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Structural Modeling of the Associations Between Physical Activity and Quality of Life Dimensions in Older Adults Based on the WHOQOL-BREF Framework

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ABSTRACT

Background: Physical activity is an important correlate of healthy aging and quality of life. However, its associations with different dimensions of quality of life among older adults require further investigation.

Purpose: This study aimed to examine the structural associations between physical activity and quality-of-life dimensions among older adults using the World Health Organization framework.

Methods: This cross-sectional, descriptive-correlational study included 200 community-dwelling older adults aged 60–80 years in Abhar, Iran. Physical activity and quality of life were assessed using the CHAMPS questionnaire and WHOQOL-BREF, respectively. Data were analyzed using structural equation modeling in LISREL.

Results: Standardized factor loadings ranged from .58 to .86. Physical activity was positively associated with overall quality of life (β = .68), environmental health (β = .61), social relationships (β = .55), physical health (β = .43), and psychological health (β = .35; all $p < .001$). The model demonstrated acceptable fit ($\chi^2/df = 2.18$, CFI = .96, GFI = .93, AGFI = .90, RMSEA = .054, SRMR = .041).

Conclusion: Physical activity was positively associated with multiple dimensions of quality of life among older adults, particularly environmental health and social relationships. These findings highlight the potential value of accessible, safe, and socially engaging physical activity opportunities in promoting healthy aging.

WHAT IS ALREADY KNOWN ON THIS TOPIC	WHAT THIS STUDY ADDS	HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY
The findings highlight the importance of accessible, safe, and socially engaging physical activity opportunities for older adults. Community-based programs tailored to individual abilities may support active aging and quality of life.	This study demonstrates positive structural associations between physical activity and multiple quality-of-life dimensions, particularly environmental health and social relationships. The findings emphasize the multidimensional relevance of physical activity to well-being in later life.	Ageing can involve declines in physical function, independence, and quality of life. Previous research has linked regular physical activity to better physical and psychological health, social participation, and overall well-being among older adults.

1. Introduction

Population ageing is reshaping health priorities worldwide as longer life expectancy and declining fertility rates increase the proportion of older adults. The World Health Organization estimates that the global population aged 60 years and older will reach approximately 2.1 billion by 2050, making the preservation of health, autonomy, and participation in later life an increasingly important public health concern (World Health Organization, 2025). Iran is undergoing a similar demographic transition. Using earlier United Nations population projections, Mehri et al. (2020) estimated that adults aged 60 years and older could account for approximately 31% of the Iranian population by 2050. Although the exact proportion varies across projection models, these estimates underscore the need to identify modifiable factors associated with healthy ageing and well-being.

Ageing can involve changes in muscle strength, mobility, sensory and cognitive functioning, and vulnerability to chronic disease; however, such changes are highly variable and do not inevitably result in dependence. For older adults, health encompasses more than survival or the absence of illness. The capacity to undertake valued activities, remain socially connected, and maintain an acceptable quality of life is also central to healthy ageing (World Health Organization, 2025). Physical activity is particularly relevant in this context because functional capacity and everyday mobility contribute to autonomy and continued participation in community life (Fanning et al., 2020).

Quality of life is a multidimensional and subjective construct. Within the World Health Organization Quality of Life framework, it includes physical health, psychological health, social relationships, and the environment. The abbreviated WHOQOL-BREF instrument assesses these four domains and includes two additional items addressing overall perceived quality of life and general health; these global items are not separate domains (The WHOQOL Group, 1998). This distinction is important because an individual may report relatively favorable functioning in one domain while experiencing limitations in another. Evaluating quality of life exclusively through a global score may therefore obscure meaningful differences across its constituent domains.

Physical activity is a potentially modifiable correlate of quality of life among older adults. The World Health Organization recommends regular aerobic activity, muscle-strengthening exercise, and multicomponent activities emphasizing balance and functional strength for older populations, according to their abilities and health conditions (World Health Organization, 2020). Participation may support physical functioning, mobility, mental well-being, and opportunities for social engagement. An umbrella review synthesizing 39 systematic reviews found evidence that physical activity and exercise training can improve health-related quality of life in older adults, although effects differed across outcomes and studies (Schwartz et al., 2025). Earlier work likewise emphasized that associations between physical activity and quality of life depend partly on how quality of life is conceptualized and measured (Rejeski & Mihalko, 2001).

These associations may extend beyond physical functioning. Activities undertaken with other people can provide opportunities for companionship, social support, and a sense of belonging, whereas continued engagement in meaningful movement may contribute to psychological well-being. In a cross-sectional study of older adults participating in mind–body exercise, Yang et al. (2024) examined the associations of exercise with quality of life through perceived social support and psychological resilience using structural equation modeling. Their findings illustrate the potential value of evaluating interrelated psychosocial pathways rather than assuming that physical activity is linked to quality of life only through physical health. Nevertheless, the magnitude and pattern of associations may differ among quality-of-life domains and across populations.

Despite the potential benefits of physical activity, insufficient participation remains common. A pooled analysis of population-based surveys reported that 31.3% of adults worldwide were insufficiently active in 2022 and that inactivity had increased among adults aged 60 years and older across world regions (Strain et al., 2024). Barriers such as health limitations, fear of falling, restricted access to appropriate facilities, and unfavorable social or environmental conditions may constrain opportunities to remain active. These circumstances also suggest that physical activity and quality of life should be examined in relation to the broader conditions of later life, particularly when physical, psychological, social, and environmental outcomes are considered simultaneously.

Although previous studies have linked physical activity to quality of life, including through multivariable and structural models, the relative associations of self-reported physical activity with the four WHOQOL domains among community-dwelling older adults in Iran require further examination. Modeling these domains simultaneously can clarify whether physical activity is similarly related to physical health, psychological health, social relationships, and environmental quality of life while accounting for measurement error when the constructs are represented by appropriate indicators. Accordingly, the present cross-sectional study aimed to assess the fit of a hypothesized structural model in which physical activity was specified as an exogenous construct associated with the four quality-of-life domains and to compare the magnitude of the estimated associations. Overall perceived quality of life was considered separately from the four domains where it was measured. Because the data are cross-sectional, the proposed paths represent hypothesized statistical associations rather than evidence of causal effects.

2. Methods

2.1. Study design and setting

This observational, cross-sectional study examined the structural associations between self-reported physical activity and quality-of-life domains among community-dwelling older adults. Data were collected in 2025 at comprehensive community health service centers and affiliated health posts in Abhar, Iran. The analytical framework was based on covariance-based structural equation modeling (SEM), with physical activity specified as an exogenous construct and the four WHOQOL-BREF domains as endogenous constructs.

2.2. Participants and sampling

The accessible population comprised approximately 600 older adults registered with the participating primary-care facilities, of whom 400 were reported to meet the preliminary screening criteria. A final sample of 200 adults was recruited using nonprobability convenience sampling. Eligibility criteria were age 60 years or older; sufficient cognitive ability to understand

and answer the questionnaire, as indicated by clinical screening and an Abbreviated Mental Test Score (AMTS) of at least 7; absence of an acute condition that severely restricted mobility or substantially impaired participation; and willingness to provide informed consent. The Persian AMTS has demonstrated screening utility in older Iranian adults (Foroughan et al., 2017). Participants were excluded from the analytical sample if more than 5% of their questionnaire responses were missing or they withdrew before completing data collection.

The sample included 108 women (54.0%) and 92 men (46.0%), with a mean age of 71.62 years (SD = 4.79; range = 60–80 years). According to the available demographic summary, 68.5% were married. A sample of 200 was available for SEM. Although this sample size is frequently encountered in applied structural modeling, adequacy depends on model complexity, factor loadings, effect sizes, missingness, and estimator choice. Simulation research demonstrates that no fixed sample-size rule guarantees adequate statistical power across SEM specifications (Wolf et al., 2013). No model-specific a priori power calculation was available, so statistical power was not assigned a numerical value solely on the basis of sample size (Kline, 2023).

2.3. Measures

2.3.1. Community Healthy Activities Model Program for Seniors (CHAMPS)

Self-reported physical activity was assessed using the Persian version of CHAMPS, an instrument developed to measure participation in a range of activities relevant to older adults (Stewart et al., 2001). An Iranian adaptation and validation study was reported by Sahaf et al. (2014). In the present study, a 34-item form was reported to assess the frequency and duration of weekly activities. Responses were summarized into composite activity indices and categorized on a four-level scale from 1 (very low participation) to 4 (frequent participation); the reported mean composite score was 1.90 (SD = 0.97). The four-level categorization constitutes the study's reported operational scoring scheme rather than the standard CHAMPS energy-expenditure score. The resulting categories were treated as study-specific derived indices rather than the original CHAMPS frequency or energy-expenditure scores. Internal consistency and convergent-reliability statistics reported for the modeled physical activity construct were Cronbach's α = .86, composite reliability = .87, and average variance extracted = .54.

2.3.2. World Health Organization Quality of Life—Brief Version (WHOQOL-BREF)

Quality of life was evaluated using the 26-item WHOQOL-BREF, which contains four domains: physical health (7 items), psychological health (6 items), social relationships (3 items), and environment (8 items), together with two general items assessing overall quality of life and general health (The WHOQOL Group, 1998). The Iranian version has been evaluated in a population-based validation study (Nedjat et al., 2008). Items use five-point response scales. According to the instrument's scoring procedure, negatively worded items are reverse-coded as appropriate, and the four domain scores can be transformed to a 0–100 metric, with higher scores representing better perceived quality of life. The two global items are analyzed separately rather than treated as a fifth domain. The reported internal consistency, composite reliability, and average variance extracted were, respectively, .81, .82, and .51 for physical health; .79, .80, and .50 for psychological health; .76, .78, and .55 for social relationships; and .84, .85, and .52 for environment.

2.4. Data collection procedure and ethical considerations

Trained researchers approached potentially eligible older adults at participating community health centers. The study purpose, voluntary nature of participation, and confidentiality safeguards were explained before consent was obtained. Questionnaires were administered in a quiet and adequately illuminated space. When visual or writing limitations prevented self-completion, items were read aloud in a neutral manner and participants' responses were recorded as stated. Rest breaks were available when needed to limit fatigue. Administrative permissions to conduct the survey were reportedly obtained from the participating health services. The study materials describe written or verbal informed consent and anonymized questionnaire responses.

2.5. Statistical analysis

Continuous variables were summarized using means and standard deviations, and categorical variables using frequencies and percentages. Covariance-based SEM was conducted in LISREL 8.80. The reported estimation approach was robust maximum likelihood with Satorra–Bentler-scaled fit statistics. Univariate distributions were examined through skewness and kurtosis, and multivariate nonnormality was assessed using Mardia's statistic. Potential collinearity among the indicators was examined using variance inflation factors.

The measurement model and the hypothesized structural relationships were evaluated sequentially. Model fit was assessed using the scaled chi-square statistic with degrees of freedom, the comparative fit index (CFI), the standardized root mean square residual (SRMR), and the root mean square error of approximation (RMSEA) with its 90% confidence interval. The goodness-of-fit index (GFI) and adjusted goodness-of-fit index (AGFI) were also reported as supplementary measures where available. Commonly cited heuristic values include CFI ≥ .90, SRMR ≤ .08, and RMSEA ≤ .08, but these are interpretive guidelines rather than universal criteria, and multiple indices should be considered together (Hu & Bentler, 1999; Kline, 2023). Standardized factor loadings, indicator reliability, composite reliability, and average variance extracted were assessed for the latent measurement model; standardized path coefficients, 95% confidence intervals, and R^2 values were used to summarize the structural relationships. Two-sided statistical significance was evaluated at α = .05. The source analysis reported that the first factor in an unrotated exploratory factor analysis accounted for 28.4% of total variance. This descriptive result was retained, but it should not be interpreted as demonstrating the absence of common method bias, because single-factor diagnostics are insufficient to rule out method-related covariance (Podsakoff et al., 2003).

3. Results

3.1. Participant characteristics and descriptive statistics

The analysis included 200 community-dwelling adults aged 60–80 years (M = 71.62, SD = 4.79), including 108 women (54.0%) and 92 men (46.0%). Table 1 presents the observed ranges, means, and standard deviations for physical activity participation, overall perceived quality of life, and the four

WHOQOL-BREF domains. Physical activity participation, evaluated using the study-specific four-level index, had a mean score of 1.90 (SD = 0.97). Among the four quality-of-life domains, the highest mean was observed for social relationships (M = 79.79, SD = 14.96), followed by environmental health (M = 68.33, SD = 14.26), psychological health (M = 64.25, SD = 17.89), and physical health (M = 61.45, SD = 21.37). The overall quality-of-life indicator had a mean of 86.38 (SD = 13.10).

Table 1. Descriptive statistics for study variables

Variable	Min	Max	M	SD
Age (years)	60	80	71.62	4.79
Physical activity participation	1	4	1.90	0.97
Overall quality of life	38	100	86.38	13.10
Physical health	11	100	61.45	21.37
Psychological health	21	100	64.25	17.89
Social relationships	33	100	79.79	14.96
Environmental health	25	100	68.33	14.26

Note. Physical activity was scored from 1 to 4 using the study-specific categorization. Quality-of-life domain scores were reported on a 0–100 scale. M = mean; SD = standard deviation.

3.2. Preliminary diagnostics and bivariate correlations

The Kaiser–Meyer–Olkin measure of sampling adequacy was .632. Bartlett's test of sphericity was statistically significant, $\chi^2(15) = 279.72$, $p < .001$, indicating that the examined correlation matrix departed from an identity matrix. These preliminary diagnostics were considered alongside the subsequent measurement-model assessment.

Pearson correlation coefficients indicated positive associations between physical activity and overall perceived quality of life (r = .62), physical health (r = .41), psychological health (r = .38), social relationships (r = .52), and environmental health (r = .58), with all reported p values below .01. The quality-of-life measures were also positively correlated (Table 2). These correlations provide a descriptive account of the observed associations prior to structural modeling.

Table 2. Pearson correlations among physical activity and quality-of-life measures

Variable	1	2	3	4	5	6
1. Physical activity	—					
2. Overall quality of life	.62	—				
3. Physical health	.41	.73	—			
4. Psychological health	.38	.70	.54	—		
5. Social relationships	.52	.66	.48	.51	—	
6. Environmental health	.58	.69	.43	.49	.56	—

Note. All off-diagonal correlations were reported as significant at p < .01 (two-tailed).

3.3. Measurement and structural model results

The measurement component of the model was examined using standardized indicator loadings, and the structural relations were evaluated using standardized path coefficients and their corresponding test statistics. Figure 1 presents the LISREL test statistics for the five structural paths, with values ranging from 7.24 to 11.16, consistent with statistically significant associations (all p < .001).

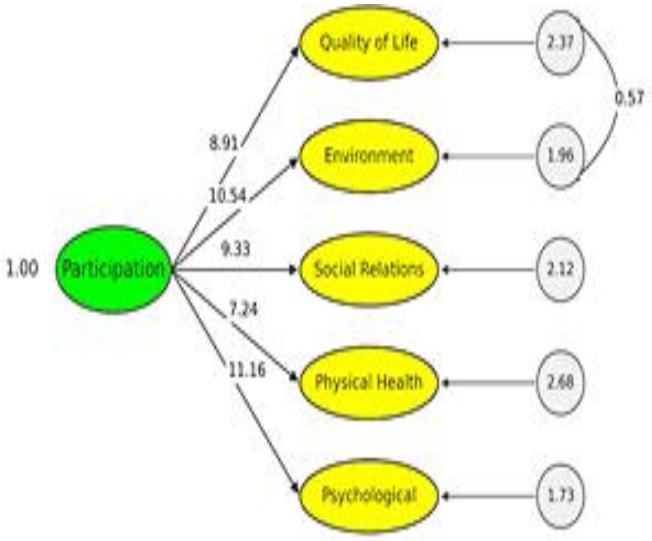


Figure 1. Standardized factor loadings of the variables

In the structural model, physical activity participation was positively associated with overall perceived quality of life and all four WHOQOL-BREF domains. The largest reported standardized coefficient was for overall quality of life (β = .68), followed by environmental health (β = .61), social relationships (β = .55), physical health (β = .43), and psychological health (β = .35). All five reported path tests were statistically significant (p < .001). The corresponding explained-variance estimates ranged from R^2 = .12 to .46 (Table 3 and Figure 2).

Table 3. Reported standardized structural paths and explained variance

Outcome predicted by physical activity	β	95% CI	t	p	R^2
Overall quality of life	.68	[.53, .83]	8.91	< .001	.46
Environmental health	.61	[.50, .72]	10.54	< .001	.37
Social relationships	.55	[.43, .67]	9.33	< .001	.30
Physical health	.43	[.31, .55]	7.24	< .001	.18
Psychological health	.35	[.29, .41]	11.16	< .001	.12

Note. β = standardized path coefficient; CI = confidence interval; R^2 = reported variance explained.

Among the four WHOQOL-BREF domains, environmental health had the largest standardized path coefficient and psychological health the smallest. Overall perceived quality of life was considered separately from the four domains. These results describe associations within a cross-sectional model rather than causal effects.

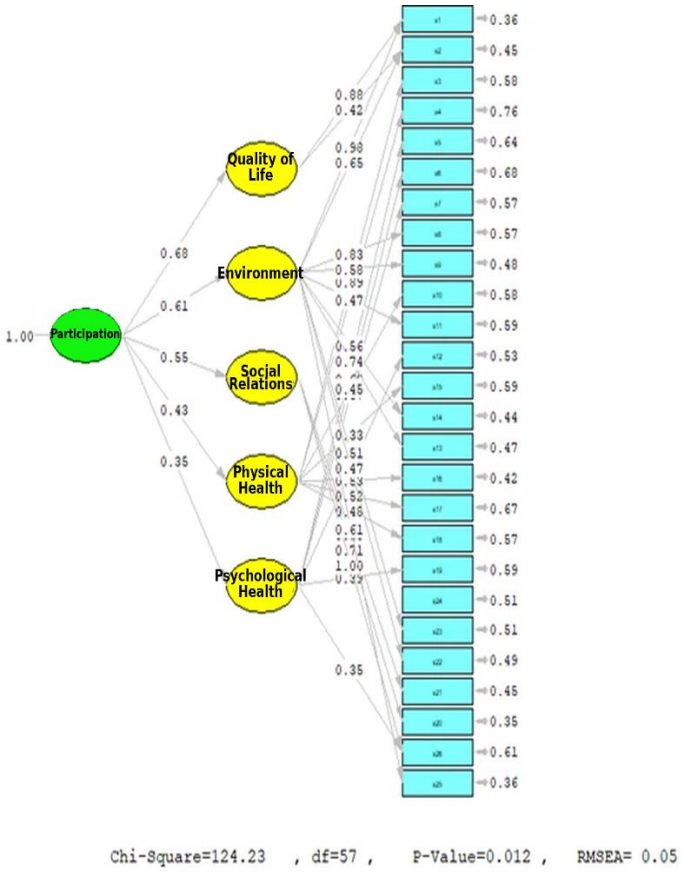


Figure 2. The research structural model showing standardized coefficient estimates, item factor loadings, and measurement error variances.

3.4. Global model fit

The model-fit results are summarized in Table 4. The reported scaled chi-square statistic was $\chi^2(57) = 124.23$, corresponding to a χ^2/df ratio of 2.18. Other reported indices included the comparative fit index (CFI = .96), goodness-of-fit index (GFI = .93), adjusted goodness-of-fit index (AGFI = .90), root mean square error of approximation (RMSEA = .054), and standardized root mean square residual (SRMR = .041).

Table 4. Reported goodness-of-fit indices for the structural model

Fit Index	Obtained Value	Recommended Criteria	Fit Evaluation
Scaled $\chi2$ / df	124.23 / 57 = 2.18	< 3.00	Acceptable
Comparative Fit Index (CFI)	0.96	≥ 0.90	Good fit
Goodness-of-Fit Index (GFI)	0.93	≥ 0.90	Good fit
Adjusted Goodness-of-Fit Index (AGFI)	0.90	≥ 0.85	Acceptable
Root Mean Square Error of Approximation (RMSEA)	0.054	< 0.08	Good fit
Standardized Root Mean Square Residual (SRMR)	0.041	< 0.08	Good fit

Taken together, the reported fit indices supported an acceptable correspondence between the specified model and the observed data. The structural coefficients should nevertheless be interpreted as cross-sectional statistical associations, and the overall fit indices do not, in themselves, establish a causal interpretation of the paths.

4. Discussion

The present study examined the relationships between self-reported physical activity and quality of life among 200 community-dwelling older adults in Abhar, Iran. Physical activity was positively associated with overall perceived quality of life (β = .68) and with environmental health (β = .61), social relationships (β = .55), physical health (β = .43), and psychological health (β = .35). Together, these findings suggest that participation in physical activity is connected to several aspects of later-life well-being, rather than to physical functioning alone. The larger coefficients for overall quality of life and the environmental and social domains indicate that the relevance of activity may be particularly evident in the everyday settings and relationships through which older adults experience their lives. These associations are interpreted within the cross-sectional design of the study.

The findings broadly accord with contemporary evidence concerning physical activity and quality of life in older populations. In an umbrella review involving 39 systematic reviews, Schwartz et al. (2025) identified potentially favorable effects of physical activity and exercise on health-related quality of life, although the findings varied across outcomes and study populations. More recently, Wang et al. (2025) reported benefits for physical health in a meta-analysis of controlled interventions but found less conclusive evidence for mental health outcomes. Considered together, these reviews support examining quality of life as a multidimensional construct: an association with physical activity in one domain need not be of the same magnitude or consistency in another. The present study contributes domain-specific evidence from older adults attending primary-care facilities in an Iranian community setting.

The association between physical activity and environmental health was especially notable. Within the WHOQOL-BREF, this domain reflects perceptions of safety, access to services, transportation, opportunities for leisure, the home environment, and material resources (The WHOQOL Group, 1998). Greater mobility may allow physically active older adults to make fuller use of neighborhood spaces and local services, potentially contributing to more favorable perceptions of their environment. At the same time, the surrounding environment may shape the opportunity to remain active. A recent systematic review by Molaei et al. (2024) identified associations between neighborhood characteristics, including walkability and social conditions, and physical functioning in middle-aged and older adults. Similarly, Shen et al. (2025), reviewing 46 studies, highlighted perceived safety, destination accessibility, and other built-environment characteristics in relation to older adults' walking. The observed environmental path is therefore consistent with a reciprocal relationship between individual movement opportunities and the context in which movement takes place, rather than with a direct change in environmental infrastructure resulting from activity.

The positive relationship with social relationships provides a complementary perspective. Physical activity may be embedded in social routines, such as walking with neighbors, attending community programs, or taking part in shared recreation, that create opportunities for contact and belonging. In a study of older adults who practiced mind–body exercise, Yang et al. (2024) identified perceived social support and psychological resilience as important correlates within a model

of quality of life. Nevertheless, social benefits should not be assumed to follow automatically from participation. A recent systematic review found that intervention effects on loneliness and subjective well-being were heterogeneous and that social features were not consistently specified or evaluated (Sang et al., 2026). Thus, the present association (β = .55) may reflect the social context of activity as well as the tendency for older adults with stronger existing relationships to participate more often. Future research could distinguish solitary and group-based activity and directly assess perceived support and social connectedness.

Physical and psychological health were also positively related to activity, although their standardized coefficients were smaller than those observed for the environmental and social domains. The association with physical health (β = .43) is compatible with evidence that appropriately adapted movement and exercise can support health-related outcomes in later life (Wang et al., 2025; World Health Organization, 2020). The psychological health association (β = .35) may reflect several interacting experiences, including self-perceived competence, mood, autonomy, and daily engagement. However, the present study did not directly measure these potential pathways, and contemporary intervention evidence shows that psychological benefits are not uniform across programs (Sang et al., 2026; Wang et al., 2025). The magnitude of the psychological coefficient should therefore be interpreted as an observed association within this model rather than as evidence of a specific neurobiological or psychosocial mechanism.

The measurement framework also informs the interpretation of these results. The WHOQOL-BREF distinguishes four standard domains from its global questions on overall quality of life and general health (The WHOQOL Group, 1998), and the Persian adaptation has been evaluated in an Iranian population (Nedjat et al., 2008). In the present analysis, overall perceived quality of life was considered separately from the four domain-level outcomes. Physical activity was represented by a study-derived four-level participation index based on CHAMPS responses, which provides a concise indicator of reported activity but differs from the questionnaire's conventional activity-frequency and energy-expenditure metrics (Stewart et al., 2001). These operational choices are useful to consider when comparing the relative strength of associations with results from other populations and measurement approaches.

From an applied perspective, the findings highlight the value of addressing physical activity within a broader healthy-aging framework. Community health services may benefit from facilitating accessible walking opportunities, adaptable strength and balance activities, and programs that make participation socially welcoming without requiring intensive athletic involvement. International guidance likewise emphasizes that activity should be adapted to functional ability and include aerobic, strengthening, and balance-oriented movement (World Health Organization, 2020). The environmental association further directs attention to transport, safe routes, and accessible community facilities. These recommendations are consistent with the wider evidence base, while their effects on quality of life in the present setting should be examined in intervention studies.

Several limitations should guide the interpretation of the findings. The cross-sectional design does not establish the temporal direction of the observed associations, and more favorable quality of life may itself encourage greater physical activity. Both principal variables were self-reported at one assessment point, allowing for recall difficulties and shared measurement influences (Podsakoff et al., 2003). Convenience recruitment from primary-care centers in one city may also limit the applicability of the findings to older adults who are more frail, socially isolated, or less engaged with healthcare services. In addition, socioeconomic conditions, chronic disease burden, medication use, and objectively assessed neighborhood characteristics were not incorporated as covariates. Longitudinal studies combining device-based activity monitoring with environmental and psychosocial measures could clarify how these domains interact over time. Intervention studies could then determine whether accessible and socially designed activity programs improve specific quality-of-life outcomes.

5. Conclusions

Among community-dwelling older adults in Abhar, greater self-reported physical activity was associated with more favorable overall quality of life and with all four WHOQOL-BREF domains. The largest reported associations involved overall perceived quality of life, environmental health, and social relationships, emphasizing that participation in movement is situated within broader everyday contexts. These findings support attention to safe, accessible, and socially inclusive activity opportunities in healthy-aging initiatives. Longitudinal and intervention research is needed to clarify the direction of these relationships and to identify the physical, environmental, and interpersonal conditions under which participation is most beneficial.

CRediT Authorship Contribution Statement

S.T: Conceptualization, Methodology, Formal analysis, Investigation, Data curation, Writing – original draft, Visualization.

A.N: Conceptualization, Methodology, Formal analysis, Resources, Writing – review & editing, Supervision, Project administration.

All authors reviewed and approved the final version of the manuscript and take responsibility for the work.

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have influenced the work reported in this article.

Declaration of generative AI in scientific writing:

During the preparation of this manuscript, the authors used ChatGPT (OpenAI) for language editing.

Data Availability Statement

The datasets generated and analyzed during the current study are

available from the corresponding author upon reasonable request.

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