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Effects of a chair-yoga exercises on stress hormone levels, daily life activities, falls and physical fitness in institutionalized older adults

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ABSTRACT

The aim of this study was to assess the changes mediated by exercise on activities of daily life and falls, physical fitness, salivary cortisol and alpha amylase in older adults living in social and health care givers centers.
Methods: Sample consisted in 35 women (83.81 ± 6.6 years old) were divided into two groups: chair-yoga exercises group (CY, n = 20) and control group (CG, n = 15). All subjects were evaluated before and after 14-weeks. CY was involved in exercise classes two times per week, while the GC did not participate in any exercise.
Results: Fear of falling decreased in both groups, cortisol increased and alpha-amylase decreased in the CG. No significant changes occurred in physical fitness outcomes. Conclusion: CY practice was able to maintain the physical fitness scores and stress hormone levels, but was not able to improve the subject's perception on the ability to perform the instrumental activities of daily life.

1. Introduction

Aging is characterized by deregulation of multiple physiological systems with deleterious effects on physical health and functional autonomy in older adults [1,2]. Biological chronic stress has been shown to have immuno-suppressive effects and to induce a physical-fragile state [3]. The gradual deterioration in the skeletal muscle system seems to be the central mechanism for decreased independency in activities of daily life (IADL) and physical fitness (PF) indicators [4].

The autonomy in the elderly can be characterized as the ability of the individual to perform IADL while demonstrating a satisfactory PF condition, without eminent risk of falling [5,6]. Functional impairment, especially when it is generated by the consequences of falls, increases public health spending to treat patients with later sequels [7]. For this reason, recent aging-autonomy models propose an integrated approach, whose major intervention mechanics are to assesses eminent risk of falls and improve PF over time [8].

Even non injurious falls are disabling with strong associations with activity constraint, isolation, deconditioning, increased fear of falling again and depression [7]. Associated with factors such as multi-comorbidity and polypharmacy, an increased risk of falls can further increase older adult's vulnerability [9]. In this sense, to check for possible associations between hormonal parameters related to stress and psychosocial and stressful constraints seems to be a prudent direction [10,11].

Cortisol (sCOR) is an essential hormone in the regulation of the biological stress response, but recently salivary alpha-amylase (sAA) has also emerged as a novel biomarker for evaluating stress [12]. These neuroendocrine markers play an important role in establishing the bodily reaction to stress and regulation of the autonomic function [13]. Stress responsiveness is primarily regulated by two neuroendocrine axes: the hypothalamic-pituitary-adrenocortical (HPA) and sympathetic adrenomedullary systems [14]. The HPA axis is a complex neuroendocrine stress system involved in bio-behavioral adjustments to confrontational stimuli and change [12]. Because saliva collection is a non-invasive method and for being accurate salivary biomarkers for detection of autonomic activity [15], sCOR and sAA received more attention lately in respect to their relationship with physical exercise [10]. However, results from

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chronic exercise on neuroendocrine modulation in the older populations are scarce [11]. In the few studies that address exercise in the older person and biological stress, the use of diverse methodologies strip the accuracy of the inference of the results [16].

The premise that preserving an adequate state of physical independence in advanced age is related to satisfactory PF seems to be widely accepted [6,17,18]. For this reason, a physical exercise routine can be a complementary form of muscle damage prevention through the improvement of HrPf [19–21]. The American College of Sport Medicine (ACSM) makes it clear in their own guidelines when it refers that ten minutes of flexibility training a day, twice a week, will aid in the prevention of falls by improving balance [22]. But the recommendations on flexibility training are controversial since this type of training by itself does not seem to be enough to promote the functional benefits required by older people to maintain an adequate level of PF [23].

Among the various forms of exercise that could be practiced by older persons, yoga has been recommended as it could mitigate the deleterious effects of aging on flexibility [21,24]. According to the literature, the benefits of regular yoga practice include improvements in balance, coordination, strength and flexibility [19,25]. In older people with physical limitations to perform the full practice of yoga, adaptations may be made and an exercise program supported by a chair can be developed [21,24].

To date, few publications on the effect of yoga in olders have been published [23]. In a recent systematic review [19], the studies that tested the effects of yoga, mainly looked at variables such as strength, flexibility and cardiovascular resistance [25], psychosocial factors such as depression and anxiety [26], and biomarkers able to assess oxidative stress and lipid profile [27]. Studies involving athletes were also used to assess the acute effects of exercise on biological stress [28]. In a recent systematic review [19], Questions regarding whether biological levels of stress are associated with PF, fear of falling and psychosocial factors, as well as if the practice of yoga is able to change these parameters in the older person remain unanswered. Towards this purpose, the aim of this study was to evaluate the effects of a chair-based yoga exercise program on stress hormone levels, ADL, fear of falling and PF in institutionalized older women.

2. Methods

2.1. Initial procedures

Participants were older women living in social and health care support centres (SHC), located in the city of Coimbra, Portugal. All participants (or responsible) were required to give a full informed consent before beginning the research project. The study protocol was approved by Faculty of Sport Sciences and Physical Education Ethical Committee - University of Coimbra [Ref.: CE/FCDEF-UC/000202013]; it respects the Portuguese Resolution (Art.º 4th; Law n. 12/2005, 1st series) on ethics in research with humans [29], follows the guidelines for ethics in scientific experiments in exercise science research [30] andcomplies with the guidelines for research with human beings of the Helsinki Declaration [31].

2.2. Design of the study

This study was planned for approximately 20 weeks and was built in 3 different stages, as described below: First phase (2 weeks) consisted in the evaluation of the participants before chair-based yoga exercise program. Second phase 2 was an intervention study with implementation. Phase 3 (2 weeks) consisted in the evaluation of the participants after the 14 weeks of exercise. All the tests were applied before and after the exercise intervention in all groups (see Fig. 1). To minimize difference in procedures the same evaluators performed the data collection both at baseline and follow-up assessments.

2.3. Participants

According to a recent systematic review (sample average of 09 participants) previous studies on exercise interventions have shown small effect size in psychobiological outcomes in similar populations [16]. For this reason, a minimum sample of 15 participants per group was recruited, sufficient to identify possible beneficial effects taking into account the size of the effect size ($d = 0.40$, strong effect size, power = 0.80) established [32]. Additionally, another 7 participants were recruited (30% of 15 participants) in order to prevent dropout of the study sample [33].

In total, 58 participants from a center for social and health care support were selected from a convenience sample. After applying the inclusion and exclusion criteria and after dropout the final sample consisted of 35 female participants (age = 83.81 ± 6.6years old). The participants were allocated into two groups: chair-based yoga exercise group (CY, n = 20) and non-exercising control group, (CG, n = 15).

2.3.1. Sample selection criteria

Baseline assessment tasks included measures of biosocial and global health status, which associated with the medical staff report, formed the basis for determining the selections sample criteria's in the study. The inclusion conditions for the older participants stipulated in first order were: Being female participant aged over 60 years; drug therapy controlled and updated; If the participant present clinical condition or comorbidity, it must be stable and enable participation in yoga classes as decided by local medical staff. The exclusion criteria were: not completing or withdrawing from the '8-foot-up and go test' (FGT) in the maximum time of 50 s, since scores above this value indicate severe mobility dependence [34]; involvement in other structured exercise program; presence of severe cardiopathy, uncontrolled hypertension or asthmatic bronchitis, musculoskeletal dysfunctions that prevented the physical testes (i.e. osteoarthritis, recent fractures), mental disorder, hearing and vision impairment, morbid obesity or the use of

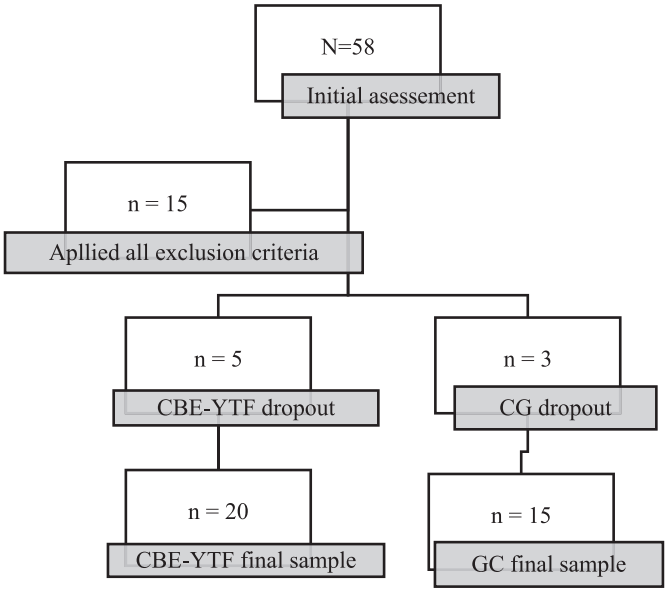

Fig. 1. Flowchart of the selection sample.