Abstract

Objective: This cross-sectional study aimed to explore the association between late-life spiritual activity participation and cognitive function in older Chinese adults in Hong Kong.

Methods: Participants aged 60 years or older without clinical dementia or major psychiatric disorders were recruited. Dementia severity and global cognitive function were assessed using the Clinical Dementia Rating and Cantonese version of the Mini-Mental State Examination, respectively. Cognitive performance was measured using 10-minute delayed recall, the Category Verbal Fluency Test, Visual Aural Digit Span Test, and Modified Card Sorting Test. Psychological status was assessed using the Chinese version of the Purpose in Life scale. Activities participated in were categorised into 6 domains of physical, cognitive, social, prosocial, spiritual, and recreational activities.

Results: A total of 380 participants were enrolled. Bivariate correlation showed that the composite score of cognitive function was positively correlated with aerobic exercise (r = 0.14; p = 0.01), cognitive activity (r = 0.30; p < 0.001), and spiritual activity (r = 0.16; p = 0.002). Multiple linear regression suggested that frequent participation in cognitive activity (B = 0.87, beta = 0.22; 95% confidence interval [CI] = 0.52-1.25 and p < 0.001) and spiritual activity (B = 0.45, beta = 0.11; 95% CI = 0.13-0.76 and p = 0.01) were associated with better cognitive function after controlling for age and years of education.

Conclusion: Engagement in spiritual activity may benefit cognitive function in old age. Longitudinal studies are recommended to further examine the causal relationship of spiritual activity and cognitive function.

Key words: Aged; Cognition; Life style; Spirituality

Introduction

Population ageing is taking place worldwide. According to the United Nation Population Division, the proportion of people aged 60 years or older has increased from 11%...
(645,546) in 2003 to 13.1% (955,243) in 2013, and is projected to increase to 25% in 2050.\(^1\) This growth in population ageing is most rapid in the Asia Pacific region. Due to the rapid growth of the ageing population, researchers are interested in exploring health and psychological factors associated with cognitive function in old age.\(^2\-^5\) Lifestyle cognitive activities are reportedly beneficial for cognition function.\(^6\-^9\) Cross-sectional association for a high level of participation in cognitive activities with reduced risk of developing dementia and mild cognitive impairment has been reported.\(^10,11\) A study found that people who do crossword puzzles frequently are more likely to delay cognitive decline.\(^12\)

Apart from cognitive activity, other lifestyle activities may also modulate brain and cognitive function. Epidemiological studies of the effect of physical activity on cognition demonstrated an inverse relationship between physical activity level and cognitive decline.\(^4,13\-^15\) A study reported that the incidence rate for Alzheimer’s disease (AD) was higher for individuals who exercised fewer than 3 times per week than for those who exercised more frequently.\(^15\) Findings from randomised controlled trials on the effect of physical exercise on cognition also reported cognitive improvement.\(^16,17\)

The Nun study reported that lifestyle factors significantly influenced clinical manifestations of AD.\(^18\) While the result could be explained from a biological perspective, other modifiable lifestyle factors such as an active spiritual life may also contribute. However, there are very few studies exploring the effects of spiritual activity on cognition in old age. Two recent studies showed that engaging elderly people in religious activity reduced cognitive decline and helped to relieve depressive symptoms.\(^19,20\) A cross-sectional study found that long-term meditators have better cognitive function than non-meditators.\(^21\)

To better understand how spiritual activities are associated with cognitive function, purpose in life in relation to cognitive function has been investigated. Spiritual activity enables a person to look into the meaning of life, and may be associated with reduced mood disturbance. Previous findings suggested that motivation to search for spiritual experience was associated with a greater sense of purpose in life.\(^22\-^24\) A study by Boyle et al\(^25\) found that expression of a purpose in life is associated with delayed decline in cognitive function. Several studies have also demonstrated a positive relationship between participation in spiritual activity and subjective well-being.\(^26,27\) Krause\(^28\) found that religious participation was related to subjective well-being among elderly people. This study aimed to examine the association between participation in spiritual activity and cognitive function in older Chinese adults in Hong Kong. The hypotheses were that a greater level of spiritual activity in later life is associated with positive purpose in life and that spiritual activity in later life is associated with better cognitive function.

**Methods**

**Participants**

The study participants were community-dwelling elderly people (aged ≥ 60 years) in Hong Kong. Participants diagnosed with clinical dementia or psychiatric illnesses were excluded. Interviews were conducted either at the participant’s home or in Tai Po Hospital, Hong Kong, according to their preference. Informed consent was obtained before the interview began. Global cognition, lifestyle, and demographic data were collected.

**Assessments**

**Global Cognitive Function**

The Clinical Dementia Rating (CDR)\(^29\) was used to ascertain dementia severity. The Cantonese version of the Mini-Mental State Examination (CMMSE)\(^30\) was used to assess global cognition, with a range of score from 0 to 30. Cognitive performance was measured by 10-minute delayed recall, the Category Verbal Fluency Test,\(^31\) Visual Aural Digit Span Test, and Modified Card Sorting Test.\(^32\)

To obtain a composite score for cognitive function, raw scores for each of the cognitive tests were converted to z-scores. The z-scores were summed to obtain a composite score of cognitive function, with a higher score indicating better cognitive function.

**Measurement of Leisure Activities**

Leisure activities are categorised into 6 different domains. The activity classification was adapted from the activity questionnaire designed for older Chinese adults in Hong Kong.\(^33\) The original classification consisted of 4 activity domains of physical, cognitive, social, and recreational activities. After revision, we extracted prosocial activity and spiritual activity from the social activity domain, resulting in 6 domains for the new activity classification: physical activity (including mind-body exercise, strenuous exercise, stretching and toning exercises), cognitive activity, social activity, prosocial activity, spiritual activity, and recreational activity. The modified classification of leisure activities is shown in the Appendix. Frequency of leisure activity participation was calculated from the number of times per week and the duration on each occasion of each activity participated in during the previous year. The number of times per week of activity was multiplied by the duration (in minutes) to produce a weekly estimate of activity level.

**Psychological Measurement**

The Chinese version of the Purpose in Life scale was adopted to measure the extent to which respondents perceive meaning and purpose in their lives.\(^34,35\) The test is a 20-item self-report attitude scale, and each item is rated on a 7-point scale ranging from 1 (low purpose) to 7 (high purpose). The score ranges from 20 to 140, with a higher score indicating a greater sense of purpose in life.\(^36\)
Potential Confounders
Socio-demographic data of age, sex, education, marital status, socio-economic status, and occupational status were obtained. Severity of physical and psychiatric illnesses was assessed using the Cumulative Illness Rating Scale. Depression was defined according to the ICD-10 criteria of persistent sadness and/or loss of interest and fatigue lasting for 2 weeks or more in the previous month. Severity of depression was measured by the depression section of the Clinical Interview Schedule-Revised, the score of which ranged from 0 to 4. A higher score indicated more frequent and severe symptoms.

Data Analysis
Variables for normality were examined, and log transformation was done for those exhibiting a high level of skewness. Bivariate correlation was conducted to explore the correlations between cognitive score and frequency of engaging in different activities. Linear regression was performed to evaluate the association of participation in different leisure activities and cognitive function. Potentially confounding variables included in the regression analysis were age and years of education. Data analysis was performed using the Statistical Package for the Social Sciences Windows version 20.0 (SPSS Inc., Chicago [IL], US). Statistical significance was defined as p < 0.05.

Results

Demographic Characteristics
A total of 380 participants (189 men and 191 women) took part in the study. The mean ± standard deviation (SD) age was 70.4 ± 7.1 years (range, 60-97 years), with a mean duration of education of 9.2 ± 5.1 years (range, 0-24 years). In all, 306 participants (81%) had a CDR score of 0 and a mean CMMSE score of 28.8 ± 1.3 (range, 24-30). Also, 74 (20%) participants had a CDR score of 0.5 and a mean CMMSE score of 25.4 ± 2.2 (range, 21-30). The socio-demographic data of the participants are shown in Table 1.

Leisure Activities
In all, 99.7% of the participants reported recreational activity, cognitive activity, and social activity as the most common leisure activities that they had engaged in during the previous year. About half of the participants engaged in prosocial activity and spiritual activity. Stretching and toning exercises (73.4%) were the most common physical activities engaged in by the participants, followed by aerobic exercise (46.6%) and mind-body exercise (27.6%). The Figure shows the frequency of leisure activity participation in each domain.

Association with Cognitive Function
The composite score for cognitive function was negatively correlated with stretching and toning exercises and positively correlated with aerobic exercise, cognitive activity, and spiritual activity. Participants with poor cognitive function preferred stretching and toning exercises to other types of exercise. Table 2 shows the correlation between cognitive function and frequency of activity participation.

Linear regression analysis was conducted to determine whether the composite cognitive score was closely associated with the frequency of activity. After controlling for age and years of education, nearly half the variation (R² = 52.1%) in the composite cognitive score could be explained by the frequency of cognitive activity (B = 0.87, beta = 0.22; 95% confidence interval [CI] = 0.52-1.25 and p < 0.001) and spiritual activity (B = 0.45, beta = 0.11; 95% CI = 0.13-0.76 and p = 0.01).

Association with Purpose in Life
The score for purpose in life was positively correlated with spiritual activity, cognitive activity, and social activity (Table 3). Linear regression was conducted to determine whether purpose in life could be predicted from the frequency of activity participation. The results showed that spiritual activity (B = 5.30, beta = 0.18; 95% CI = 2.45-8.15 and p ≤ 0.0001), social activity (B = 4.93, beta = 0.18; 95% CI = 2.13-7.73 and p = 0.001), and cognitive activity (B = 4.57, beta = 0.16; 95% CI = 1.31-7.82 and p = 0.01) were associated with a higher score for purpose in life. When the results were then further controlled for loneliness in addition to age and years of education, only spiritual activity (B =

Table 1. Socio-demographic characteristics of the participants (n = 380).*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean ± SD age (years)</td>
<td>70.4 (7.1)</td>
</tr>
<tr>
<td>Mean ± SD duration of education (years)</td>
<td>9.2 (5.1)</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>191 (50.3)</td>
</tr>
<tr>
<td>Male</td>
<td>189 (49.7)</td>
</tr>
<tr>
<td>Marital status</td>
<td></td>
</tr>
<tr>
<td>Married / common-law spouse</td>
<td>258 (67.9)</td>
</tr>
<tr>
<td>Widowed</td>
<td>73 (19.2)</td>
</tr>
<tr>
<td>Divorced / separated</td>
<td>29 (7.6)</td>
</tr>
<tr>
<td>Single</td>
<td>20 (5.3)</td>
</tr>
<tr>
<td>Religion</td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>201 (52.9)</td>
</tr>
<tr>
<td>Christian</td>
<td>62 (16.3)</td>
</tr>
<tr>
<td>Catholic</td>
<td>28 (7.4)</td>
</tr>
<tr>
<td>Buddhism</td>
<td>46 (12.1)</td>
</tr>
<tr>
<td>Others (e.g. ancestor worship)</td>
<td>43 (11.3)</td>
</tr>
<tr>
<td>Occupation status</td>
<td></td>
</tr>
<tr>
<td>Retired</td>
<td>307 (80.8)</td>
</tr>
<tr>
<td>Employed</td>
<td>51 (13.4)</td>
</tr>
<tr>
<td>Unemployed / never worked</td>
<td>22 (5.8)</td>
</tr>
</tbody>
</table>

Abbreviation: SD = standard deviation.
* Data are shown as no. (%) of participants, unless otherwise stated.
4.68, beta = 0.16; 95% CI = 2.21-7.14 and p ≤ 0.001) was able to predict a higher score for purpose in life.

Linear regression was also conducted to determine whether cognitive function could be predicted from purpose in life. The results suggested that better cognitive function was associated with a higher score of purpose in life independent of age and years of education (B = 1.99, beta = 0.28; 95% CI = 1.10-2.87 and p < 0.001). The interaction between frequency of spiritual activity and purpose in life score and the effect on cognitive function was also examined. The main effects of spiritual activity (B = 0.42, beta = 0.10; 95% CI = 0.09-0.75 and p = 0.01) and purpose in life (B = 5.709, beta = 0.18; 95% CI = 3.22-8.19 and p < 0.001) were significant. The effect on cognitive function was also significant (B = 0.23, beta = 0.12; 95% CI = 0.70-0.38 and p = 0.01).

**Discussion**

These findings suggest that late-life cognitive and spiritual activities are associated with better cognitive function. While the effect of late-life cognitively stimulating activity has been well studied, the effect of spiritual activity on cognition has not been comprehensively studied.

We adapted and modified the activity questionnaire initially designed to measure leisure activity profiles in older Chinese adults. After revision of the original activity classification, we believed that reciprocal behaviour and spiritual activity are different from some of the more commonly defined social activities such as singing and social gathering with friends. Spiritual activity may play a role in fostering hope when encountering adversity, which may enhance positive affect and improve endurance of
negative life events such that self-actualisation may be achieved. The new 6-domain classification may enable us to examine different leisure activities more comprehensively.

Spiritual activity includes engaging in regular religious rituals and meditation. Extensive findings have demonstrated that spirituality is correlated with a variety of positive mental health outcomes, including lower rate of depression, higher self-esteem, and better quality of life.40-42 Emerging data also suggest that active involvement in spiritual activity is associated with slow progression of AD. Coin et al40 examined the relationship between religiosity and the development of cognitive impairment in people living with AD. The low-religiosity group experienced significantly greater decline in cognitive performance after 12 months than did the high-religiosity group. Kaufman et al41 also assessed the effect of spirituality and religion on people with probable AD. This longitudinal study found that older adults with higher levels of spirituality and religiosity declined less rapidly. Spiritual activity may be qualitatively different from cognitively stimulating activity as it was found to be associated with subjective well-being.43 Future studies could focus more on how spiritual activity may act as a modulating factor that contributes to protection against dementia through improving other positive mental health outcomes.

Although the relationship among spiritual activity, psychological well-being, and cognitive function could not be inferred directly, our results suggest that spiritual activity is associated with purpose in life. Previous cross-sectional studies have found that purpose in life is associated with psychological well-being such as happiness, satisfaction with life, personal growth, self-acceptance, and better sleep.44-47 A 7-year prospective study by Boyle et al48 found that older adults with a greater purpose in life were more likely to maintain cognition than those with a low purpose in life. Our findings suggest that there is an interaction between spiritual activity and purpose in life resulting in better cognition. These results suggest that cognitive function may be modulated by spiritual activity and purpose in life through a pathway that connects spiritual activity and purpose in life.

It would be of interest to study the association between spiritual activity and brain function. Functional imaging study has demonstrated that the repetitive practice of meditation in daily life enhances brain connectivity49 and increases prefrontal cortical thickness50 and grey matter density in the lower brain stem region.50 These results might account for the effect of enhancing attention and maintaining cognition in old age.

In this study, we used a self-report method to obtain information on activity participation among elderly people. This method has limitations in terms of reliability and validity. One of the challenges in obtaining the frequency of activity participation is that elderly people do not necessarily maintain consistent behaviour for certain activities. Therefore, it may be helpful to ascertain a time frame when asking about the frequency of activities performed.

Conclusion

Out findings suggest that a higher level of spiritual activity and a high purpose in life in later life are both associated with better cognitive function. Longitudinal studies are recommended to further examine the causal relationship of spiritual activity and cognitive function in older adults.

Declaration

The authors declared no actual or potential conflict of interest in relation to this article.

References


