizes personality traits as stable psychological dispositions with physiological consequences. Neuroticism, a trait characterized by emotional instability, sensitivity to stress, and proneness to negative affect, has been repeatedly implicated in poor physical health outcomes. Multiple studies have demonstrated a link between higher neuroticism and adverse metabolic markers, including increased central adiposity, higher blood pressure, and impaired glycemic control (13,14). Our study affirms these associations in younger populations, suggesting that such risk patterns are detectable even before the onset of clinical metabolic syndrome. In contrast, conscientiousness, characterized by self-discipline, goal-orientation, and impulse control, has been robustly associated with protective health behaviors and better physical outcomes. Previous studies have found that individuals high in conscientiousness are more likely to maintain a healthy weight, follow medical advice, engage in regular exercise, and avoid smoking or excessive alcohol use (15,16). Our study supports this evidence by showing that higher conscientiousness is linked to lower BMI, healthier HDL cholesterol levels, and better blood pressure regulation, even in a relatively young, otherwise healthy populations.

The mechanisms by which personality traits influence metabolic risk are multifaceted and likely to operate via both behavioral and biological pathways. For neuroticism, several overlapping pathways are plausible. Individuals with neuroticism show heightened activation of the hypothalamic-pituitary-adrenal (HPA) axis and sympathetic nervous system in response to stress, which leads to elevated cortisol levels, visceral fat accumulation, and insulin resistance (17). Neurotic individuals are more likely to experience poor sleep quality and mood disturbances, both of which have been independently associated with dysregulated glucose metabolism, blood pressure variability, and systemic inflammation (18). High neuroticism is associated with increased emotional eating, preference for calorie-dense foods, and physical inactivity, behaviors that promote weight gain and elevated metabolic risk (4). Conversely, conscientiousness may exert protective effects through the regulation of daily habits, planning, and long-term adherence to healthy routines. These individuals are more likely to engage in preventive care, maintain stable circadian rhythms, and exhibit better dietary choices. Importantly, these behavioral pathways likely interact with physiological resilience mechanisms, such as reduced oxidative stress and lower basal inflammation, leading to improved cardiometabolic outcomes over time.

The fact that these associations are already observable in young adulthood has critical implications. Most previous work in this domain has focused on middle-aged or older adults when metabolic syndrome is more prevalent. However, our findings demonstrate that the foundations of metabolic risk may be laid down much earlier, and that personality traits could serve as early psychological markers of biological vulnerability. This also helps explain why some preventive interventions fail to achieve lasting change; they do not take into account the stable personality traits that predispose individuals to certain behaviors or stress responses. For example, individuals high in neuroticism may not respond effectively to generic lifestyle advice without additional stress management support. While our results align with studies, some studies have failed to find consistent associations. For instance, a study by Ohseto et al. found no significant relationships between neuroticism and metabolic syndrome but reported links between extraversion and metabolic risk (19). These inconsistencies may reflect differences in sample characteristics, cultural norms regarding emotional expression, or variations in personality assessment tools (e.g., BFI vs. NEO-PI-R). Moreover, studies focused solely on clinical cut-offs (e.g., metabolic syndrome diagnosis) may miss subtler, subclinical risk elevations observable through continuous biomarkers, which our study captured.

These findings reinforce the importance of integrated biopsychosocial models of health. They suggest that physical health outcomes cannot be fully understood or addressed without incorporating psychological dispositions. Personality traits, being relatively stable over time, could serve as valuable predictors in preventing health models and even as screening tools in primary care. On a practical level, interventions could be tailored to personality profiles. For example, individuals high in neuroticism might benefit from structured cognitive-behavioral approaches, mindfulness-based stress reduction, or emotional regulation training (20). Those low in conscientiousness may benefit more from goal-setting, accountability-based coaching, or habit-tracking apps to reinforce routines. This study has several strengths. It is among the few to examine personality-metabolic associations in a young adult cohort, providing early insights into psychological risk profiling. It used objective metabolic measured (e.g., fasting glucose, HDL) alongside validated psychological instruments. Moreover, the inclusion of relevant lifestyle covariates strengthens the validity of our inferences. However, limitations include the cross-sectional design, which limits causal inference. The self-reported nature of personality and lifestyle variables introduces potential bias, although we used validated scales. The sample, while adequate, was limited to a limited population and may not generalize to more socioeconomically diverse or older populations. Future research should employ longitudinal designs to explore how personality traits prospectively predict changes in metabolic health. Additionally, studies should examine interaction effects between traits and explore mediators such as emotional regulation, resilience, social support, and sleep quality. Including biological markers such as cortisol, CRP, or adiponectin may also help clarify physiological pathways.

Finally, personality-informed health interventions could be tested for their impact on long-term metabolic outcomes.

5. Conclusion

This study provides compelling evidence that personality traits, specifically neuroticism and conscientiousness, are associated with key metabolic markers in young adults. These traits may shape early biological vulnerability via behavioral and psychophysiological pathways. Recognizing and integrating personality into metabolic risk assessment and interventions may improve early prevention strategies and contribute to more personalized public health efforts.

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Authors Contribution	
Saif Imdad ,	Conception of study design, acquisition, analysis, and interpretation of data.
Shahjehan Khan	Drafting and methodology, data interpretation
Muneer Ahmed	Analysis and interpretation of data for work & Data Collection