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Original article

Qi-gong training reduces basal and stress-elicited cortisol secretion in healthy older adults

Elisa Ponzio [a], Lucio Sotte [b], Marcello M. D'Errico [a], Stefano Berti [c], Pamela Barbadoro [a], Emilia Prospero [a], Andrea Minelli [d,*]

[a] *Department of Biomedical Sciences and Public Health, Università Politecnica delle Marche, Ancona, Italy*
[b] *Department of Chinese Pharmacology, School of Acupuncture, Amab, Bologna, Italy*
[c] *Department of Prevention, Office of Health Promotion, ASUR Marche, Area Vasta n.2, Ancona, Italy*
[d] *Department of Earth, Life and Environmental Sciences (DiSTeVA), Università di Urbino Carlo Bo, Urbino, Italy*

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Abstract

Introduction: Qi-gong, a mind–body practice combining meditation, physical movement and controlled breathing, is reported to improve psychological well-being and physical function in older adults. However, the effects of Qi-gong on hypothalamic–pituitary–adrenal (HPA) axis activity and reactivity to stress in older people are elusive. An uncontrolled, before-and-after study in a group of healthy older adults was conducted to investigate the possible benefits of 12-week Qi-gong training on self-rated distress symptoms and cortisol secretion under basal and stimulated conditions.

Methods: Before (T0) and after (Tf) Qi-gong training, participants ($n = 28$), men and women, mean age 65 years;(smokers, obese subjects, persons with chronic diseases and oral pathologies, and subjects reporting major stressful events in their recent past were excluded) answered the PSS-10 questionnaire. Salivary samples were collected for cortisol detection at various times of the day during a challenging mental task.

Results: Qi-gong training reduced basal cortisol output across the day, notably in the morning. In subjects who responded to the stressor at T0 ($n = 16$, baseline-to-peak increment >1.5 nmol/l), cortisol response to cognitive challenge was markedly blunted after training, accompanied by a decreasing trend of PSS-10 score.

Conclusion: Qi-gong practice in elderly people appears to improve control on HPA axis activity, reducing daytime cortisol levels and attenuating cortisol responses to mental stress. Ameliorating the profile of basal and stimulated HPA activity, may reflect better adaptation to stress, and may favor successful aging and positive health outcomes. Present findings encourage the implementation of programs aimed at further disseminating Qi-gong practice among the older population.

Keywords: Meditative movement; Stress management; Aging; Mental stressor; Hypothalamic–pituitary–adrenal axis; Qi-gong

Introduction

Qi-gong has always been acknowledged as a core component of traditional Chinese medicine, with both preventive and therapeutic roles [1]. It is a meditative movement practice sharing some postures with ancient martial arts and involving the "mind" and the "body" at the same time, apt to promote a healthy life style [2]. By combining meditation, physical movements and controlled breathing, Qi-gong helps practitioners to develop the skill of controlling *qi*, the vital energy of the body, and consequently improve spiritual, physical and mental health [3]. Although underlying mechanisms are not yet well understood, clinical studies have reported a wide range of beneficial health-related outcomes of Qi-gong practice as a form of "mind–body" intervention, including reduction of depressive symptoms and mood disturbances, as well as improvements in psychomotor, cardiovascular, metabolic and immune functions [4–9]. Moreover, practicing Qi-gong can reduce psychological distress and

* Corresponding author at: Department of Earth, Life and Environmental Sciences (DiSTeVA), Università di Urbino "Carlo Bo", Via Ca' Le Suore 2/4, Urbino (PU), Italy. Tel.: +39 0722 30 4305/4288; fax: +39 0722 30 4306.
E-mail address: andrea.minelli@uniurb.it (A. Minelli).

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improve control on hypothalamic–pituitary–adrenal (HPA) axis activity: anxiety levels and plasma concentrations of ACTH and cortisol were shown to decrease after a single bout of Qi-gong training in healthy adult men [10]; few weeks of Qi-gong training were reported to improve psychological well-being, reduce performance-related distress and blunt cortisol secretion levels in different groups of young and very young subjects, such as pupils, adolescents and university students [11–14].

Its documented anti-stress, health-promoting effects, together with its easy-to-perform nature, makes Qi-gong practice a promising option for older adults. In fact, among the aging population, chronic conditions such as depression, heart diseases, hypertension, and chronic pain usually produce *sequelae* that have an adverse impact on individual's ability for daily function. Moreover, aging people are generally characterized by low levels of physical activity, associated to a gradual dysregulation of neuroendocrine response to stress [15]. Clinical studies have evidenced that meditative movement, including Qi-gong, may indeed enhance adaptation to aging, improving mood and psychological well-being, vitality and physical function, thus globally ameliorating the quality of life in older persons [16–19]. In older people, the effects of Qi-gong practice on HPA activity regulation have so far been poorly investigated. In the current pilot study, we sought to investigate, in a population of healthy older adults, the possible benefits of Qi-gong training on subjective and objective indices of stress, i.e. psychological distress symptom ratings and HPA activity and reactivity to stress, indexed by measuring basal salivary cortisol across the day and cortisol response to acute mental stress.

Methods

Participants

This is a non-randomized, uncontrolled, before-and-after study. Healthy elderly subjects were recruited from people attending "*Passo Passo Program*" (step-by-step program), which included 12-week Qi-gong training. Subjects willing to participate were given thorough explanations describing design and aims of the study, and detailing experimental methods and procedures; phone contacts were provided for prospective participants who desired additional information. Smokers, severely overweight persons (BMI > 30), subjects affected by chronic diseases and oral or dental pathologies, persons taking beta blockers, diuretics, glucocorticoids or hormonal therapies and subjects reporting bereavements or major stressful events in their recent past (6 months) were excluded from the study. All eligible participants (7 men, 21 women; age range: 53–78 years, $M_{age} = 64.82 \pm 1.45$; $M_{BMI} = 24.74 \pm 0.45$) were enrolled in the years 2010–2011, after signing an informed consent form. The study was approved by the Healthcare Company of Marche Region (Prot. N. 900/ZT7DZONA of December 29, 2010).

Qi-gong intervention

Qi-gong training was articulated in four different series of exercises, through which participants were gradually introduced to the fundamental principles of traditional Chinese medicine, i.e. yin-yang, five elements, acupunture points and channels connected with organs (kidney, liver, heart, spleen, lung) and bowels (bladder, gallbladder, stomach, small and large intestine); the format is called "Phoenix's flight" [20]. Principal aim of Qi-gong intervention was to increase the level of coordination between body movement, breathing activity, and mental concentration, thus potentiating mind–body balance. Importantly, all exercises required low level of physical effort, thus being particularly suitable for elderly people.

The intervention format had a duration of 12 weeks; two times a week, participants attended a 1-h Qi-gong class under the supervision of an instructor with several years of experience in Qi-gong and acupuncture (LS); in addition, subjects were given a manual outlining the acupuncture meridians and the rationale for exercises, and were asked to practice independently on non-class days for at least 30 min. Each training session included three static and one dynamic sequences of Qi-gong exercises: (1) "self-massage": exercises intended to physically stimulate key acupuncture points of cephalic meridians (sequence composed of 31 movements); (2) "tendon and marrow exercises": gentle stretching and joint mobilizations (starting from cervical region and then going down to shoulder girdle and upper limb, spine, and finally hip girdle and lower limb) performed in synchrony with breathing and visualization of energetic flow through primary meridians (sequence of 16 movements); (3) "three steps toward Yin-Yang re-balancing": walking a few steps in synchrony with gentle twisting movements of the bust, to promote the coordination between breathing, movement of arms and legs, and visualization of the flow of *qi* (sequence of three movements); (4) "six ideograms and six sounds": exercises intended to coordinate abdominal breathing, body movement, sound vocalizations, and visualization of the flow of *qi* through acupuncture meridians associated to various thoracic and abdominal organs (sequence of six movements).

Psychometric measures

An Italian version of the 10-item questionnaire perceived stress scale (PSS-10) [21] was administered before (T0) and at the end (Tf) of Qi-gong intervention. PSS-10 is commonly used in health and behavioral health contexts for examining self-reported stress experiences by measuring the degree to which situations in one's life are appraised as stressful using a 5-point Likert scale (0–4).

Cortisol tests

Before (T0) and after (Tf) Qi-gong intervention, five saliva samples were obtained across the day for determining circadian profile of salivary cortisol basal secretion. In most healthy people, morning awakening is associated with a brisk increase of cortisol secretion reaching its peak around half hour after wake-up, being more pronounced in older age [22] and relatively unaffected by gender, sleep duration and time of awakening [23]; taking this into account, both at T0 and Tf the first sample was collected rigorously 30 min after wake-up (from 7.00 h to