Postprint: A Canonical Correlation Analysis of the Relationship between Subjective Well-being and Personality Traits in Older Adults

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Abstract

Background: With the intensification of population aging, mental health issues among the elderly have become a topic of great societal concern. Existing research indicates that mental health problems in older adults are closely associated with well-being, and personality traits exert a substantial influence on subjective well-being; however, the intrinsic relationship between these two factors in the elderly population remains unclear. Objective: To investigate the relationship between subjective well-being and personality traits in older adults. Methods: From July to August 2022, 511 elderly individuals from Lincun, Tangxia Town, Dongguan City, Guangdong Province were selected as participants. On-site survey investigations of the elderly were conducted using a questionnaire method. The Memorial University of Newfoundland Scale of Happiness (MUNSH) and the Chinese Big Five Personality Inventory-15 (CBF-PI-15) were employed to assess subjective well-being and personality traits, respectively. Pearson correlation analysis was utilized to examine the correlation between subjective well-being and personality traits in older adults, and canonical correlation analysis was performed to construct a standardized canonical correlation model, conduct canonical structure analysis, and canonical redundancy analysis, so as to explore the relationship between subjective well-being and its dimensions with the dimensions of personality traits. Results: The total MUNSH score for the elderly was (39.72$\pm$7.74).$TheMUNSHdimensionscores, fromhighesttolowest, were$: $positiveexperience$(9.48$\pm$3.24), $positiveaffect$(8.61$\pm$2.24), $negativeexperience$(1.44$\pm$2.31), $andnegativeaffec$ $PI-15dimensionscoreswere$: $agreeableness$(14.04$\pm$2.60), $extraversion$(11.77$\pm$4.05), $conscientiousness$(10.7 Pearson correlation analysis revealed that subjective well-being was positively correlated with conscientiousness (r=0.334) and openness (r=0.219) (P<0.05), and negatively correlated with neuroticism (r=-0.223, P<0.05). Canonical correlation analysis showed that the correlation coefficients for the first and

second pairs of canonical variables were 0.476 and 0.331 (P<0.001), respectively. The standardized canonical correlation model indicated that the correlation between the first canonical variable of subjective well-being (U1) and the first canonical variable of personality traits (V1) was primarily characterized by a negative correlation between positive experience and neuroticism, and a positive correlation with conscientiousness. The correlation between the second canonical variable of subjective well-being (U2) and the second canonical variable of personality traits (V2) was mainly manifested as a positive correlation between positive affect, negative affect and neuroticism. Canonical structure analysis demonstrated that U1 was strongly correlated with positive affect, negative affect, positive experience, and negative experience, while U2 was strongly correlated with negative affect and negative experience. V1 was strongly correlated with positive experience, conscientiousness, and openness; V2 was strongly correlated with neuroticism and openness. Canonical redundancy analysis revealed that U1 explained 5.4% of the variance in personality traits, while V1 explained 12.2% of the variance in subjective well-being, indicating that personality traits have a greater influence on subjective well-being than vice versa. Conclusion: Overall, older adults maintain a positive and optimistic attitude with relatively high levels of subjective well-being. Subjective well-being is closely associated with neuroticism and conscientiousness. Future interventions may adopt tailored strategies based on different personality characteristics to enhance subjective well-being, preserve mental health among older adults, and proactively address population aging.

Full Text

Research on the Relationship between Subjective Well-being and Personality Traits in the Elderly Based on Canonical Correlation Analysis

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Abstract

Background
With the intensification of population aging, mental health issues among older adults have become a major societal concern. Previous research has demonstrated close links between mental health problems and subjective well-being in the elderly, while also showing that personality traits significantly influence subjective well-being. However, the internal relationship between these constructs in older populations remains unclear.

Objective
To explore the relationship between subjective well-being and personality traits among older adults.

Methods
From July to August 2022, we conducted a field survey of 511 elderly residents in Lincun, Tangxia Town, Dongguan City, Guangdong Province using questionnaires. Subjective well-being was assessed with the Memorial University of Newfoundland Scale of Happiness (MUNSH), and personality traits were evaluated using the Chinese Big Five Personality Inventory-15 (CBF-PI-15). Pearson correlation analysis examined associations between subjective well-being and personality traits. Canonical correlation analysis was then performed to construct a standardized canonical correlation model, conduct canonical structure analysis, and perform canonical redundancy analysis to investigate relationships between dimensions of subjective well-being and personality traits.

Results
The total MUNSH score was (39.72$\pm$7.74).$Dimensionscoresfromhighesttolowestwere:$
$positiveexperience(9.48\pm3.24), positiveaffect(8.61\pm2.24), negativeexperience(1.44\pm2.31), andnegativeaffec$
$PI-15dimensionscoreswere: agreeableness(14.04\pm2.60), extraversion(11.77\pm4.05), conscientiousness(10.7$
Pearson correlation analysis revealed that subjective well-being was positively correlated with conscientiousness (r=0.334) and openness (r=0.219) (P<0.05), and negatively correlated with neuroticism (r=-0.223, P<0.05). Canonical correlation analysis showed correlation coefficients of 0.476 and 0.331 for the first and second pairs of canonical variables, respectively (P<0.001). The standardized canonical correlation model indicated that the relationship between the first canonical variable of subjective well-being (U1) and the first canonical variable of personality traits (V1) primarily manifested as a negative correlation between positive experience and neuroticism, and a positive correlation between positive experience and conscientiousness. The relationship between the second canonical variable of subjective well-being (U2) and the second canonical variable of personality traits (V2) primarily showed positive associations of positive affect and negative affect with neuroticism. Canonical structure analysis revealed that U1 was strongly correlated with positive affect, negative affect, positive experience, and negative experience, while U2 was strongly correlated with negative affect and negative experience. V1 showed strong correlations with positive experience, conscientiousness,

and openness, whereas V2 was strongly correlated with neuroticism and openness. Canonical redundancy analysis demonstrated that U1 explained 5.4% of variance in personality traits, while V1 explained 12.2% of variance in subjective well-being, indicating that personality traits exert a stronger influence on subjective well-being than vice versa.

Conclusion
Overall, the elderly participants demonstrated a positive and optimistic attitude with high levels of subjective well-being, which was closely related to neuroticism and conscientiousness. Future interventions targeting specific personality characteristics may enhance subjective well-being, maintain mental health among older adults, and promote active responses to population aging.

Keywords: Aged; Subjective well-being; Personality trait; Big five personality traits; Canonical correlation analysis

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Introduction

The trend of population aging is becoming increasingly severe. Beyond meeting material needs, attention to mental health among older adults has emerged as a social priority. In the context of actively responding to population aging, the 14th Five-Year Plan emphasizes continuously enhancing people' s sense of gain, happiness, and security while improving the elderly care service system [1]. Subjective well-being refers to individuals' emotional and cognitive evaluations of their life circumstances, encompassing life satisfaction, self-fulfillment, pleasure, and tranquility, as well as the experience of positive emotions and absence of negative emotions. It represents a crucial indicator for assessing mental health status in older adults [2], and research suggests that improving subjective well-being can ameliorate psychological problems among the elderly [1,3-4]. Among various influencing factors, personality traits constitute the most core determinant of subjective well-being [5]. Researchers typically define personality as a dynamic, organized set of characteristics that influence individuals' cognition, motivation, and behavior across different situations [6]. After extensive validation by personality researchers, consensus has emerged that the fundamental structure of personality comprises five major factors: neuroticism, conscientiousness, agreeableness, openness, and extraversion [7].

International studies have investigated the relationship between subjective well-being and personality traits [8-9], while domestic research has primarily focused on students [10] and teachers [11], with limited attention to elderly populations. Existing studies typically employ simple correlation and regression analyses to examine relationships between single or multiple personality dimensions and overall subjective well-being, rarely comparing correlations across all dimensions of both constructs. This study aims to explore the relationship between subjective well-being and personality traits in older adults using canonical correlation analysis to examine associations among all dimensions, thereby providing

a theoretical basis for improving subjective well-being and actively addressing population aging.

Methods

1.1 Study Participants This study selected elderly residents of Lincun, Tangxia Town, Dongguan City, Guangdong Province as participants from July to August 2022. Inclusion criteria were: (1) clear consciousness with reading/writing ability or capacity to answer questions normally; (2) age $\geq$ 60 years according to WHO classification; and (3) voluntary participation. Exclusion criteria included: (1) severe physical illness; (2) disability or blindness; and (3) intellectual disability or severe mental illness preventing comprehension of the questionnaire. The study was approved by the Ethics Committee of Guangdong Medical University (Approval No.: YS2022092), and all participants provided informed consent.

A total of 511 questionnaires were distributed with a 100% response rate. After review, 499 valid questionnaires were obtained (e.g., complete and properly answered without omissions or random responses), yielding a validity rate of 97.65%. The sample size was calculated using the cluster sampling formula: n = deff $\times$ $[(Z\alpha/2\sigma)/\delta]^2$, where $\alpha = 0.05$ (two-tailed), $Z\alpha/2 = 1.96$, $\delta = 0.25\sigma$ [14], with a design effect of 2 for cluster sampling, resulting in a required sample size of 123 cases. Considering a 10% non-response rate, the final calculated sample size was 137 cases, which this study exceeded.

1.2 Instruments 1.2.1 Basic Information Questionnaire
We used a self-designed questionnaire to collect data on gender, age, residential area, religious beliefs, physical condition (disability status), household registration status, education level, marital status, and living arrangement.

1.2.2 Memorial University of Newfoundland Scale of Happiness (MUNSH)
Subjective well-being was assessed using the MUNSH [12], which comprises 24 items across four dimensions: positive affect (PA; 5 items), negative affect (NA; 5 items), positive experience (PE; 7 items), and negative experience (NE; 7 items). Scoring was as follows: Item 19 ("current residence" = 2 points, "other residence" = 0 points); Item 23 ("satisfied" = 2 points, "dissatisfied" = 0 points); all other items ("yes" = 2 points, "unclear" = 1 point, "no" = 0 points). Each item scored 0-2 points, with total MUNSH score = PA - NA + PE - NE, ranging from -24 to +24. For convenience, a constant of 24 was added, resulting in a final range of 0-48, where higher scores indicate greater well-being. The Cronbach' s α was 0.853 and validity was 0.700, indicating good reliability and validity.

1.2.3 Chinese Big Five Personality Inventory-15 (CBF-PI-15)
Personality traits were evaluated using the CBF-PI-15 developed by ZHANG et

al. [13] based on the Chinese Big Five Personality Inventory-Brief (CBF-PI-B). This 15-item scale includes five dimensions: neuroticism (N), conscientiousness (C), agreeableness (A), openness (O), and extraversion (E), with three items per dimension. A 6-point Likert scale was used, ranging from 1 (completely disagree) to 6 (completely agree), with items 2 and 5 reverse-scored. Cronbach's α values for N, C, A, O, and E dimensions were 0.747, 0.611, 0.740, 0.803, and 0.738, respectively, indicating good reliability.

1.3 Data Collection We employed a questionnaire survey method using cluster sampling to survey 511 elderly residents in Lincun, Tangxia Town, Dongguan City. Prior to implementation, survey team members received standardized training to ensure uniform procedures and instructions. During data collection, researchers fully informed participants about the study purpose, strictly maintained confidentiality, coded all participant information to protect privacy, and obtained informed consent after briefly introducing themselves and the survey content.

1.4 Statistical Analysis Data were double-entered into Excel to ensure accuracy and analyzed using SPSS 26.0. Normality of continuous variables was assessed using skewness and kurtosis tests; data were considered normally distributed when absolute skewness < 3 and absolute kurtosis < 10 [15]. Normally distributed continuous data are presented as ($\bar{x}\pm s$), and categorical data as frequencies and percentages. Pearson correlation analysis examined relationships between subjective well-being and personality traits. Canonical correlation analysis was performed to construct a standardized canonical correlation model, conduct canonical structure analysis, and perform canonical redundancy analysis to explore relationships between dimensions of subjective well-being and personality traits. In canonical structure analysis, $r > 0.7$ indicated strong correlation, 0.5-0.7 good correlation, 0.3-0.5 moderate correlation, and < 0.3 weak correlation [16]; this study used $|r| > 0.4$ as the threshold for strong correlation. Statistical significance was set at $P < 0.05$.

Results

2.1 General Characteristics of Participants A total of 499 valid questionnaires were collected. The sample included 206 males and 293 females, with 219 aged 60-70 years, 244 aged 70-80 years, and 36 aged over 80 years. Regarding residence, 11.02% (55/499) lived in urban areas and 88.98% (444/499) in rural areas. Most participants (96.39%, 481/499) had no religious beliefs, while 3.61% (4/499) had disabilities. For household registration, 13.83% (69/499) were non-local residents and 86.17% (430/499) were local residents. In terms of education, 14.23% (71/499) had no formal education, 46.09% (230/499) had primary school education, 27.86% (139/499) had junior high school education, 11.22% (56/499) had high school/technical secondary education, 0.40% (2/499) had col-

lege/vocational education, and 0.20% (1/499) had bachelor' s degree or higher. Regarding marital status, 78.76% (393/499) were married, 1.00% (5/499) unmarried, 0.20% (1/499) divorced, and 20.04% (100/499) widowed. For living arrangements, 6.81% (34/499) lived alone and 93.19% (465/499) lived with others.

2.2 Normality Tests The total MUNSH score showed skewness of -1.688 and kurtosis of 2.926. Dimension scores were: PA (skewness -2.044, kurtosis 4.265), NA (skewness 2.381, kurtosis 6.044), PE (skewness -1.054, kurtosis 0.153), and NE (skewness 2.202, kurtosis 6.079). For CBF-PI-15 dimensions: A (skewness -1.433, kurtosis 3.734), E (skewness -0.254, kurtosis -0.807), C (skewness -0.572, kurtosis -0.237), O (skewness 0.742, kurtosis -0.231), and N (skewness 0.695, kurtosis -0.409). All variables were considered normally distributed.

2.3 MUNSH and CBF-PI-15 Scores The total MUNSH score was $(39.72\$\pm7.74), significantly higher than the national norm of (28.70\pm10.72) (t = 31.791, P < 0.001)$[17]. $Dimension scores from highest to lowest were : PE(9.48\pm3.24), PA(8.61\pm2.24), NE(1.44\pm2.31), and NA(0.93\pm1.80). CBF - PI-15 dimension scores from highest to lowest were : A(14.04\pm2.60), E(11.77\pm4.05), C(10.75\pm3.57), O(7.20\pm3.$

2.4 Pearson Correlation Analysis Pearson correlation analysis revealed that PA was positively correlated with C, O, and E ($P < 0.05$). NA was negatively correlated with C ($P < 0.05$) and positively correlated with N ($P < 0.05$). PE was negatively correlated with N ($P < 0.05$) and positively correlated with C and O ($P < 0.05$). NE was positively correlated with N ($P < 0.05$) and negatively correlated with C and A ($P < 0.05$). Total subjective well-being scores were positively correlated with C and O ($P < 0.05$) and negatively correlated with N ($P < 0.05$) .

Table 1 Correlation analysis of subjective well-being and its dimensions with each dimension of personality traits in the elderly (r values)

[Table content would be inserted here with PA, NA, PE, NE correlations with N, C, A, O, E]

2.5 Canonical Correlation Analysis 2.5.1 Canonical Correlation Results

Using subjective well-being as the X variable set (X1=PA; X2=NA; X3=PE; X4=NE) and personality traits as the Y variable set (Y1=N; Y2=C; Y3=A; Y4=O; Y5=E), canonical correlation analysis yielded four pairs of canonical variables. The first two pairs showed statistically significant canonical correlation coefficients ($P < 0.001$): the first pair had a correlation coefficient of 0.476 with an eigenvalue contribution rate of 67.3%; the second pair had a correlation coefficient of 0.331 with a contribution rate of 28.3%. The cumulative contribution rate of the first two pairs was 95.6%, indicating that the correlation between

subjective well-being and personality traits was primarily explained by the first pair .

Table 2 Canonical correlation analysis between subjective well-being and personality traits of the elderly

[Table content showing first pair: 0.476, Wilks' lambda 20.000, P<0.001; second pair: 0.331, Wilks' lambda 12.000, P<0.001]

2.5.2 Standardized Canonical Correlation Model

In the first pair, the large absolute coefficient for X3 indicated that U1 was primarily determined by PE. The coefficients for Y1 and Y2 were 0.518 and -0.763, respectively, indicating that N and C were the main determinants of V1. In the second pair, coefficients for X1 and X2 were -0.759 and -0.806, respectively, showing that U2 was jointly determined by PA and NA. The coefficient for Y1 was -0.765, indicating that N was the primary determinant of V2 .

Table 3 Standardized canonical correlation model between subjective well-being and personality traits of the elderly

[Table content showing the equations for U1, V1, U2, V2]

2.5.3 Canonical Structure Analysis

U1 was negatively correlated with X1, X3, Y2, Y3, Y4, and Y5, and positively correlated with X2, X4, and Y1, showing strong correlations with X1, X2, X3, and X4. U2 was positively correlated with Y3 and negatively correlated with all other variables, with strong correlations with X2 and X4. V1 was negatively correlated with X1, X3, Y2, Y3, Y4, and Y5, and positively correlated with X2, X4, and Y1, showing strong correlations with X3, Y2, and Y4. V2 was positively correlated with Y3 and negatively correlated with all other variables, with strong correlations with Y1 and Y4 .

Table 4 Typical structure analysis of subjective well-being and personality traits of the elderly (r values)

[Table content showing correlation matrix]

2.5.4 Canonical Redundancy Analysis

U1 explained 53.9% of within-group variance in the X variable set and 5.4% of variance in the Y variable set. V1 explained 24.1% of within-group variance in the Y variable set and 12.2% of variance in the X variable set, confirming that personality traits have a greater influence on subjective well-being than the reverse .

Table 5 Canonical redundancy analysis of subjective well-being and personality traits of the elderly (%)

[Table content showing explained variance percentages]

Discussion

3.1 Current Status of Subjective Well-being and Personality Traits Based on previous scoring classifications where MUNSH total score $\geq$ 36 indicates high well-being, $\leq$ 12 indicates low well-being, and intermediate scores indicate moderate well-being [18], the elderly participants in this study achieved a total score of (39.72$±$7.74), indicating high well-being that significantly exceeded the national norm [17]. This aligns with findings from Liu et al. [19], suggesting that older adults in Dongguan City, Guangdong Province generally experience high levels of well-being, possibly due to low rates of solitary living. The high scores on PE and PA dimensions indicate abundant positive emotions and experiences among these older adults.

In contrast, Long et al. [3] reported that rural empty-nest elderly had a subjective well-being score of (21.33$±$1.36), substantially lower than our findings. Li et al. [20] found that solitary older adults showed significantly higher negative factors than non-solitary elders, as long-term solitary living leads to monotonous lifestyles, lack of family and companionship, unmet emotional needs, and consequent feelings of loss and loneliness. In our study, while 88.98% (444/499) of participants lived in rural areas, only 7.43% (33/444) of rural-dwelling elderly lived alone, suggesting that solitary living may reduce well-being levels.

Regarding personality traits, CBF-PI-15 scores were highest for agreeableness (14.04$±2.60), $followedbyextraversion(11.77±4.05), conscientiousness(10.75±3.57), openness(7.20±3.90), an$ Overall, participants exhibited positive personality profiles, consistent with Tang et al. [21]. The high agreeableness scores likely reflect older adults' characteristics of warmth, kindness, amiability, and helpfulness, aligning with the compassionate and cooperative nature of this trait [8]. The lowest neuroticism scores may reflect emotional stability in later life, with personality features tending toward modesty and calm self-confidence [22], as neuroticism primarily manifests as emotional instability, distress, and anxiety. Liu [23] reported higher agreeableness but lower conscientiousness among older adults, differing from our findings—possibly due to variations in regional economic levels and urban-rural differences [24].

3.2 Relationship between Subjective Well-being and Big Five Personality Traits This study found close connections between subjective well-being and Big Five personality traits. Pearson correlation analysis showed positive correlations between subjective well-being and conscientiousness, agreeableness, openness, and extraversion, and negative correlations with neuroticism, consistent with research by Liu [10], Li et al. [11], and Li et al. [25]. These findings suggest that individuals scoring higher on conscientiousness, agreeableness, openness, and extraversion tend to have higher well-being than those scoring high on neuroticism. Three potential explanations emerge: (1) Environmental influences on personality formation [26]—currently, China' s stable and harmonious social environment fosters positive personality tendencies across age groups, thereby enhancing subjective well-being; (2) Optimization of elderly

care services ensuring support and security, coupled with diverse recreational activities, meets both material and spiritual needs and strengthens subjective well-being; and (3) Personality traits influence behavioral patterns and emotions [8]—conscientiousness, agreeableness, openness, and extraversion manifest as positive behaviors and attitudes, whereas neuroticism predisposes individuals to negative emotions, reducing life satisfaction and subjective well-being.

While previous research examined correlations between single or multiple personality dimensions and overall subjective well-being using simple correlation and regression analyses, our study employed canonical correlation analysis to investigate relationships across all dimensions comprehensively. Results showed that subjective well-being was primarily influenced by positive experiences, with close ties to neuroticism and conscientiousness. Positive affect and positive experience were negatively correlated with neuroticism—individuals with pronounced neuroticism tendencies experience more negative emotions and fewer positive experiences, resulting in lower well-being. Positive experience was positively correlated with conscientiousness, reflecting self-discipline, caution, and self-regulation abilities, consistent with Abdullahi et al. [8]. This suggests that highly conscientious individuals experience more frequent positive affect, higher life satisfaction, and fewer negative emotions, as they are more likely to regulate negative emotions effectively, thereby enhancing subjective well-being [27].

This study has several limitations. First, while Lincun was selected for its large, concentrated elderly population facilitating data collection, the single-region sample limits generalizability. Future research should examine different types of older adults across various economic regions to enhance robustness and representativeness. Second, this cross-sectional design establishes correlation rather than causation. Third, reliance on questionnaires and scales introduces subjectivity; future studies should integrate objective health examination data for more comprehensive and convincing results.

In conclusion, this study provides an in-depth exploration of the relationship between subjective well-being and personality traits in older adults. The findings indicate that positive personality traits enhance subjective well-being, with relationships primarily manifesting as positive correlations between positive experience and conscientiousness, and negative correlations with neuroticism. Personality traits exert a stronger influence on subjective well-being than the reverse. Future interventions should address the specific needs of older adults with different personality characteristics through psychological interventions, emotion regulation strategies, music therapy, narrative therapy, and physical exercise [28] to improve subjective well-being, address psychological problems, and inform more scientific and precise elderly care strategies for maintaining physical and mental health while actively responding to population aging.

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Note: Figure translations are in progress. See original paper for figures.