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Relationship between big five personality profile and quality of life in patients with knee osteoarthritis patients after total knee replacement: a cross-sectional study

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ABSTRACT

Introduction: Knee osteoarthritis (KOA) is a leading cause of disability worldwide; however, the role of personality traits in shaping quality of life (QoL) after total knee replacement (TKR) remains poorly understood, particularly in non-Western populations. This study investigated the relationship between Big Five personality profiles and QoL in patients with KOA who underwent TKR.

Methods: This cross-sectional observational study was conducted in 2019–2020 and involved 91 patients who underwent TKR between January 2015 and December 2017. Personality was assessed using the Big Five Inventory-44 (BFI-44), while quality of life was measured using the WHOQOL-BREF. Data were analyzed using Spearman's correlation and Mann–Whitney tests.

Results: Most participants were women (74.7%) and aged 63–66 years (69.3%). The predominant personality profile featured low openness (80.2%), high conscientiousness (92.3%), high extraversion (89.0%), high agreeableness (83.5%), and low neuroticism (85.7%). Social relationships scored highest (65.56±7.228) and physical health lowest (58.77±3.442). No significant correlation was found between any personality domain and QoL measures (all p>0.05).

Conclusions: No statistically significant relationship was found between Big Five personality profiles and QoL in patients with post-TKR KOA. The observed personality patterns reflect Asian collectivist cultural norms. Physical recovery demands may overshadow personality influences on QoL in this population. Longitudinal studies with larger, culturally diverse samples are warranted.

Keywords: big five personality, knee osteoarthritis, quality of life, total knee replacement, WHOQOL-BREF

Introduction

Knee osteoarthritis (KOA) is a major global health challenge, particularly for the older segment of the population. This condition affects approximately 22.9% of persons aged 40 years and above, with a higher prevalence among females (Cui *et al.*, 2020). The global trend of increasing prevalence has continued owing to an aging population and rising rates of obesity (Cui *et al.*, 2020; Yang *et al.*, 2023; Wang and Ye, 2024). KOA severely affects the quality of life and is among the most incapacitating diseases. Therefore, KOA imposes significant years lived with disability (YLD) because of

the burden on many health systems worldwide (Yang *et al.*, 2023).

In Indonesia, KOA represents a substantial public health burden. National data indicate that KOA affects approximately 7.3% of the Indonesian population, with higher rates in elderly women aged > 65 years (Riskesdas, 2018). Indonesia's demographic profile—characterized by a rapidly aging population, high rates of obesity, and distinct cultural attitudes toward pain expression and healthcare-seeking behavior—shapes both the epidemiology and experience of KOA. Cultural values such as nrimo (acceptance) and gotong royong (mutual assistance) influence how Indonesian patients perceive pain and engage with rehabilitation, factors that are particularly relevant when examining the psychosocial determinants of post-surgical outcomes.

KOA has far-reaching effects, extending beyond physical incapacity. Chronic pain, stiffness, and mobility limitations in patients with KOA place a substantial burden on daily activities (Wojcieszek *et al.*, 2022; Fazaa *et al.*, 2024). Evidence has presented that KOA affects physical functioning as well as the mental and social aspects of quality of life (QoL) (Lamini N'Soundhat, Ntsiba and Bileckot, 2020; Wojcieszek *et al.*, 2022; Tekaya *et al.*, 2023). Such functional limitations are frequently encountered in the elderly population, to whom QoL measurements have a high correlation (Fazaa *et al.*, 2024).

Total knee replacement (TKR) has been performed for several years as the main surgical operation in patients with end-stage KOA. This knee procedure provides enormous relief from pain, coupled with the restoration of function (Gomoll *et al.*, 2016). Although most patients find TKR beneficial, a number report significant persistent pain and loss of function, even after surgery (Menzies and Hawkins, 2015; Belford *et al.*, 2020). More recent studies have emphasized the importance of psychological factors in surgical outcomes. Depressive symptoms, anxiety, and pain catastrophizing are major predictors of TKR outcomes (Belford *et al.*, 2020). The Pre-operative psychological state has been found to affect post-operative pain, stiffness, and overall functioning and recovery (Belford *et al.*, 2020). There is evidence to suggest that targeting the treatment of these psychological factors could improve surgical outcomes and satisfaction in these patients (Isaji *et al.*, 2025).

The Big Five personality model is one of the most widely validated frameworks for understanding individual personality differences. It comprises five broad dimensions: openness to experience, conscientiousness, extraversion, agreeableness, and neuroticism, often referred to as the acronym OCEAN (John and Srivastava, 1999). These traits have demonstrated cross-cultural consistency and predictive validity for a range of health behaviors and outcomes (McCrae and Costa, 1997). In medical contexts, Big Five traits have been linked to treatment adherence, healthcare utilization, and health-related quality of life across diverse conditions (Kuwornu *et al.*, 2025; Dwan and Ownsworth, 2019). In the field of psychology, personality traits may be important predictors of surgical outcomes. Research has found that neuroticism is associated with worse total knee replacement (TKR) outcomes (Belford *et al.*, 2020; Moghtadaei *et al.*, 2020). Although research suggests that traits such as extraversion may not grossly affect postoperative outcomes, depression is certainly a significant factor in recovery (Moghtadaei *et al.*, 2020).

However, there is a glaring gap in the research concerning the wide-ranging influence of personality profiles on TKR outcomes. Although the literature deals with psychological factors and their effects on TKR outcomes, the impact of the Big Five personality traits remains an under-researched area (Belford *et al.*, 2020; Moghtadaei *et al.*, 2020). Most existing studies focus on individual symptoms, such as depression or anxiety, with limited exploration of broad personality profiles (Belford *et al.*, 2020; Moghtadaei *et al.*, 2020). Furthermore, research on this relationship in Asian populations, particularly in Indonesia, where cultural factors may significantly influence both personality expression and QoL perception, is notably scarce. Therefore, this study aimed to investigate the correlation between Big Five personality profiles and QoL in patients with KOA after TKR.

Materials and Methods

Research Design

This study employed an observational analytic approach with a cross-sectional design. Data were collected at the Department of Orthopaedics and Traumatology, RSUD Dr. Soetomo, Surabaya, a major tertiary referral center in East Java, Indonesia, which performs a high volume of TKR annually, making it an appropriate setting for this study. The independent variable was the Big Five personality traits (openness, conscientiousness, extraversion, agreeableness, and neuroticism), and the dependent variable was quality of life. Confounding variables included age, sex, education level, occupation, comorbid diseases, and post-operative factors (pain, mobility, and rehabilitation).

Population and Sample

The target population comprised patients with grade III–IV knee osteoarthritis who had undergone total knee replacement (TKR) using Medacta implants between January 2015 and December 2017 at the RSUD Dr. Soetomo. The study included patients who fulfilled all the inclusion criteria and did not meet any of the exclusion criteria. After obtaining ethical approval, the research was conducted at RSUD Dr. Soetomo, Surabaya, between November 2019 and March 2020.

Inclusion and Exclusion Criteria

The inclusion criteria were as follows: (1) patients who had completed at least six months post-TKR, (2) willingness to participate in the study, and (3) ability to communicate verbally and in writing in the Indonesian language. The exclusion criteria were as follows: (1) patients who experienced post-operative TKR complications and (2) patients who had been under psychopharmacological treatment (antipsychotics, antidepressants, benzodiazepines) within the previous two weeks. The drop-out criteria were as follows: (1) patients who withdrew from the study and (2) patients who did not complete the questionnaires.

Sample Size

The sample size was calculated using the correlational sample size formula with a significance level of 0.05 and power of 80%, yielding a minimum requirement of 30 subjects. However, the actual study included all eligible patients who underwent TKR during the specified timeframe and met the inclusion criteria. Of the 118 patients screened, 27 were excluded (15 had post-operative complications, 8 declined participation, and 4 were receiving psychopharmacological treatment), resulting in a final sample of 91 participants.

Research Instruments

This study utilized two validated questionnaires without biological materials and was conducted in collaboration with the Department of Orthopedics and Traumatology.

WHOQOL-BREF: The WHOQOL-BREF, a shortened version of WHOQOL-100, assesses quality of life across four domains: physical health (7 items), psychological (6 items), social relationships (3 items), and environment (8 items), with two additional facets for overall quality of life and general health. Responses were rated on a five-point Likert scale (1=very dissatisfied/very poor to 5=very satisfied/very good). Raw scores were calculated by summing item responses within each domain and then transformed to a 0-100 scale using the following formula: (actual raw score - lowest possible raw score) / possible raw score range × 100. Higher scores indicate better quality of life. The Indonesian version of WHOQOL-BREF, validated by Purba *et al*. (2018), has demonstrated good validity (correlation coefficients ranging from 0.69 to 0.89) and reliability (Cronbach's alpha = 0.89).

Big Five Inventory-44 (BFI-44): The BFI-44 measures five personality dimensions: openness (10 items), conscientiousness (9 items), extraversion (8 items), agreeableness (9 items), and neuroticism (8 items). The 44-item questionnaire uses a 1-5 Likert scale (1=strongly disagree to 5=strongly agree), with some items reverse-scored to control for response bias. Scores were categorized as high or low using domain-specific midpoints based on the scoring range of the original instrument: openness (≥30), conscientiousness (≥32), extraversion (≥28), agreeableness (≥32), and neuroticism (≥24). These midpoints represent the midrange of each domain's theoretical score range and were applied as a pragmatic categorization approach; they are not empirically validated clinical cut-offs, and this limitation should be considered when interpreting categorical findings. The Indonesian adaptation of the BFI-44 (Ramdhani, 2012) has shown acceptable validity (correlation coefficients >0.30) and reliability (Cronbach's $\alpha = 0.71–0.84$).

Data Collection

After obtaining research permits from the RSUD Dr. Soetomo (No. 070/7344/436.7.11/2019, dated November 25, 2019), eligible patients were identified through medical records and contacted by telephone. Those who agreed were scheduled for appointments at the hospital, where the researchers explained the study purpose and procedures and obtained written informed consent. Participants completed both questionnaires in a private and comfortable setting with trained research assistants available to answer questions.

Statistical Analysis

Data were analyzed for normality using the Shapiro–Wilk test. Non-parametric methods were employed because of the non-normal distribution of all variables: Spearman's correlation was used to examine the relationships between personality domain scores and QoL measures, and the Mann–Whitney U test was used to compare QoL between high and low personality categories. Statistical significance was set at $P < 0.05$. All analyses were performed using SPSS.

Ethical Considerations

This study was approved by the Health Research Ethics Committee of RSUD Dr. Soetomo Surabaya (No. 0209/KEPK/VI/2020, issued on April 15, 2020) prior to participant recruitment and data collection. All procedures performed in this study involving human participants were conducted in accordance with the ethical standards of the institutional research committee and the 1964 Declaration of Helsinki and its later amendments. This study adhered to current biomedical experimentation regulations and guidelines. All participants provided written informed consent prior to their inclusion in the study after being fully informed about the study's purpose, procedures, potential risks, and benefits. Participant confidentiality and privacy were maintained throughout the research process, and all personal identifying information was securely protected in compliance with data protection regulations.

Table 1. Demographic Characteristics of Respondents

Variable	n	%
Gender		
Male	23	25.3
Female	68	74.7
Age (years)		
55 - 56	2	2.2
57 - 58	2	2.2
59 - 60	4	4.4
61 - 62	3	3.3
63 - 64	28	30.8
65 - 66	35	38.5
67 - 68	14	15.4
69 - 70	3	3.3
Religion		
Islam	80	87.9
Protestantism	3	3.3
Catholicism	5	5.5
Buddhism	3	3.3
Education		
No formal education	6	6.6
Elementary school	5	5.5
Junior high school	38	41.8
Senior high school	37	40.7
Bachelor's degree	5	5.5
Employment Status		
Unemployed	45	49.5
Part-time work	45	49.5
Full-time work	1	1.1

Results

Demographic Characteristics of Respondents

The sample comprised 91 participants, predominantly female (74.7%) and aged 63–66 years (69.3%). Most were Muslims (87.9%), and the majority had junior or senior high school education. Nearly half were unemployed (49.5%), and half worked part-time (49.5%).

Personality Profile an QoL

As shown in Tables 2 and 3, the predominant personality profile featured low openness (80.2%), high conscientiousness (92.3%), high extraversion (89.0%), high agreeableness (83.5%), and low neuroticism (85.7%). Most participants rated their overall QoL as good (58.2%) or very good (15.4%). Social relationships scored highest (65.56 ± 7.228) across the four domains, and physical health scored lowest (58.77 ± 3.442).

Quality of Life Assessment

Overall, the quality of life and general health perceptions were predominantly positive (Table 4). Most participants rated their overall quality of life as good (58.2%) or very good (15.4%), with smaller percentages rating it as average (16.5%) or poor (9.9%). Similarly, general health was most commonly rated as good (61.5%), followed by average (29.7%), very good (4.4%), and poor (4.4%). No participants rated their overall quality of life or general health as very poor.

Statistical Analysis

The Shapiro-Wilk normality test showed that the data for all personality and quality-of-life domains were not normally distributed ($p < 0.05$). Therefore, nonparametric statistical methods were employed for the correlation and comparative analyses.

Table 2. Big Five Personality Domain and QoL Scores

Domain	Mean ± SD	Median	Min	Max
Openness (O)	26.15 ± 6.261	26.00	15	41
Conscientiousness (C)	32.75 ± 3.863	33.00	22	38
Extraversion (E)	29.33 ± 4.232	30.00	16	34
Agreeableness (A)	32.91 ± 4.802	35.00	20	39
Neuroticism (N)	19.49 ± 3.796	18.00	15	30
Physical Health	58.77 ± 3.442	56.00	56	63
Psychological	60.68 ± 4.896	63.00	56	69
Social Relationships	65.56 ± 7.228	69.00	56	75
Environment	65.24 ± 7.460	69.00	56	75

Table 3. Low-High Category of Big Five Personality Domains

Category	n	%
Openness		
Low (<30)	73	80.2
High (≥30)	18	19.8
Conscientiousness		
Low (<32)	7	7.7
High (≥32)	84	92.3
Extraversion		
Low (<28)	10	11.0
High (≥28)	81	89.0
Agreeableness		
Low (<32)	15	16.5
High (≥32)	76	83.5
Neuroticism		
Low (<24)	78	85.7
High (≥24)	13	14.3

Table 4. Overall Quality of Life and General Health

Variable	n	%
Overall Quality of Life		
Poor	9	9.9
Fair	15	16.5
Good	53	58.2
Very Good	14	15.4
General Health		
Poor	4	4.4
Fair	27	29.7
Good	56	61.5
Very Good	4	4.4

Correlation Between Personality and Quality of Life

Spearman's correlation analysis (Tables 5 and 6) revealed no significant relationships between any personality domain and QoL measures, including overall QoL, general health, and all four domain scores (all $p > 0.05$).

Comparison of Quality of Life Between Personality Categories

The results of Mann–Whitney U tests (Table 7) revealed no significant differences in QoL between high and low categories for any personality domain (all $p > 0.05$). Although not statistically significant, descriptive trends suggested that participants with high Conscientiousness, Extraversion, and Agreeableness, and low Neuroticism tended to report slightly better QoL.

Table 5. Spearman Correlation Test Between Personality Scores and Overall Quality of Life and General Health

Variable	Overall Quality of Life		General Health	
	p	r_s	p	r_s
Openness (O)	0.986	-0.002	0.913	0.012
Conscientiousness (C)	0.826	0.023	0.353	0.098
Extraversion (E)	0.391	-0.091	0.611	-0.054
Agreeableness (A)	0.489	0.074	0.29	0.112
Neuroticism (N)	0.861	0.019	0.804	-0.026

Table 6. Spearman Correlation Test Between Personality Scores and Physical Health, Psychological, Social Relationships, and Environmental Domains

Variable	Physical Health		Psychological		Social Relationship		Environment	
	p	r_s	p	r_s	p	r_s	p	r_s
Openness (O)	0.261	0.119	0.875	-0.017	0.458	0.079	0.107	0.170
Conscientiousness (C)	0.961	-0.005	0.978	-0.003	0.582	-0.059	0.815	-0.025
Extraversion (E)	0.399	-0.09	0.974	0.004	0.964	-0.005	0.646	-0.049
Agreeableness (A)	0.139	-0.156	0.649	0.048	0.490	0.073	0.184	-0.141
Neuroticism (N)	0.253	0.121	0.472	0.076	0.482	0.075	0.163	0.147

Table 7. Mann-Whitney Non-Parametric Test

Variable	Overall Quality of Life	General Health
	p	p
Openness (O)	0.474	0.830
Conscientiousness (C)	0.961	0.978
Extraversion (E)	0.399	0.974
Agreeableness (A)	0.694	0.604
Neuroticism (N)	0.253	0.472

Discussions

The study predominantly included elderly (63–66 years, 69.3%) and female (74.7%) participants, aligning with global osteoarthritis epidemiology. Age-related OA prevalence is linked to cumulative cartilage degeneration, oxidative stress, and reduced tissue repair capacity (Cui *et al.*, 2020). The sex disparity in our data is consistent with epidemiological findings demonstrating that women > 50 years have a higher prevalence of OA (18%) than men (13%), attributed to postmenopausal estrogen decline affecting cartilage metabolism, anatomical differences, including a wider pelvic structure and greater knee valgus angle, and relatively lower muscle mass providing joint protection (Molendijk *et al.*, 2021).

The personality profile of the respondents was characterized by low openness, high conscientiousness, high extraversion, high agreeableness, and low neuroticism. This constellation of traits describes individuals who are practical, disciplined, sociable, cooperative, and emotionally stable. This profile reflects broader patterns observed in Indonesian populations, consistent with collectivist cultural values that emphasize social harmony and adherence to social norms (Pristyna *et al.*, 2022). From a theoretical perspective, high conscientiousness is linked to better adherence to rehabilitation regimens and goal-oriented recovery (Staniute *et al.*, 2015); high agreeableness facilitates cooperative relationships with healthcare providers and enhances social support (Ghiggia *et al.*, 2021); and low neuroticism supports emotional stability during postsurgical recovery.

WHOQOL-BREF results indicate that most participants rated their quality of life as good (58.2%), with the highest scores in social relationships (65.56) and environment (65.24) domains, and the lowest in physical health (58.77). The prominence of social relationships scores aligns with cultural psychology literature, suggesting that in collectivist Asian cultures, social support and harmonious interpersonal relationships serve as primary protective factors in health recovery (Razak and Yeo, 2015).

Indonesian cultural values emphasizing gotong royong (mutual assistance) and strong family bonds likely enhance post-TKR recovery through tangible instrumental support and emotional encouragement. Conversely, persistent mobility limitations, residual joint stiffness, and post-surgical pain commonly reported in the TKR literature may explain the lower physical health scores (Skou *et al.*, 2015). Even successful TKR procedures may not fully restore pre-morbid physical function, particularly in elderly patients with comorbidities and age-related functional decline.

The lack of a significant correlation between personality traits and quality of life ($p > 0.05$) contradicts several previous studies. Several methodological and contextual explanations warrant consideration, supported by existing literature. Hwang et al. (2017) found that neuroticism negatively predicted quality of life in orthopedic patients, whereas conscientiousness showed positive associations. Similarly, international studies have demonstrated that personality traits significantly influence health-related quality of life outcomes across various medical conditions. Several methodological and contextual factors may explain this discrepancy. First, our sample demonstrated considerable homogeneity in personality profiles, with the vast majority displaying similar trait patterns (e.g., 92.3% high conscientiousness, 89.0% high extraversion).

This restricted range may have limited statistical power in detecting associations. Second, the non-normal data distribution required non-parametric tests, which typically have reduced statistical power compared to parametric alternatives. Third, cultural factors may play a central role: Indonesian patients, shaped by the values of nrimo (acceptance of fate) and collectivism, may homogenize their QoL perceptions around social and cultural norms, attenuating the expression of individual personality influences on reported QoL (Nadiroh and Setyaningrum, 2015; Pristyna *et al*., 2022). Fourth, as proposed by Dwan and Ownsworth (2019), when physical health challenges are severe and salient—as they are in the post-TKR period—physical factors may dominate QoL perceptions, masking subtler personality effects. Finally, while WHOQOL-BREF and BFI-44 are internationally validated, their cultural adaptation for the Indonesian population may be incomplete, potentially limiting construct validity (Purba *et al*., 2018).

Furthermore, the overwhelming impact of physical factors following major orthopedic surgery may overshadow more subtle psychological influences. Dwan and Ownsworth (2019) proposed that when physical health challenges are severe and salient, they dominate quality of life perceptions, potentially masking personality effects. In the immediate-to-medium-term post-TKR period (our participants were all within 3-5 years post-surgery), persistent pain, mobility limitations, and ongoing rehabilitation demands may constitute such overwhelming physical factors that personality traits exert minimal discernible influence on quality-of-life reports.

Additionally, our findings may reflect limitations in the measurement instruments used. While the WHOQOL-BREF and BFI-44 are internationally validated, they may not fully capture culturally specific constructs of quality of life and personality expression in the Indonesian population. Cultural adaptation beyond translation may be necessary to increase construct validity. The use of Likert-scale questionnaires with mid-point response options may have encouraged socially desirable or neutral responses, particularly in a culture that values modesty and avoids extreme self-evaluations.

This study has several important limitations that require acknowledgment. Data collection occurred during the early COVID-19 pandemic, which imposed constraints on face-to-face interactions and may have influenced response thoroughness. Elderly participants may also have experienced cognitive difficulties with the extensive questionnaires, potentially introducing response inaccuracy or social desirability bias when completing questionnaires with a researcher or family member. Importantly, the study design carries a substantial risk of recall bias: personality traits and QoL were assessed two to five years after surgery (TKR performed 2015–2017; assessments conducted 2019–2020). Participants' responses regarding their post-operative experience may therefore reflect memory distortion and life events unrelated to surgery. Furthermore, the absence of postoperative clinical data—such as residual pain scores, functional outcome measures (e.g., Knee Society Score or Oxford Knee Score), or rehabilitation records—limits the interpretability of QoL findings and prevents the examination of clinical confounders. Additionally, confounding variables (age, sex, comorbidities, and educational level) were not controlled via multivariable models; thus, observed associations or their absence cannot be attributed solely to personality. Future studies should employ longitudinal designs with larger and more diverse samples, include postoperative clinical data, and apply multivariable regression approaches to control for confounders.

Conclusion

This study found no significant relationship between the Big Five personality profiles and quality of life in post-TKR knee osteoarthritis patients at RSUD Dr. Soetomo. The predominant personality profile among participants (low openness, high conscientiousness, high extraversion, high agreeableness, and low neuroticism) and quality of life assessment (highest in social relationships and environment, lowest in physical health) align with Asian cultural patterns emphasizing collectivism and social harmony. Several factors may explain the lack of correlation, including older sample characteristics, measurement challenges, cultural influences on quality-of-life perception, and the potentially overwhelming impact of physical factors post-TKR that may overshadow personality influences. Although personality assessment may not directly predict quality of life outcomes in this population, our findings suggest that attention to social support systems and targeted interventions addressing persistent physical limitations may be particularly beneficial for enhancing post-TKR quality of life in Indonesian patients.

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Availability of data and materials

The datasets generated and/or analyzed in the current study are not publicly available because of patient confidentiality and institutional privacy regulations. However, de-identified data may be available from the corresponding author upon reasonable request and with permission from the research ethics committee of RSUD Dr. Soetomo.

Authors' contributions

GPD contributed to the conceptualization, data collection, statistical analysis, and manuscript drafting.

AK supervised the research process, provided critical revisions, and contributed to the interpretation of psychiatric aspects related to personality traits and quality of life.

ME supervised the study design, particularly the orthopedic aspects, and contributed to the clinical interpretation of findings related to knee osteoarthritis and total knee replacement outcomes.

AA contributed to methodological guidance, statistical analysis, and the interpretation of public health perspectives in this study.

All authors reviewed and approved the final version of the manuscript.

Declaration of Interest

The authors declare that they have no financial, professional, or personal conflicts of interest that could inappropriately influence or bias the research presented in this manuscript.

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