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The Influence of Lifestyle on Cognitive Function and Quality of Life in People with Dementia

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Background: Dementia is a significant global health challenge, with many cases in China, causing heavy socioeconomic burden. Current treatments mainly relieve symptoms, but lifestyle interventions may reduce dementia risk. However, existing research on the association between lifestyle factors and cognitive outcomes in older adults with cognitive impairment in China lacks regional specificity, which limits the development of tailored intervention strategies for diverse local elderly populations.

Objective: The present study aimed to assess the impact of specific lifestyle factors, including smoking status, physical activity levels, and smartphone utilization patterns, on cognitive function and among individuals diagnosed with dementia.

Methods: One hundred and sixty-nine community-dwelling individuals diagnosed with dementia according to DSM-5 criteria were recruited for this study. Lifestyle Questionnaire was collected, the Mini-Mental State Examination (MMSE) was used to measure the cognitive function and the quality of life (QoL) scale was used to assess the quality of life. The relationship between lifestyle and cognitive function and quality of life was analyzed by simple and multiple linear regression models.

Results: Univariate analysis revealed that smoking, moderate aerobic exercise and smartphone use were positively correlated with MMSE score. However, in multivariate models, the significant association with smoking status was no longer observed, while the positive association with ≤1 hour of daily aerobic exercise remained statistically significant. Additionally, anaerobic exercise and smartphone use exceeding 1 hour per day were independently and positively associated with QoL, whereas smoking showed an independent negative association. Alcohol consumption did not demonstrate a statistically significant association with QoL, despite a positive trend observed in some preliminary models.

Conclusion: Moderate aerobic/anaerobic exercise and smart device use are promising non-drug interventions for cognition and QoL in dementia. Smoking's link to worse QoL highlights the need for targeted cessation.

Keywords: dementia, lifestyle, cognitive function, quality of life

Introduction

Globally, an estimated 50 million individuals live with dementia, of whom 20% reside in China.[1] With the intensification of population aging, the associated economic and societal burden is expected to intensify significantly.[2] Beyond progressive cognitive decline, dementia also severely impairs the quality of life in older adults and is strongly correlated with elevated mortality rates with elevated mortality rates,[3] which is a serious disease that threatens the health and quality of life of the elderly. Given the geographic diversity in China, this study focuses on the under-investigated Southeast coastal region to provide preliminary evidence for future region-specific intervention strategies, at present, there is no radical drug for dementia, and clinical treatment mainly focuses on symptom management and disease progression delay. Reduction of risk factors for dementia through lifestyle interventions reduces or delays the onset of dementia by 45%.[4,5] As a non-pharmacological intervention, it has a significant impact on cognitive function and quality of life in individuals with dementia.[6] For example, aerobic exercise enhances cognitive function by promoting the secretion of brain-derived

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neurotrophic factor (BDNF),[7] while smoking accelerates neuronal apoptosis by inducing oxidative stress.[8] A study designed to guide a multidomain lifestyle intervention to prevent cognitive decline in high-risk elderly individuals showed significantly better cognitive performance in the intervention group than in the controls after 3 years, providing robust evidence for large-scale promotion of such interventions.[8] The Intervention to Prevent Cognitive Impairment in the Elderly (FINGER) study in Finland, which involved 1260 high-risk elderly individuals aged 60–77 years, showed that the multidomain intervention (diet, exercise, cognitive training, and vascular risk monitoring) for 2 years could improve or maintain cognitive function in high-risk elderly individuals compared with a control group.[9]

However, there is a lack of localized evidence for lifestyle interventions. The China Health and Retirement Longitudinal Study (CHARLS) showed significant geographic variations in the incidence of dementia in China, as well as inter-provincial variations in the association between lifestyle and dementia.[10] These findings highlight the necessity for targeted strategies to investigate the relationship between lifestyle factors and both dementia prevalence and cognitive function in specific regions. It is critical for developing more effective prevention and treatment approaches of dementia.[11]

This study aims to analyze the independent effects of smoking, alcohol consumption, aerobic/anaerobic exercise, sleep duration, and smart device use on cognitive function and quality of life in participants with dementia in southeast coastal communities of China using a three-stage hierarchical regression model (lifestyle → demographic → care factors) and to identify the core intervention indicators. The participant's demographic data and the degree of interference of care received on the lifestyle-outcome association were analyzed after adjusting for confounding to provide accurate guidance for local community intervention and nursing strategies.

Methods

This study was approved by the Ethics Committee of Longyan Third Hospital (Approval No.: Lun Pi Lun Wen (2022) No.5). All participants signed informed consent forms, and the study was conducted in strict accordance with the ethical principles of the Declaration of Helsinki.

Participants

We recruited one hundred and sixty-nine individuals diagnosed with Alzheimer's disease from community in Longyan from January 2023 to June 2024. Approval of this study was obtained from the Ethics Committee of The Third Hospital of Longyan.

The criteria was meeting the diagnostic criteria for dementia according to the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5). The exclusion criteria for individuals with dementia were as follows: (1) Acute cardiovascular and cerebrovascular diseases; (2) schizophrenia; (3) Advanced malignant tumor.

Clinical Assessment

Recruitment was carried out at Longyan Third Hospital. A random sampling approach was employed. From the dementia participant cases in the hospital, we stratified by age (such as ≤60 years, 61–80 years, and >80 years) and disease severity (based on MMSE scores), and then randomly selected the subjects. This ensured the inclusion of participants of different genders, age groups, and disease stages, thus guaranteeing the representativeness of the sample for the dementia participant population in our hospital and reducing the impact of selection bias.

The questionnaire consists of 5 items, including smoking, alcohol consumption, aerobic/anaerobic exercise (hours/week), sleep duration (hours/day), and smart device use (hours/day). Smoking and alcohol consumption were defined dichotomously (current user: yes/no). Physical activity was categorized by duration: aerobic exercise (none, ≤1 hour/day, >1 hour/day) and anaerobic exercise (none, <30 minutes/day, ≥30 minutes/day), with cut-offs based on guidelines and sample distribution. Sleep duration was grouped as ≤6 hours, 6–8 hours, or >8 hours. Smartphone use was classified as none, ≤1 hour/day, or >1 hour/day.

The Mini-Mental State Examination (MMSE), a cognitive function assessment tool widely used in clinical and research fields, was collected to measure the cognitive function. The total score of the scale is 30 points. Higher scores indicate better cognitive function. A score of 27–30 is classified as normal cognition, 21–26 as mild cognitive impairment, 10–20 as moderate cognitive impairment, and a score below 10 as severe cognitive impairment. It should be noted, however, that these cutoff scores may vary depending on the specific population studied and the research context.

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The quality of life (QoL) scale was used to assess the quality of life. It covers multiple dimensions, such as physiological state, psychological state, social relationships and environmental factors, etc. The QOL Life Scale comprises a set of questions designed to explore an individual's feelings and experiences in different aspects. For instance, some issues may involve appetite, mental state, sleep quality, degree of fatigue, degree of pain, and attitude towards treatment, etc. Through these items, individuals gain comprehensive insight into their quality of life, while enabling medical personnel to assess participants' overall health status, thereby facilitating the development of tailored treatment plans.

The demographic information including age, gender, degree of education, marital status, number of physical disease and care factors comprising the number of caregivers and their average monthly care frequency were collected.

Statistics

In the statistical description section, counting data are described by frequency (percentage); continuous variables with a normal distribution are presented as mean ± standard deviation; continuous variables with a skewed/non-normal distribution are expressed as median (P25, P75); and categorical variables are described by frequency (percentage). A univariate analysis was conducted using simple linear regression, with the total MMSE score and QoL score as dependent variables, and the participants' lifestyles and behaviors as independent variables, including smoking, drinking, aerobic exercise time, anaerobic exercise time, daily sleep time, and daily smartphone usage time. Three multivariate linear regression models were constructed for the total score of MMSE. Model 1 included only six lifestyle and behavioral factors as independent variables. Model 2 additionally adjusted for age, sex, education level, marital status, and number of physical comorbidity. Model 3 further incorporated the number of caregivers and monthly caregiving frequency. A similar three-model approach was adopted for the QoL total score, with the addition of dementia severity level in Models 2 and 3. All the above statistical analyses were conducted using SPSS 25.0. The significance level was set at 0.05.

Ethics Approval and Copyright Statement

An unauthorized version of the Chinese MMSE was used by the study team without permission, however this has now been rectified with PAR. The MMSE is a copyrighted instrument and may not be used or reproduced in whole or in part, in any form or language, or by any means without written permission of PAR (www.parinc.com).

Results

Demographic and Clinical Characteristics

The average age of the subjects was 75.30 ± 10.10 years, with 65.70% being female. The educational level was mainly at the elementary school level and below (63.90%), and the average MMSE score was 13.40 ± 7.30 points. Detailed demographic and clinical characteristics of the participants are presented in Table 1

Table 1 Baseline Demographic, Clinical, and Lifestyle Characteristics of Community-Dwelling Patients with Dementia (N = 169)

Variables	**Frequency/Median (P25, P75)/Mean ± SD**
Sample size	169
Age	75.3 ± 10.1
Gender	
Male	58(34.3%)
Female	111(65.7%)

(*Continued*)

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Table 1 (Continued).

Variables	**Frequency/Median (P25, P75)/Mean ± SD**
Educational level	
Elementary school and below	108(63.9%)
Junior high school	26(15.4%)
High School	27(16%)
Associate degree	5(3%)
University degree	3(1.8%)
Marital status	
Married	105(62.1%)
Divorced	4(2.4%)
Widowed	58(34.3%)
Unmarried	2(1.2%)
Number of physical disease	2(1,3)
Number of caregivers	1(1,1)
Average monthly care frequency	30(30,30)
Smoking	
Yes	136(80.5%)
No	33(19.5%)
Alcohol consumption	
Yes	136(80.5%)
No	33(19.5%)
Aerobic exercise	
No exercise	74(43.8%)
≤1 hour	89(52.7%)
>1 hour	6(3.6%)
Anaerobic exercise	
No exercise	154(91.1%)
<30 minutes	9(5.3%)
≥30 minutes	6(3.6%)
Sleep duration	
≤6 hours	41(24.3%)
6–8 hours	123(72.8%)
>8 hours	5(3%)
Smartphone use	
Not using a smartphone	148(87.6%)
≤1 hour	10(5.9%)
>1 hour	11(6.5%)
MMSE score	13.4 ± 7.3
Qol score	19 ± 4.2
Dementia severity level	
MCI	38(22.5%)
Alzheimer's disease	24(14.2%)
Moderate Alzheimer's disease	58(34.3%)
Severe Alzheimer's disease	49(29%)

Note: Data are presented as n (%), mean ± SD, or median (25th percentile, 75th percentile).

Abbreviations: MMSE, Mini-Mental State Examination; QoL, Quality of Life; SD, Standard Deviation.

Analysis of the Influence of Participants' Lifestyles on MMSE

Simple Linear Regression Analysis of MMSE

The results of univariable regression analysis showed that smokers had significantly higher total MMSE score (β = 3.176, P = 0.024), though the potential mechanisms underlying the association between smoking and better cognitive performance in this population remain unclear and require further investigation. Similarly, engaging in less than one hour of aerobic exercise per day was associated with an increased total MMSE score (β = 6.364, p < 0.001) compared with those who did not exercise at all. Notably, smartphone use was also found to be significantly correlated with MMSE performance, which we will further investigate in subsequent research. No other lifestyle factors demonstrated a significant association with MMSE performance (Table 2), which might be explained by its role in promoting social connection and sustained cognitive engagement among older adults.

Multivariate Linear Regression Analysis of MMSE

The multivariate linear regression model incorporating all lifestyle factors demonstrated that engaging in aerobic exercise less than one hour per day was significantly associated with higher MMSE total scores (Model1: β = 5.692, $p < 0.001$). However, the influence of smoking on the total score of MMSE is no longer significant after adjusting for all measured lifestyle factors. Adjusting for demographic information (Model 2) and care factors (Model 3), respectively, the association between aerobic exercise less than one hour per day and MMSE total score remained significant, as no other lifestyle factors demonstrated statistically significant associations with MMSE score (Table 3).

Analysis of the Influence of Participants' Lifestyles on QoL

Simple Linear Regression Analysis of QoL

The results of univariable regression analysis showed that daily aerobic exercise, anaerobic exercise and the use of smartphone had increased QoL score. Compared with individuals without aerobic exercise, individuals who did aerobic exercise for less than one hour per day (β = 2.055, $p = 0.001$) and those who did aerobic exercise for one hour or more per day (β = 5.991, $p = 0.001$) exhibited significantly higher quality of life. Likewise, compared with individuals without anaerobic exercise, individuals who performed anaerobic exercise for less than thirty minutes per day (β = 7.348, $p < 0.001$) and those who did anaerobic exercise for thirty minutes or more per day (β = 7.348, $p < 0.001$) exhibited significantly higher quality of life. Similarly, individuals who use smartphone for less than or equal to one hour

Table 2 Univariate Linear Regression Analyses of Associations Between Lifestyle Factors and Cognitive Function (MMSE Score) in Patients with Dementia

Variables	MMSE Score		
	β (95% CI)	*p*	R^2
Smoking	3.176(0.43,5.922)	0.024*	0.030
Alcohol consumption	2.46(−0.303,5.223)	0.081	0.018
Aerobic exercise (compared with no aerobic exercise)			0.186
Aerobic exercise < 1 hour	6.364(4.318,8.411)	<0.001*	
Aerobic exercise ≥ 1 hour	4.428(−1.093,9.949)	0.115	
Anaerobic exercise (compared with no anaerobic exercise)			0.013
Anaerobic exercise < 30 minutes	−3.329(−8.24,1.582)	0.183	
Anaerobic exercise ≥ 3 0 minutes	−1.996(−7.955,3.964)	0.509	
Sleep duration (compared with sleep duration ranging from 6 to 8 hours)			0.012
Sleep duration > 8 hours	−1.065(−3.648,1.518)	0.417	
Sleep duration ≤6 hours	−4.197(−10.731,2.338)	0.207	
Smartphone use (compared with not using smartphone)			0.083
Usage time ≤1 hour	5.465(0.955,9.974)	0.018*	
Usage time > 1 hour	7.001(2.688,11.314)	0.002*	

Notes: The dependent variable is the total MMSE score. Each row represents a separate simple linear regression model. *P-value < 0.05.
Abbreviations: MMSE, Mini-Mental State Examination; β, regression coefficient; CI, confidence interval.

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Table 3 Multivariate Linear Regression Analyses of Associations Between Lifestyle Factors and Cognitive Function (MMSE Score) in Patients with Dementia

Variables	**Model 1**		**Model 2**		**Model 3**	
	β (95% CI)	***p***	**β (95% CI)**	***p***	**β (95% CI)**	***p***
Intercept	8.816(6.979,10.652)	<0.001*	9.702(−3.059,22.463)	0.135	11.28(−3.043,25.602)	0.122
Smoking	4.716(−1.218,10.649)	0.118	4.5(−1.864,10.864)	0.164	4.498(−1.905,10.901)	0.167
Alcohol consumption	−1.528(−7.41,4.355)	0.608	−2.175(−8.157,3.808)	0.473	−2.259(−8.309,3.791)	0.461
Aerobic exercise (compared with no aerobic exercise)						
Aerobic exercise < 1 hour	5.692(3.461,7.922)	<0.001*	5.097(2.661,7.532)	<0.001*	4.895(2.371,7.418)	<0.001*
Aerobic exercise ≥ 1 hour	4.597(−2.487,11.681)	0.202	3.987(−3.412,11.387)	0.288	3.616(−3.963,11.195)	0.347
Anaerobic exercise (compared with no anaerobic exercise)						
Anaerobic exercise < 30 minutes	−3.657(−8.899,1.586)	0.170	−2.776(−8.148,2.596)	0.309	−2.475(−8.133,3.184)	0.389
Anaerobic exercise ≥ 30 minutes	−5.368(−11.887,1.151)	0.106	−5.189(−11.801,1.422)	0.123	−5.273(−11.93,1.384)	0.120
Sleep duration (compared with sleep duration ranging from 6 to 8 hours)						
Sleep duration > 8 hours	−0.03(−6.123,6.063)	0.992	−1.226(−7.829,5.377)	0.714	−1.214(−8.051,5.623)	0.726
Sleep duration ≤6 hours	0.472(−2.029,2.972)	0.710	0.06(−2.533,2.652)	0.964	0.088(−2.527,2.703)	0.947
Smartphone use (compared with not using smartphone)						
Usage time ≤1 hour	3.662(−1.365,8.688)	0.152	3.449(−1.705,8.603)	0.188	3.544(−1.65,8.738)	0.179
Usage time > 1 hour	3.973(−0.694,8.64)	0.095	3.255(−1.862,8.373)	0.211	3.235(−1.919,8.388)	0.217
Age	–	–	0.005(−0.13,0.14)	0.945	0.009(−0.128,0.146)	0.896
Gender (female vs male)	–	–	−0.349(−3.935,3.237)	0.848	−0.323(−4.042,3.397)	0.864
Educational level	–	–	−0.133(−1.287,1.021)	0.820	−0.072(−1.28,1.136)	0.907
Number of physical diseases	–	–	0.352(−0.456,1.161)	0.390	0.331(−0.488,1.151)	0.425
Marital status						
Divorced	–	–	5.158(−2.602,12.917)	0.191	5.048(−2.769,12.864)	0.204
Widowed	–	–	−1.766(−4.343,0.81)	0.177	−1.875(−4.489,0.739)	0.158
Unmarried	–	–	−10.245(−23.325,2.836)	0.124	−10.383(−23.576,2.811)	0.122
Number of caregivers	–	–	–	–	−1.242(−5.543,3.059)	0.569
Average monthly care frequency	–	–	–	–	−0.018(−0.178,0.142)	0.826
R^2	0.253		0.291		0.293	

Notes: The dependent variable is the total MMSE score. Model 1 adjusts for all lifestyle factors listed. Model 2 additionally adjusts for age, gender, educational level, number of physical diseases, and marital status. Model 3 further adjusts for the number of caregivers and average monthly care frequency. *P-value < 0.05.

Abbreviations: MMSE, Mini-Mental State Examination; β, regression coefficient; CI, confidence interval.

Table 4 Univariate Linear Regression Analyses of Associations Between Lifestyle Factors and Quality of Life (QoL Score) in Patients with Dementia

Variables	QoL Score		
	β (95% CI)	*p*	R^2
Smoking	−1.319(−2.928,0.29)	0.107	0.015
Alcohol consumption	−0.227(−1.848,1.394)	0.783	0
Aerobic exercise (compared with no aerobic exercise)			0.103
Aerobic exercise < 1 hour	2.055(0.806,3.303)	0.001*	
Aerobic exercise ≥ 1 hour	5.991(2.622,9.36)	0.001*	
Anaerobic exercise (compared with no anaerobic exercise)			0.247
Anaerobic exercise < 30 minutes	7.348(4.854,9.843)	<0.001*	
Anaerobic exercise ≥ 3 0 minutes	7.348(4.322,10.375)	<0.001*	
Sleep duration (compared with sleep duration ranging from 6 to 8 hours)			0.015
Sleep duration > 8 hours	−1.114(−2.613,0.386)	0.144	
Sleep duration ≤6 hours	0.989(−2.805,4.782)	0.608	
Smartphone use (compared with not using smartphone)			0.095
Usage time ≤ 1 hour	4.414(1.809,7.018)	0.001*	
Usage time > 1 hour	3.423(0.931,5.914)	0.007*	

Notes: The dependent variable is the total QoL score. Each row represents a separate simple linear regression model. *P-value < 0.05.
Abbreviations: QoL, Quality of Life; β, regression coefficient; CI, confidence interval.

per day (β = 4.414, p = 0.001) and more than one hour per day (β = 3.423, p = 0.007) demonstrated a significantly higher quality of life, compared with those who did not use smartphone. No other lifestyle factors showed significant association with QoL score. Both aerobic and anaerobic exercise, sleep duration of 6 to 8 hours, higher educational level, and being non-widowed were significantly associated with higher QoL scores, underscoring the combined benefits of lifestyle modifications and demographic factors for enhancing well-being in this cohort (Table 4).

Multivariate Linear Regression Analysis of QoL

The multivariate linear regression model including all lifestyle factors demonstrated that smoking (Model1: β = −3.694, p = 0.024), alcohol consumption (Model1: β = 3.567, p = 0.028), engaging in anaerobic exercise (Model1: <30 minutes: β = 6.667, P < 0.001; ≥30 minutes: β = 7.72, P < 0.001) and the use of smart phones for more than one hour (Model 1: β = 4.928, P < 0.001) both significantly associated with the QoL scores.

The influence of smoking, anaerobic exercise and the use of smartphone more than one hour on the total score of QoL remained significant after adjusting for demographic information and care factors. Individuals with smoking exhibited lower QoL scores (Model 2: β = −4.078, P = 0.014; Model3: β = −4.117, P = 0.012). Individuals who engaged in anaerobic exercise less than thirty minutes (Model 2: β = 6.689, P < 0.001; Model3: β = 7.323, P < 0.001) or more than thirty minutes (Model 2: β = 7.49, P < 0.001; Model 3: β = 7.483, P < 0.001) and those who used smartphone more than one hour per day (Model2: β = 4.408, P = 0.001; Model 3: β = 4.306, P < 0.001) showed increased QoL scores. After adjusting for demographic information and dementia severity level, the association between alcohol consumption and QoL score remained significant (Model 2: β = 3.097, P = 0.046). However, the influence of alcohol consumption on the total score of QoL is no longer significant after adjusting for care factors (Model 3: β = 2.828, P = 0.66). (Table 5)

Discussion

Our study revealed distinct patterns between lifestyle factors and cognition and quality of life. Both moderate aerobic exercise and smartphone use were significantly associated with higher MMSE scores, while smokers surprisingly showed better cognitive performance than non-smokers. However, after multivariate adjustment, the apparent cognitive advantage among smokers was attenuated. For quality of life measures, anaerobic exercise demonstrated the most consistent positive association, and the effects persisting after full covariate adjustment. Notably, extended smartphone use showed an independent positive association with QoL, while smoking exhibited an inverse relationship. These findings suggest

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Table 5 Multivariate Linear Regression Analyses of Associations Between Lifestyle Factors and Quality of Life (QoL Score) in Patients with Dementia

Variables	Model 1		Model 2		Model 3	
	β (95% CI)	*p*	β (95% CI)	β (95% CI)	*p*	β (95% CI)
Intercep	17.693(16.7,18.686)	<0.001*	15.295(8.657,21.933)	<0.001*	16.83(9.575,24.084)	<0.001*
Smoking	−3.694(−6.901,-0.487)	0.024*	−4.078(−7.316,-0.84)	0.014*	−4.117(−7.315,-0.919)	0.012*
Alcohol consumption	3.567(0.388,6.747)	0.028*	3.097(0.058,6.137)	0.046*	2.828(−0.19,5.846)	0.066
Aerobic exercise (compared with no aerobic exercise)						
Aerobic exercise < 1 hour	0.547(−0.659,1.752)	0.371	−0.051(−1.335,1.234)	0.938	0.084(−1.218,1.385)	0.899
Aerobic exercise ≥ 1 hour	1.16(−2.668,4.989)	0.550	0.379(−3.383,4.142)	0.842	0.075(−3.706,3.857)	0.969
Anaerobic exercise (compared with no anaerobic exercise)						
Anaerobic exercise < 30 minutes	6.667(3.834,9.501)	<0.001*	6.689(3.956,9.422)	<0.001*	7.323(4.495,10.15)	<0.001*
Anaerobic exercise ≥ 3 0 minutes	7.72(4.197,11.244)	<0.001*	7.49(4.131,10.85)	<0.001*	7.483(4.163,10.803)	<0.001*
Sleep duration (compared with sleep duration ranging from 6 to 8 hours)						
Sleep duration > 8 hours	−0.379(−3.672,2.914)	0.820	−0.953(−4.313,2.408)	0.576	−1.861(−5.278,1.556)	0.283
Sleep duration ≤6 hours	−0.544(−1.896,0.807)	0.427	−0.745(−2.066,0.576)	0.266	−0.852(−2.16,0.455)	0.200
Smartphone use (compared with not using smartphone)						
Usage time ≤1 hour	2.251(−0.466,4.967)	0.104	1.515(−1.104,4.135)	0.254	1.409(−1.183,4)	0.284
Usage time > 1 hour	4.928(2.405,7.451)	<0.001*	4.408(1.807,7.008)	0.001*	4.306(1.736,6.877)	0.001*
Age			0.049(−0.019,0.118)	0.158	0.049(−0.019,0.117)	0.156
Gender (female vs male)			0.083(−1.74,1.906)	0.929	−0.432(−2.288,1.424)	0.646
Educational level			0.799(0.212,1.387)	0.008*	0.611(0.008,1.215)	0.047*
Number of physical disease			−0.289(−0.7,0.122)	0.167	−0.322(−0.731,0.087)	0.122
Marital status (compared with Married)						
Divorced			1.794(−2.157,5.746)	0.371	1.978(−1.929,5.885)	0.318
Widowed			−2.171(−3.491,-0.852)	0.001*	−2.077(−3.391,-0.763)	0.002*
Unmarried			−3.801(−10.467,2.865)	0.261	−4.206(−10.808,2.396)	0.210
Dementia Severity Level			−0.288(−0.833,0.258)	0.299	−0.279(−0.818,0.26)	0.308
Number of caregivers					1.863(−0.283,4.008)	0.088
Average monthly care frequency					−0.075(−0.155,0.005)	0.066
R2	0.374		0.479		0.479	

Notes: The dependent variable is the total QoL score. Model 1 adjusts for all lifestyle factors listed. Model 2 additionally adjusts for age, gender, educational level, number of physical diseases, marital status, and dementia severity level. Model 3 further adjusts for the number of caregivers and average monthly care frequency. Variable coding follows the same definitions as in Table 3. *P-value < 0.05.
Abbreviations: QoL, Quality of Life; β, regression coefficient; CI, confidence interval.

differential effects of lifestyle factors, with exercise demonstrating robust benefits across outcomes, while technology use and smoking show more complex, outcome-specific associations.

Our study found that exercise less than or equal to one hour per day is beneficial to cognitive function, consistent with the findings of Aydin et al. Notably, our findings extend beyond exercise to highlight the independent contributions of sleep duration between 6–8 hours and smartphone use to cognitive function and QoL, which aligns with recent work on lifestyle synergies in aging populations. These results underscore the need for nuanced, multi-domain lifestyle interventions rather than a sole focus on physical activity. A latest study led by Harvard Medical School, recently published in the journal Nature Neuroscience. The study systematically elucidates the profound effects of exercise on the brains of Alzheimer's disease (AD) mouse models employing single-nucleus RNA (Ribonucleic Acid) sequencing as its primary methodology. This comprehensive investigation revealed exercise-induced remodeling across multiple dimensions, including neurogenesis, cellular microenvironment, and gene expression regulation, establishing a crucial framework for understanding the neuroprotective mechanisms of physical activity.[12] This indicates that exercise may confer neurorestorative potential in the AD brain by stimulating the generation of new neurons and the repair of synaptic networks.[13] The benefits of exercise more than one hour in our study did not reach statistical significance, which might be related to the sample size of this group (N = 6). Larger sample size is needed to confirm the impact of longer exercise duration on cognitive function in further study. According to our study, even low-dose exercise is beneficial to cognitive function, emphasizing the importance of moderate exercise of the elderly. Our study showed that anaerobic exercise was associated with the improvement of the quality of life. Scientists from institutions such as the University of Texas Southwestern Medical Center in the United States discovered that sustained high-level physical activity may assist in reducing brain atrophy in adults and maintaining long-term cognitive health.[14] There are also research reported that moderate-to-vigorous intensity exercise was associated with a 56% reduction in the risk of Alzheimer's disease, implying that high-intensity anaerobic exercise (when tolerated) may offer substantial quality-of-life benefits for the elderly.[15,16] Meta-analytic evidence indicates that middle-aged and older adults who regularly engage with digital technologies (eg, mobile phones, computers, and internet applications) demonstrate a 58% reduced risk of cognitive impairment. Furthermore, smartphone use appears to confer quality-of-life benefits.[17] People who use mobile phones at night experience an alleviation in depressive symptoms.[18,19] These findings indicate the benefits of smartphone usage on the quality of life.

Our study revealed a spurious protective association of smoking in univariate models that dissipated upon multivariate adjustment, suggesting potential survivor bias or unmeasured confounding. Conversely, smoking demonstrated robust negative impacts on QoL that persisted after full covariate adjustment, potentially mediated through respiratory function decline and increased caregiver burden.[20]

Limitation

This study is a cross-sectional study preventing a causal interpretation. Further studies utilizing longitudinal cohort designs are necessary to elucidate the cumulative effects of sustained lifestyle modifications. Besides, lifestyle information relied on self-description and lacked objective records of usage duration.

Conclusion

This study identifies distinct associations between lifestyle factors, cognitive function (assessed via MMSE), and quality of life (QoL). Moderate aerobic exercise and smartphone use correlate with higher cognitive scores, though the initial cognitive advantage among smokers diminishes after multivariate adjustment. For QoL, anaerobic exercise exhibits the strongest and most persistent positive association, followed by smartphone use, while smoking consistently links to poorer QoL.

Exercise demonstrates robust benefits for both outcomes, whereas technology use shows positive but outcome-specific associations, and smoking's potential indirect cognitive effects contrast with its clear negative impact on QoL. These findings underscore the need for tailored interventions, such as smoking cessation, in dementia populations.

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1. **Optimization of exercise prescription**: Recommend low-intensity aerobic exercise (eg, brisk walking for less than 1 hour daily) combined with anaerobic resistance training (such as elastic band exercises) to enhance QoL.
2. **Integration of smart devices**: Develop dementia-friendly applications (featuring simplified interfaces and voice interaction) and incorporate caregiver supervision.
3. **Comprehensive intervention for smokers**: Combine smoking cessation plans with cognitive training (such as memory card games) to reduce the risk of QoL deterioration.

Acknowledgments

An unauthorized version of the Chinese MMSE was used by the study team without permission, however this has now been rectified with PAR.

The MMSE is a copyrighted instrument and may not be used or reproduced in whole or in part, in any form or language, or by any means without written permission of PAR (www.parinc.com).

Disclosure

The authors report no conflicts of interest in this work.

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