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ORIGINAL RESEARCH

The influence of physical fitness on pressure pain threshold of elderly women

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Summary Several factors may influence pressure pain threshold (PPT), including physical fitness. However, only a few authors have studied this relationship. The aim of this study was to investigate the relationships between muscle strength, functional capacity (ability to perform physical work and activities of daily living) and PPT in elderly women. This observational cross-sectional study involved 75 healthy women aged between 60 and 75 years. Volunteers underwent an evaluation consisting of anthropometry, functional capacity, muscle strength and PPT assessment by algometry in the following muscles: biceps brachii, flexor carpi ulnaris, flexor carpi radialis, vastus medialis, vastus lateralis and gluteus maximus. Mean age of the 75 volunteers was 66.8 ± 4.6 years old. No significant correlations were found between handgrip or elbow flexion strength and PPT in the upper limb muscles evaluated. The same was observed regarding functional capacity, lower limbs strength and PPT in lower limb muscles. Functional capacity and muscle strength did not correlate with PPT in healthy elderly women.

Introduction

Population aging is a worldwide phenomenon that requires attention in view of the many important changes it causes in individuals (Sanderson and Scherbov, 2015). It is a normal development process that must be seen as dynamic and progressive, bringing about social, psychological and physiological changes (Charlier et al., 2015).

Among the physiological changes that occur in people with aging, the ones in the musculoskeletal system (such as reduction in muscle strength and mass) are relevant as they are associated with motor skills performance (Scott et al., 2011; Dodds and Sayer, 2015).

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Central and peripheral nervous system involvement is also a significant feature in the aging process. There is a loss of myelinated and unmyelinated fibers, producing a decrease in nerve conduction velocity, which leads to a decrease in sensorial perception, as well as changes in autonomic responses and blood flow (Verdú et al., 2000). Changes in the quantity and biochemistry of nervous structures conveys to somatosensory changes, such as increasing the vibration sensitivity threshold in the hands and feet of the elderly (Verdú et al., 2000).

Another important aspect of aging is the onset of pain and functional limitations. Chronic pain can be considered a public health issue and estimates show that up to 86% of elderly present musculoskeletal pain (Miranda et al., 2012). Thus, the perception of pain in the elderly becomes a major problem that requires diagnosis and thorough evaluation so that accurate treatments are targeted to this population (Wranker et al., 2015).

The process of pain evaluation is challenging, as it has an important subjective component and varies individually due to cultural, emotional and environmental experiences (Wandner et al., 2012). However, quantifying the painful sensorial experience is essential for monitoring and diagnosis of pain and the most appropriate techniques are the induction ones. An example is algometry, in which through a handheld device called algometer, pressure pain tolerance capacity by a physical stimulus can be quantified (Fischer, 1987, 1988; Egloff et al., 2011). Algometry describes the pressure sensitivity as the smallest degree of pressure that causes pain. This type of measurement has been performed on various conditions: low back pain (Schenk et al., 2007; Imamura et al., 2013), knee osteoarthritis (Imamura et al., 2008), fibromyalgia (Mikkelsson et al., 1992), neck pain (Cheung et al., 2013) and temporomandibular joint disorders (Visscher et al., 2004). It is known that the threshold for nociceptive somatosensory stimuli is increased with age, while the pressure pain threshold (PPT) as well as heat threshold seem not to be related to aging changes (Kaye et al., 2010; Andrzejewski et al., 2010).

One factor that may be related to localized pain or perception of pain is exercise. A review study suggests that some types of exercise (e.g. aerobic, isometric, resistance training) can reduce the perception of experimentally induced pain in healthy subjects (Kaye et al., 2010). To the best of our knowledge, the study by Andrzejewski et al. (2010) was the only one to verify the influence of age and level of physical activity on PPT in some muscles. Authors have compared students aged 20—26 years and individuals aged 50—75 years and found no difference between groups regarding PPT. They reported that the pressure sensitivity of students depended on the level of physical activity: the higher this level, the more increased the threshold of sensitivity to pain tolerance (i.e. less sensitive the individuals were). However, these authors did not assess the physical activity by means of an instrument, they used individuals' reports. Also, participants aged 50 years onwards were included in the adults group, and they did not separately analyze the elderly ones.

As the changes entailed by the aging process are increasing concerns in developing countries whose populations are aging, and as they involve limiting conditions such as sarcopenia, tendency to pain, and reduction in the ability to perform physical work and activities of daily living (functional capacity) (Dodds and Sayer, 2015), and especially because women have a higher prevalence of pain (Wiesenfeld-Hallin, 2005), acknowledging functional capacity, muscle strength and PPT in community elderly women can add relevant information about the aging process. Therefore, the aim of this study was to investigate the relationships between muscle strength, functional capacity and the pressure pain threshold in healthy elderly women.

Methods

This was an observational cross-sectional study, in which 75 women participated. The study was approved by the Research Ethics Committee of the Adventist University of São Paulo (protocol number 1.063.539). Recruitment of research participants was conducted through direct contact with community-dwelling elderly from the city of Embu-Guaçú (metropolitan area of São Paulo — SP, Brazil). All participants gave informed written consent.

Inclusion criteria for this research were age between 60 and 75 years old, female gender, absence of psychiatric disorders, body pain lower than 4 in the Visual Analogue Scale (VAS) (Chapman and Syrjala, 1990), no chronic use of analgesic or anti-inflammatory drugs, especially in the last 12 h prior to the evaluation, and not being currently participating in physical therapy sessions.

Volunteers underwent an evaluation that consisted of demographic data collection, anthropometry, PPT, functional capacity, handgrip strength, and upper and lower limbs strength.

The PPT was assessed by algometry (J Tech algometer, J Tech Medical, Salt Lake City, UT, USA). The algometer is a hand-held device consisting of a piston which has at its end a 1 cm^2 rubber, able to register through an electronic device the pressure applied to a surface. Its reliability has already been demonstrated (Ylinen et al., 2007; Visscher et al., 2004). The evaluator operated the algometry with his right hand, and his left hand was placed on the right one for fitting and coordinating the movements, avoiding small deviations. The reading was expressed in kg/cm^2 (Fischer, 1987, 1988). Pressure was applied at a 90° angle (between the stimulation surface and the stimulated point) with a constant speed of 1 kg/s, up to the level where the volunteer reported pain or discomfort. All volunteers were evaluated by the same examiner and equipment. Participants were instructed to say "stop" as soon as the feeling of pressure went from unpleasant to painful. The test was interrupted once the volunteer indicated the onset of pain, and the final amount of force applied was recorded. The application points in the muscles and the position that the volunteers remained during testing are shown in Table 1. All assessments were performed bilaterally (Fischer, 1987; Schenk et al., 2007; Andrzejewski et al., 2010).

To evaluate functional capacity, the 6-min walk test (6 MWT) was employed. It is a safe, simple and practical tool, used to evaluate the voluntary ability to walk. It directly reflects the ability to perform activities of daily life and is also a predictor of morbidity and mortality (American Thoracic Society, 2002). The test was applied at an indoor