

Ageing and Cognitive Health: A Preventive Approach

Sampurna Chakraborty^{1*}, Shridhar Utagi², Susmita Halder³

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Abstract

Ageing often leads to a decline in cognitive abilities. Significant cognitive impairment leads to functional impairment, loss of independence and need for long term care. A cognitive reserve is a functional ability that helps to prevent cognitive decline. Identifying the modifiable risk factors for cognitive decline with advancing age is crucial. Research has shown that cognitive

exercise and cognitive training in older adults can slow down or resist cognitive decline. Continuous cognitive engagement, adequate and rich cognitive stimulation and complex mental activity can foster neuroplasticity in the brain and, therefore, may be utilized to mitigate age-related changes in cognition. Therefore, adopting a preventive approach to healthy ageing will benefit the ageing population and the community.

Key Words: Ageing, Cognitive decline, Cognitive reserve, Cognitive exercise, Neuroplasticity

Introduction

Ageing often leads to a decline in cognitive abilities. This decline can be due to varied factors like metabolic changes, genetic factors, stress, environmental factors, general health and well-being. People worldwide are living longer. Today most people can expect to live into their seventies and eighties and beyond. Most of the countries in the world is experiencing growth in both the size and the proportion of older persons in the population. By 2030, 1 in 6 people in the world will be aged 60 years or over [1]. A longer life can bring opportunities, not only for older people and their families but

also for societies as a whole. However, ageing also means a particular decline in physical and mental abilities. General health deterioration and medical conditions are expected in late life, and the capacity for self-care may reduce at old age. This may pose a burden on the families and the society at large. Prevention of cognitive decline and delaying its progression would help to reduce the need for long-term care. Therefore, adopting a preventive approach to healthy ageing where the rate of cognitive decline can be reduced and the quality of life can be improved may benefit the ageing population and the community and society.

¹Project Stree Manoraksha, NIMHANS, Karnataka, India

²Department of Psychiatry, NIMHANS, Karnataka, India

³Department of Psychology, St. Xavier's University, West Bengal, India

*Corresponding author: Sampurna Chakraborty, Project Manager, Project Stree Manoraksha, NIMHANS, Karnataka, India, Tel: +918582947749, E-mail: sampurnachakraborty92@gmail.com

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Cognition and Cognitive Health

The word 'Cognition' comes from the Latin word '*cognoscere*', which means "to know". Therefore etymologically speaking, cognition broadly refers to everything related to knowledge. In other words, cognition is the accumulation of receiving and processing information, perceiving it or giving meaning to the percept through past experiences, reasoning, decision making and planning, and then storing the information and reusing it appropriately. Cognition allows us to integrate this information to evaluate and interpret our world. It is the ability that we have to assimilate and process the information that we receive from different sources (perception, experience, beliefs) and convert them into knowledge. It includes different cognitive processes, like learning, attention, memory, language, reasoning, decision-making.

Cognitive health refers to the ability to clearly think, process information, learn, make rational decisions and plan and thereafter apply and remember the information adequately and appropriately. Therefore it can be understood that cognitive health is an essential component for performing the everyday activity.

With growing age, cognitive functioning starts declining gradually. With the growing elderly population worldwide, the number of people with dementia is expected to double by 2030 and more than triple by 2050 [2]. It is essential to identify the modifiable risk factors for dementia and even cognitive decline to use this knowledge for prevention. Prevention of cognitive disorders is as important as the prevention of other lifestyle disorders because cognitive functioning has a direct relationship with functional autonomy and self-care, and a failure to restrict the rate of cognitive decline with ageing would imply functional impairment in the elderly. Therefore, identifying cognitive decline in old age, its determinants, and prevention becomes an imperative subject for

research and clinical investigation.

Ageing and Cognition

Let us understand the common changes and decline in cognition associated with old age. Cognitive abilities such as attention, memory, executive cognitive function, language, and visuospatial abilities have significant decline with age [3]. Existing literature has shown a decline in sensory perception and processing speed with age [4]. There is also deterioration in attentional capacities that occurs with age. The most significant changes noticed in ageing are in selective attention and divided attention [3,5].

In the cognitive domain of learning and memory, it has been found that some aspects are stable with normal ageing. However, there are consistent declines in new learning abilities with increasing age and some decline in recall and recognition of newly learned material [3]. Usually, the sensory memory or immediate memory remains unaffected with age, but when the material is heavy or complex, then it starts faltering, and older people tends to find it challenging to process and retain new information. Episodic memory, both personal (autobiographical) and impersonal (historical events or events of public significance), are relatively stable with advanced age, but the accuracy of the source declines with age, as does the level of detail of recalled episodic memories. New learning, as measured by a delayed free recall, also declines with age. Prospective memory, which involves remembering instructions or tasks to perform intended action in the future, such as taking medication after breakfast or making a particular phone call, declines with age. Procedural memories, such as remembering how to ride a bike or swim, are preserved with age [5].

Working memory is the cognitive function that requires the active manipulation of material to be stored and recalled. Working memory is noticeably affected in older adults. It has

been noted that retention of newly learned information is relatively stable with advancing age, but retrieval of information is the capacity that is mainly affected. Recall of information may require more retrieval cues; however, recognition tasks is comparatively unaffected in advanced age groups. Executive function involves higher-order cognitive functions such as decision making, problem-solving, planning. Each of these areas of executive cognitive function declines with advancing age. In addition, concept formation, abstraction, mental flexibility and response inhibition decline with age, especially in individuals older than age 70 [3,5].

Speech and language function remains largely intact with advancing age. There is no noticeable decline and deterioration in vocabulary and verbal reasoning; however, there is some decline in verbal fluency, verbal retrieval and speech comprehension [6,7]. Researcher Critchley observed that older adults were less verbose, more repetitive in their speech content, and less specific in their word choice in spontaneous speech when compared with young adults [8]. There are age-related declines in aspects of visuospatial processing and constructional praxis as well. Visual recognition of objects and shapes remains stable into advanced age. However, visuperceptual judgment and the ability to perceive spatial orientation may decline with age [3].

Therefore, it can be understood that the cognitive functions naturally starts declining and gradually deteriorating with advanced age. However, it may be necessary to slow down the rate of cognitive changes and decline in older adults to prevent dementia or cognitive impairment and retain the functional autonomy and quality of life of the older adults. Therefore, it is vital to adopt a preventive approach in this regard.

Maintaining Cognitive Health

Before understanding how to decelerate the rate of decline in cognitive abilities in older adults and how to retain their cognitive functioning and autonomy even in advanced age needs, a discussion about what is a cognitive reserve.

Cognitive reserve refers to the hypothetical capacity of the brain to tolerate ageing changes or pathological effects such as diseases and brain damage. It sheds light on the individual differences that may allow some people to be more resilient than others with regard to the decline in cognitive abilities with the advancement of age. The concept of cognitive reserve holds out the promise of preventive approaches that could slow cognitive ageing or reduce the risk of cognitive impairment or various types of dementia.

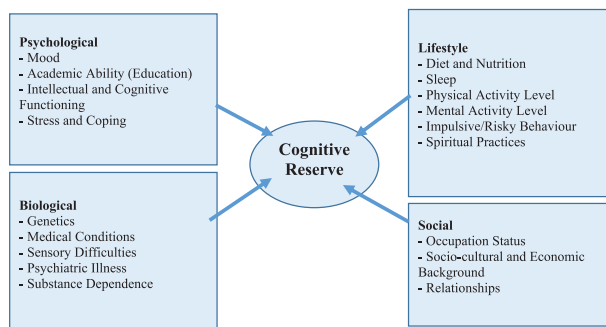


Figure 1. Showing Factors Contributing to Cognitive Reserve.

The concept of cognitive reserve (CR) suggests that innate (genetically inherited) intelligence, known as fluid intelligence and aspects of life experience like educational ability or occupational attainments known as crystallized intelligence forms the reserve that allows some people to cope better with progressing age and cognitive changes associated with ageing. However, factors such as various medical conditions or sensory difficulties noticeable in the elderly may start impacting the cognitive reserve. Research has shown how chronic medical conditions like hypertension and diabetes are estimated to be risk factors for the progression of cognitive decline and may also trigger a transition from mild cognitive impairment to dementia [9-11]. A study

conducted by Vidoni et al. [12] reported that low cholesterol or a low BMI might act as a risk factor for cognitive impairment. Psychiatric diagnosis of Depression or general mood may be considered a predictor of cognitive function, as has also been implicated in many previous studies [13,14,10].

Social engagement and networks also play an important role in cognitive reserve. Park et al. [15] showed that elderly individuals living alone had a relatively low cognitive function compared to those living with family, and attributed to the fact that older adults living alone had a lack of adequate social and familial ties and therefore experience lowered emotional and cognitive stimulation. It may also be possible that a socially isolated person may adhere less to a healthy lifestyle, which may again impact cognitive abilities.

The association between substance use or dependence and the cognitive deficit is well established. The brain regions and neural processes that underlie addiction overlap extensively with those that support cognitive functions such as learning, memory, response inhibition, flexibility and planning and reasoning. Some of the commonly abused substances and their associated cognitive deficit can be noted as follows: cocaine - deficits in cognitive flexibility [16]; amphetamine—deficits in attention and impulse control [17]; opioids—deficits in cognitive flexibility [18]; alcohol—deficits in working memory and attention [19]; cannabis—deficits in cognitive flexibility and attention [20]; and nicotine—deficits in working memory [21].

The effect of stress on cognitive function can be short term and long term. For instance, minor daily hassles or when individuals appraise events and situations in their lives to be stressful, or when the individual is experiencing significant adverse or traumatic life events, they tend to allocate cognitive resources to coping with these demands this in turn limits available resources

to new incoming information or difficulty in processing and responding to environmental cues [22, 23].

Talking about the lifestyle correlates, the importance of diet, sleep and physical exercise on cognitive functioning is immense. A healthy diet can help to prevent cognitive decline in older adults. Diets consisting of saturated fatty acids and high calories are known to increase the risk of chronic heart disease, diabetes, and other medical conditions that have a strong association with cognitive impairment, such as vascular dementia. On the other hand, diets rich in vitamins, minerals and antioxidants are considered protective for cognitive functioning [24]. Quality of sleep and sleep deprivation has also been linked to cognitive abilities and their dysfunction or decline in the ageing process. The two most widely studied cognitive domains related to sleep research are attention and working memory. Research has shown that sleep deprivation, non-restorative sleep or poor quality of sleep often impacts the level of vigilance, reaction time, processing speed and is reflected in various auditory, visual and spatial tasks [25, 26]. Among lifestyle factors of utmost importance is activity level and engagement in physical activities. Research has shown that physical activity sustains cerebral blood flow, and it, in turn, improves aerobic capacity and cerebral nutrient supply. Studies have shown greater hippocampal volume and better cognitive functions in individuals doing regular aerobic exercises [27]. Therefore, active life and engagement in adequate physical activity is not only a marker of good health but also plays an imperative role in maintaining cognitive functioning and restricting the cognitive decline with advancing age [3,24].

Implication of Cognitive Exercise

Continuous cognitive engagement, adequate and rich cognitive stimulation and complex mental activity can foster neuroplasticity in the brain and, therefore, may be utilized to mitigate age-

related changes in cognition [28]. Research has indicated that individuals with higher levels of mental activity and cognitive engagement are at a reduced rate of experiencing cognitive decline and only about half the risk of developing dementia [29]. It is further noteworthy that cognitive exercise, even initiated at an advanced age, irrespective of early life experiences, reduces the risk of cognitive impairment and dementia [30].

Cognitive tasks like thoughtful debates, problem-solving activities such as quizzes, word association activity, crosswords, and puzzles, which are common in our day-to-day lives, can be effectively used as cognitive exercise. In recent times, with the growing familiarity with computers and technology, involving older adults in computerized cognitive tasks may also be an option. Computerized games like chess, concentration card games, and arcade games can be included in the intervention plan of older adults. The inclusion of cognitive exercise activities in the daily living of older adults needs to be highly recommended for prevention and early intervention. The cognitive functioning of patients diagnosed with dementia starts deteriorating at an accelerated rate; therefore, with patients with dementia, the primary focus should be on the identification of areas of decrement, and an early stage inclusion of cognitive exercises and regular practice of it might slow down the progression of the disorder [31, 32].

A substantial number of research evidence supports the preventive and interventional implication of cognitive exercise and cognitive training in older adults to slow down or resist the cognitive decline associated with age-related factors. A longitudinal randomized controlled trial of cognitive training among older adults demonstrated that it helped slow the rate of age-related cognitive decline on a range of cognitive tasks, with a moderate effect size of 0.6 [33]. Another very famous randomized trial, the ACTIVE (Advanced

Cognitive Training for Independent and Vital Elderly) study, which involved 2802 older Americans, compared three training programs (memory strategy, reasoning, and computer-based speed of processing) and the participants were assessed immediately after the training and at 1- and 2-year follow-up. Results indicated that domain-specific training led to improvement in the targeted cognitive functions. It also showed that computer-based speed training resulted in the most significant gains compared with pen-and-paper reasoning and memory strategy training [34]. The maintenance effect was not evident at 2 years; however, the subsequent assessment revealed positive functional benefits at 5-year follow-up [35].

Conclusion

Cognition is critical for every human behaviour. It becomes closely related to functional independence as people age, including whether someone can live independently, manage finances, take medications correctly. In addition, intact cognition is vital to communicate effectively, including processing and integrating sensory information and responding appropriately to others. Cognitive abilities often decline with age. The decline and deterioration in cognitive ability and functioning can impact an individual's well-being and quality of life and, at the same time, increase the dependence on caregivers, which in the long run may result in some amount of caregiver burden. It is therefore of great importance to understand what types of changes in cognition are expected as a part of normal ageing and what are the modifiable and preventive factors that can be tapped at a nascent stage. One of these is specific lifestyle modification and practice of cognitive tasks where a regular, intense cognitive engagement may effectively delay cognitive decline or slow the process of cognitive decline. Therefore it is essential to be associated and be continually exposed to a socially enriched environment and maintain an intellectually stimulating life.

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