Modulating Factors that Preserve Cognitive Function in Healthy Ageing

维持健康老人认知功能的调控因素

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Abstract

Objectives: Most studies examining factors contributing to cognitive impairments and dementia in late life focused on risks. In this study, we aimed to evaluate factors that might help preserve cognition in healthy Hong Kong elders.
Methods: This was a 2-year prospective study of 476 cognitively healthy community dwellers (aged 60-92 years) recruited in Hong Kong. Participants were assessed with a battery of cognitive tests and questionnaires on their sense of loneliness and leisure activities.
Results: A high level of cognitive activity participation ($r = 0.13$, $p = 0.03$) and a low level of loneliness ($r = –0.15$, $p = 0.01$) were associated with better cognitive test performance. Participants with more years of education (odds ratio = 1.27, $p < 0.001$) and a higher frequency of drinking (odds ratio = 1.17, $p = 0.05$) were associated with high cognitive function, while those with a high level of loneliness (odds ratio = 0.79, $p = 0.01$) were associated with low cognitive function. The correlation with cognitive activity participation remained significant in participants with very good cognitive function ($r = 0.20$, $p = 0.04$).
Conclusions: These results suggested that social engagement and moderate drinking may be modulating factors for cognition. Further studies should explore the interactions between lifestyle factors and cognition in older adults with no significant cognitive impairment.

Key words: *Aged; Cognition; Life style*

摘要

目的：现时大部份文献均着眼于在晚年患上认知缺损和脑退化症的相关风险。本研究旨在评估有助维持香港健康老人认知功能的因素。
方法：这项为期2年的前瞻性调查，纳入476名介乎60至92岁的社区认知健康老人，并以一系列认知测试及针对孤独感水平和消闲活动参与度的问卷作出评估。
结果：积极参与认知活动（$r = 0.13$，$p = 0.03$）和孤独感水平较低（$r = -0.15$，$p = 0.01$）的老人其认知测试结果较佳；教育水平较高（比数比 = 1.27，$p < 0.001$）和喝酒次数较频密（比数比=1.17，p=0.05）的老人也与认知功能较佳相关，而孤独感水平较高（比数比=0.79，$p = 0.01$）的老人其认知功能表现则较差。拥有上佳认知功能的老人与其认知活动参与度显著相关（$r = 0.20$，$p = 0.04$）。
结论：结果建议，社交活动和适度喝酒或是认知功能的调控因素。对于无显著功能缺损的老人其生活方式和认知的相关性，则有待进一步研究。

关键词：*老人、认知、生活方式*

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Introduction

Successful ageing is a concept that has received increasing attention. Paradoxical to the convention of ageing which signifies process of degeneration and loss of function, successful ageing embraces the need for physical, mental, and cognitive well-being, as well as active engagement in life. While the studies of risk factors for cognitive impairment and dementia are extremely important, it is

apparent that identification of protective factors for good cognition offers insights for the prevention of disability. Recent research suggested that certain lifestyle factors, such as physical exercise, cognitively stimulating activities, and participation in leisure activities may facilitate cognitive preservation.[1-10]

The main objective of this study was to explore factors that may modulate cognitive function in healthy non-demented Chinese elders in Hong Kong. We assumed that there was a difference in lifestyle, emotional status, and physical health in elderly persons with different levels of cognitive function. We also hypothesised that older people with better cognitive function were more active when it came to participating in leisure activities, and that they had a lower level of loneliness and less physical illnesses than those with lower levels of cognitive function.

Methods

Participants

This study was the secondary analyses from a follow-up study[11] on the prevalence of cognitive impairment in community-dwelling elders in Hong Kong. A total of 788 participants aged ≥ 60 years were recruited at baseline. At follow-up, 515 (65%) subjects were followed up at 22 months, 251 (32%) refused interview or were not contacted, 21 (3%) had passed away, and 1 had deteriorated due to physical illness and was unable to complete the cognitive assessment.

In this analysis, subjects diagnosed with dementia (n = 29) or having a Cantonese-version Mini-Mental State Examination (CMMSE) score of < 20 (n = 9) were excluded from the analyses. The severity of dementia was based on the Clinical Dementia Rating (CDR).[12] On completion of each assessment, participants were assigned with a CDR by trained raters. This indicated the severity of their cognitive impairment as: (i) non-demented (score 0); (ii) very mild dementia (score 0.5); (iii) mild dementia (score 1); (iv) moderate dementia (score 2); and (v) severe dementia (score 3). One subject with a baseline age of 57 years was also excluded from analysis. As a result, information from 476 cognitively normal healthy subjects was analysed.

Procedure

Potential subjects were invited by telephone to participate in follow-up interviews, conducted either at their home or at the nearest elderly centre. Informed consent and information regarding socio-demographic data, history of physical health and psychiatric illness, as well as mood were also collected by the team psychiatrist. A battery of cognitive assessment tests was administered by a trained research assistant.

Assessment

Socio-demographic data regarding age, gender, education, marital and socio-economic status, self-rated health, and medication were obtained. The severity of physical or psychiatric illnesses, cardiovascular and cerebrovascular risk factors were assessed using the Cumulative Illness Rating Scale.[13]

Lifestyle and psychosocial factors regarding smoking, drinking, social networks and supports, leisure activity and loneliness were collected. The level of leisure activity engaged was measured using a specifically designed questionnaire delving into the variety and frequency of leisure activities usually undertaken. Leisure activity was divided into 4 types: cognitive, social, recreational, and physical. The follow-up study also employed a Chinese version of the 6-item De Jong Gierveld Loneliness Scale[14] to measure the level of social, emotional, and overall loneliness.

Cognitive functional assessment was based on the Cantonese version of Alzheimer's Disease Assessment Scale – cognitive subscale,[15] the 10-minute delay recall, the category verbal fluency test,[16] the digit and visual span tests, and the abstract thinking test (similarities and differences). The CMMSE[17] and CDR[12] were used as a measure of global cognitive function.

Functional ability was evaluated using the Chinese version of the Disability Assessment for Dementia.[18] The Chinese-version Neuropsychiatric Inventory[19] was administered to assess any emotional, behavioural, and psychiatric symptoms.

Analysis

Two sets of comparisons were performed as follows:

(i) High cognitive function (HCF_{75}) versus low cognitive function (LCF_{25}), i.e. subjects with a CMMSE score ≥ 75th percentile (CMMSE ≥ 28) were compared with those at the 25th percentile (CMMSE of 20-24); and

(ii) Very high cognitive function (HCF_{90}) versus very low cognitive function (LCF_{10}), i.e. subjects with a CMMSE score ≥ 90th percentile (CMMSE ≥ 29) were compared with those at the 10th percentile (CMMSE of 20-22).

Subjects of the respective groups were compared for differences in socio-demographic data and cognitive performance. To investigate which factors were correlated with or could modify cognitive function, partial correlation and multivariate logistic regression analyses were performed on lifestyle, psychosocial factors, and physical health with cognitive function. Potentially confounding variables included in the multivariate analyses were age, gender, and education. Data analysis was performed using Predictive Analytics Software 17.0 for Windows. Statistical significance was defined as $p < 0.05$.

Results

Of these 476 subjects, 225 (47%) were male. The mean (standard deviation [SD]) subject age was 72 (7) [range, 60-92] years, with a mean (SD) duration of completed education of 5 (4.6) [range, 0-20] years. Also, 264 (55%)

Table. Comparison of baseline characteristics and cognitive performance of low versus high cognitive function groups, as well as very low versus very high cognitive function groups.*

Characteristic	LCF_{25} (n = 170)	HCF_{75} (n = 172)	p Value	LCF_{10} (n = 43)	HCF_{90} (n = 88)	p Value
Age	73.5 (6.7)	70.2 (6.7)	< 0.0001	73.9 (7.7)	69.7 (6.7)	< 0.0001
Education (years)	2.9 (3.5)	7.2 (4.8)	< 0.0001	1.6 (2.5)	8.2 (4.7)	< 0.0001
ADAS-Cog total	11.3 (3.3)	8.8 (2.5)	< 0.0001	12.2 (4.3)	8.5 (2.8)	< 0.0001
10-Minute delay recall	4.2 (2.3)	6.2 (2.0)	< 0.0001	3.4 (2.5)	6.8 (1.8)	< 0.0001
Category verbal fluency test	30.6 (6.7)	36.5 (7.3)	< 0.0001	28.6 (7.3)	38.4 (7.9)	< 0.0001
Digit backward score	3.4 (1.3)	5.4 (2.4)	< 0.0001	3.1 (1.4)	5.9 (2.3)	< 0.0001
Visual backward score	3.7 (1.5)	5.2 (1.7)	< 0.0001	3.3 (1.4)	5.5 (1.7)	< 0.0001
Abstract thinking (similarities)	4.2 (1.5)	5.3 (1.1)	< 0.0001	3.7 (1.7)	5.3 (1.2)	< 0.0001
Abstract thinking (differences)	4.9 (0.9)	5.4 (0.7)	< 0.0001	4.8 (0.9)	5.4 (0.7)	< 0.0001
Cumulative illness rating scale	2.7 (1.8)	2.3 (1.7)	< 0.05	2.8 (2.0)	2.3 (1.7)	-
Self-rated health	2.8 (0.8)	2.7 (0.8)	-	2.8 (0.8)	2.5 (0.7)	< 0.05
Drinking (episodes per month)	1.5 (0.7)	1.7 (0.9)	< 0.05	1.3 (0.6)	1.7 (0.9)	< 0.01

Abbreviations: *ADAS-Cog = Alzheimer's Disease Assessment Scale – cognitive subscale; HCF_{75} = high cognitive function; HCF_{90} = very high cognitive function; LCF_{25} = low cognitive function; LCF_{10} = very low cognitive function.*

* *Data are shown as mean (standard deviation), unless otherwise specified.*

of the subjects had no features of cognitive impairment (i.e. CDR = 0), and 212 (45%) had only very mild dementia (i.e. CDR = 0.5).

Besides, 170 (50%) of the subjects were assessed as LCF_{25} and 172 (50%) as HCF_{75}; 179 (52%) of these subjects were females and 163 (48%) were males. The proportion with HCF_{75} was higher among males (n = 99; 29%) than in females (n = 73; 21%) [Chi-square: $r = 13.59$, $p < 0.001$].

Moreover, 43 (33%) of the subjects were assessed as LCF_{10} and 88 (67%) as HCF_{90}; 66 (51%) of these subjects were females and 65 (49%) were males. The proportion with HCF_{90} was higher in males (n = 55; 42%) than in females (n = 33; 25%) [Chi-square: $r = 17.80$, $p < 0.001$]. The Table lists the group differences in baseline characteristics and cognitive performance for both levels of comparison.

High Cognitive Function Group Versus Low Cognitive Function Group

After adjustment for baseline age, gender and education, cognitive function correlated positively with the frequency of cognitive activities performed ($r = 0.13$, $p = 0.03$) as well as drinking frequency ($r = –0.13$, $p = 0.03$). Cognitive function correlated negatively with the level of social loneliness ($r = –0.12$, $p = 0.05$) and overall loneliness ($r = –0.15$, $p = 0.01$). The LCF_{25} with HCF_{75} subjects were compared using multivariate logistic regression analyses to investigate factors that might be modifying cognitive function. This showed that high cognitive function was significantly associated with lower levels of overall loneliness (odds ratio [OR] = 0.79, $p = 0.01$), more years of education (OR = 1.27, $p < 0.001$), and a higher frequency of drinking (OR = 1.17, $p = 0.05$).

Very High Cognitive Function Group Versus Very Low Cognitive Function Group

The association between cognitive function and frequency of cognitive activities performed remained significant, when only subjects at the extreme ends were included ($r = 0.20$, $p = 0.04$). Physical activity was also found to be associated with cognitive function ($r = –0.20$, $p = 0.05$). To investigate the modifying relationship between personal attributes, lifestyle, and psychosocial factors with cognitive function, the same type of multivariate logistic regression analyses was performed to compare LCF_{10} to HCF_{90} subjects. The results showed that high cognitive function was significantly associated with greater cerebrovascular risk (OR = 1.91, $p = 0.03$) and more years of education (OR = 1.76, $p \leq 0.001$).

Discussion

We intended to investigate modulating factors that might preserve cognitive functioning in old age. In this cross-sectional study, we showed that elderly with better cognitive function do more cognitive leisure activities, feel less lonely, and are more frequent drinkers. However, we are not yet ready to make any causal statement about social engagement and cognitively stimulating activities in enhancing or preserving cognitive function.

Results of a previous community-based survey suggested an apparently favourable impact of late-life

cognitive activities on the frequency of dementia.[9] We found that elderly with high cognitive function performed cognitively stimulating activities more frequently. The effect remained significant in elderly of distinguished cognitive function. We also found that elderly of distinguished cognitive function performed physical activity less frequently than those at the other extreme. It is possible that cognitively stimulating activity was able to offer a larger effect size in preserving cognition than physical exercise. It was also possible that participation in physical activities is a more basic leisure activity, which is readily taken up by elders even after the onset of subtle cognitive impairment. Recent evidence from randomised controlled trials actually highlights the beneficial effects of regular practice of mind-body exercises on cognitive function.[8,20-22]

Interestingly, a higher frequency of drinking had a modulating effect on cognitive function in the high cognitive function group, but not in the distinguished group. Notably the subjects reported in this study were primarily social drinkers who consumed in moderation. The majority drank only a few times per month. Recent studies supported some gains in terms of cognition from moderate drinking.[23,24] However, many of these studies were inconclusive, as they depended on cross-sectional surveys based on self-reporting.[23] Issues regarding the age of first-time alcohol use, the type and amount of alcohol consumed, and the monitoring of drinking behaviour changes should all be addressed in future studies.

The relationship between cerebrovascular diseases and cognitive function must not be assumed to be simple. A possible explanation might be due to the self-reporting of cerebrovascular risk factor measurements in the interview. Information on medical history was self-reported. Therefore, under-estimation of cerebrovascular risk factors was possible. A local study reported that the percentage of subjects with undiagnosed diabetes was 64%.[25] It is possible that a sizeable proportion of our sample who reported no hypertension, diabetes, dyslipidaemia or heart disease were in fact undiagnosed and undertreated. Those with undiagnosed cardiovascular risk factors might be at an even higher risk for cognitive impairment. Studies have found that the control of hypertension could reduce the risk of stroke by about 40%,[26] and the duration of diabetes and its metabolic control are also important predictors of stroke in the elderly.[27]

In our study, an association between cognitive function and loneliness was only found on comparing high and low cognitive function groups. Cognitive function and negative emotion were reported to be interactive. The underlying mechanism of how emotion influences cognitive function was not fully understood. Since our study only focused on the level of loneliness, we do not have information on how and when loneliness developed in participants with low cognitive function.

Limitations

The most important limitation of this analysis was the profound effect of education on CMMSE. Currently, our definition of high cognitive function has been limited to elderly subjects with CMMSE scores at or above the upper end of the sample in a cross-sectional study. To better control the inclusion criteria, multiple cognitive test scores should be used as references. Even better, a more rigorous definition on superior cognitive function could be used to include only elderly persons with cognitive performance comparable to or above the mean level of older adults.

The second limitation to our analysis was the narrow group of psychometric properties, as the 6-item De Jong Gierveld Loneliness Scale was the only instrument used to measure psychological factors. As noted previously, loneliness is only one of many aspects of negative emotions. More psychological factors, such as hopelessness, level of life satisfaction, and the duration of emptiness should be included and explored in future studies so as to gain a full picture of the effect of emotions on cognition in old age.

Another difficulty we encountered was the small sample size when it came to comparing the very high and very low functioning groups, which was very likely relevant to the level of significance that could be obtained.

Conclusions

Our results suggested that active and frequent engagement in cognitively stimulating activities, accompanied by physical activities, may be related to the sustainment of high intellectual function into old age. Our findings have illustrated the importance of a multi-faceted lifestyle as a potential dementia prevention strategy. Further studies should explore interactions between social factors and cognitive ability in older adults with no significant cognitive impairment.

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