Chapter 18
Yoga and Aging:
Neurobiological Benefits

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ABSTRACT

Governments and societies need to be prepared to confront population aging. Such preparation includes policies that can improve quality of life, functional capacity, and health of the general population, encouraging a more active and healthier lifestyle. Normal aging is associated with changes in brain structure and function, which may cause behavioral and cognitive impairments. It is important to understand which changes make some individuals healthier than others. Yoga has been associated with improved quality of life, cognition, and physical health as well as brain functional and structural changes.

AGING

As longevity increases in the population, the incidence of aging-related diseases also increases, generating higher medical costs (Grootjans-van Kampen et al., 2014). Advances in prevention and treatment, in addition to improved public health policies, have successfully increased life expectancy. At present, the greatest number of deaths is due to diseases related to lifestyle (Rouquayrol & Almeida Filho, 1999). Lifestyle has components, such as such nutrition habits, physical activity, and leisure, which constitute important factors to promote health and quality of life. Both, Government and society need to be prepared to confront this state of affairs. Such a preparation includes policies that can improve quality of life, functional capacity, and health of the general population, notably the elder, encouraging a more active and healthier lifestyle.

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As life expectancy increases, it is necessary to face this reality by tackling the problems of what has been described as unsuccessful aging. Young et al. (2009) define successful aging as: "*A state wherein an individual is able to invoke adaptive psychological and social mechanisms to compensate for physiological limitations to achieve a sense of well-being, high self-assessed quality of life, and a sense of personal fulfillment even in the context of illness and disability"*. This multidimensional approach takes into consideration three domains: physiological, psychological, and social. From this perspective, lifestyle is of fundamental importance for a healthy aging and also to promote a resilient brain (Taket et al., 2013) which is associated to reduced mental disorders in life, better mental health and greater psychological well-being (Smithet et al., 2014).

Whilst sedentary elderly are more likely to develop health problems, a healthy lifestyle may help reverse the situation, potentially modifying risk profiles for frailty syndrome (Cesari et al., 2015), mortality, and overall disability (Seeman et al., 1995), contributing to a more successful aging (Kanning & Schlicht, 2008).

In addition, normal aging, even before occurrence of Alzheimer's disease or cerebrovascular disease, is associated with changes in brain structure and brain function, which may cause behavioral and cognitive impairments (Lockhart & DeCarli, 2015; Persson et al., 2006). Although aging causes changes in brain and cognition, some individuals, unlike others, despite advanced aging, have more preserved brain structure and more stable cognition over the course of aging. Thus, it is important to understand what kind of changes are associated with normal aging and, on the other hand, which makes some individuals healthier than others.

Regarding the brain structure, accessed by MRI studies, white matter, cortical and subcortical gray matter may present decreased volume across the lifespan. Although most studies are gray matter ones, some studies show declines in white matter throughout aging, which also affect cognitive functions. Gray matter volume decline was found in subcortical areas such as the caudate, hippocampus and in the cerebellum (Raz et al., 2005). According to Persson and colleagues (2006) bilateral hippocampus was smaller in older adults with declining memory compared to older adults with stable memory. In this study, Persson and colleagues divided 40 older adults into two groups based on longitudinal episodic memory performance: 20 participants classified into stable memory and 20 participants, declining memory. Changes in hippocampal structure and differences in diffusion tensor imaging (DTI) measures of anterior white matter were associated with cognitive decline and it seems that a compensatory mechanism would be increased recruitment of frontal regions, once the brain and cognition are closely linked. De Carli et al. (2005) analyzed the brain MRIs from more than 2200 individuals. According to them, neurodegeneration related to age is associated to reduced cortical thickness in prefrontal cortex (PFC) areas, which presents the largest decline. Frontal subcortical systems are also affected by the aging process. Differences in brain volume in the frontal lobes were even greater in men compared to women. PFC is a source pole of many neuronal circuits. Degeneration of this region can compromise many cognitive or executive function and activities, such as working memory, attention, impulse control and many others. On the other hand, the relationship between PFC thickness and better executive performance was demonstrated in a meta-analysis conducted by Yuana and Raz (2014). Temporal lobe volumes also showed decline in older adults, resulting in declines in cognitive functions such as episodic memory, attention, working memory and executive control (Kirovaet et al., 2015). Thus activities with neuroprotective effect should be considered in a program for the elderly, contributing to cognitive preservation, better mental health and quality of life.

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