BrJP. 2024, v.7:e20240029 **ORIGINAL ARTICLE**

Relationship between core function and pressure pain threshold in senior women with non-specific chronic low back pain: cross-sectional study

Relação entre a função do core e o limiar de dor a pressão em mulheres idosas com dor lombar crônica inespecífica: estudo transversal

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ABSTRACT

BACKGROUND AND OBJECTIVES: Chronic nonspecific low back pain (CNLBP) is a public health issue. Dysfunctions in muscle activation and spinal stability are estimated to directly impact pain intensity. Additionally, senior women experience greater decline in muscle function due to aging, rendering this demographic more susceptible to developing low back pain. The aim of this study was to analyze the correlation between core muscle instability, strength, and endurance with pressure pain threshold in senior individuals with CNLBP.
METHODS: This is a quantitative observational study, with a descriptive cross-sectional design, conducted on women aged 60 to 79 years. The pressure pain threshold (PPT). The pressure pain threshold (PPT) was assessed using a pressure algometer applied to the paravertebral and anterior tibial musculature. Trunk instability was assessed on both a stable and an unstable seat, positioned atop a force platform that provided real-time displacement of the pressure center. Maximum isometric strength and endurance of trunk flexors and extensors were assessed using the McGill protocol. Person's correlations coefficient (r) was calculated, and the data were presented as mean and standard deviation. The significance level was set at p<0.05.
RESULTS: This study included 49 senior women (67,3±5,6 years; body mass index of 28,5±5,2 kg/m^2; pain intensity of 4,6±2,3 on a 0-10scale). No correlation was observed between PPT at L3, L5 and TA with lumbar instability, maximum isometric strength and trunk muscle endurance.
CONCLUSION: In this study, no correlation was found between lumbar instability, maximum isometric strength and trunk muscle endurance with the PPT in senior women with CNLBP.
Keywords: Abdominal core, Chronic pain, Core stability, Pain threshold.

RESUMO

JUSTIFICATIVA E OBJETIVOS: A dor lombar crônica inespecífica (DLCI) é um problema de saúde pública. Estima-se que disfunções na ativação muscular e na estabilidade da coluna possam repercutir diretamente na intensidade da dor. Além disso, em decorrência da idade, as mulheres idosas apresentam maior declínio na função muscular, tornando esse público mais suscetível a desenvolver a dor lombar. O objetivo deste estudo foi analisar a correlação entre instabilidade, força e resistência dos músculos do core com o limiar de dor por pressão em idosas com DLCI.
MÉTODOS: Trata-se de um estudo observacional quantitativo, com delineamento transversal descritivo, realizado em mulheres com idade entre 60 e 79 anos. O limiar de dor por pressão (LDP) foi avaliado com um algômetro de pressão na musculatura paravertebral (bilateralmente ao processo espinhoso nível de L3 a L5) e cinco cm abaixo da tuberosidade da tibial direita no tibial anterior. A instabilidade de tronco foi avaliada em um assento estável e outro instável, posicionados sobre uma plataforma de força para análise do deslocamento do centro de pressão em tempo real. A força isométrica máxima e a resistência de flexores e ex-

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HIGHLIGHTS
- This study found no correlation between trunk instability and pressure pain threshold (PPT).
- PPT did not correlate with the maximum isometric strength and endurance of the trunk muscles in women with chronic low back pain.
- Trunk instability, maximum isometric strength and endurance were assessed using replicable tests for the population.

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tensores do tronco foi avaliada por meio do protocolo de McGill. Foi calculado o coeficiente de correlação de Pearson (r), os dados foram expressos em média e desvio padrão e o valor considerado significativo quando p<0,05.

RESULTADOS: Participaram deste estudo 49 mulheres (67,3±5,6 anos; índice de massa corporal de 28,5±5,2 kg/m^2; intensidade da dor 4,6±2,3 em uma escala de 0- a 10). Não foi encontrada correlação entre o LDP em L3, L5 e TA com instabilidade lombar, força isométrica máxima e resistência dos músculos do tronco.

CONCLUSÃO: Não foi encontrada, neste estudo, uma correlação entre a instabilidade lombar, a força isométrica máxima e a resistência dos músculos do tronco com o LDP em mulheres idosas com DLCI.

Descritores: Centro abdominal, Dor crônica, Estabilidade central, Limiar da dor.

INTRODUCTION

Low back pain (LBP) is located between the costal margin and the lower gluteal folds and may or may not be associated with irradiation to the lower limb[1]. It is the second leading cause of sick leave and is a public health problem associated with high direct and indirect health costs, as well as having a physical, psychological and social impact, and is described as one of the main causes of disability on a global scale[2].

Chronic low back pain (CLBP) can take two forms: specific or non-specific. Specific chronic low back pain is related to congenital, degenerative, inflammatory, infectious, tumor, mechanical-postural conditions or an imbalance between the functional load and the efforts required in activities of daily living. When there is no defined cause to explain the persistence of the pain, it is called chronic nonspecific low back pain (CNLBP)[1]. Several studies have therefore been carried out to find possible alterations in the spinal system that could justify this idiopathic pain, which drastically impacts functionality[3].

In this sense, dysfunction in the spinal stabilization system is proposed by some authors as one of the possible causes of CNLBP[4]. This stabilizing system is made up of muscles in the center of the core, who are responsible for ensuring control of the trunk, and is made up of three subsystems: active (ligaments, intervertebral discs, vertebrae and joints), passive (multifidus, interspinal, intertransverse, internal and external oblique and transverse abdominis muscles) and neural (central and peripheral nervous system). These subsystems must work together to maintain control and muscle activation of the spine[5]. It is estimated that a dysfunction in at least one of these subsystems generates an alteration in stability, causing changes in muscle activation as a form of compensation[4].

In addition, motor control is considered to be responsible for establishing the connection between the central and peripheral nervous systems and the musculoskeletal structures, and its alterations have been identified as one of the factors influencing CNLBP[6]. In this sense, other studies have shown a reduction in extensor strength and a delay in peak strength for flexors, as well as a shorter contraction maintenance time, showing that the strength and endurance of the abdominal muscles are closely linked to CNLBP[7].

Thus, considering the osteomyoarticular factors that can influence low back pain, this study evaluated a population of senior women, in view of the declines in the various body systems resulting from age[8], which impact muscle activation, strength, endurance and balance. In addition, women show a reduction in conditioned pain modulation, which influences the pressure pain threshold (PPT)[9]. Studies show that this variable of pain perception through the ascending and descending pathways is altered in individuals with CNLBP[10], resulting in a lower PPT when compared to healthy individuals[11].

However, despite the evidence that individuals with LBP have alterations in core muscle stability, strength and endurance and a reduction in PPT, no known study has investigated the interaction between them. Pain is a limiting factor for functionality and has a negative impact on people's quality of life, so this study is justified by the importance of assessing the relationship between core functions and PPT in people with CNLBP.

The aim of this study was to assess the relationship between trunk instability, strength and endurance and PPT in senior women with CNLBP, which led to the hypothesis that there is a positive correlation between maximum isometric strength and trunk muscle endurance, and a negative correlation between trunk instability and PPT in senior women with CNLBP.

METHODS

This was a quantitative observational study with a descriptive cross-sectional design. PPT, trunk instability, maximum isometric strength and trunk muscle endurance were assessed. This study followed the recommendations for observational studies (Strengthening the Reporting of Observational Studies in Epidemiology - STROBE).

The population of this study, composed only of women, as they are the gender most affected by this condition, were recruited for convenience among the patients on the waiting list for appointments at the Rehabilitation Center of the University Hospital of the Federal University of Sergipe. The inclusion criteria were: 1) female gender; 2) age between 60 and 79 years; 3) complaint of low back pain for more than 3 months; 4) pain level between 3 and 7 on the numerical pain scale; 5) body mass index ≤ 30 kg/m2; 6) no pharmacological and/or physiotherapeutic treatment for pain; 7) no use of opioid and/or immunosuppressant drugs.

Participants were excluded from the sample if they had been diagnosed with spondylolisthesis and/or cancer, neurological and/or inflammatory diseases, had undergone back surgery in the last year, were undergoing hormone replacement, had physical, mental or cognitive disabilities, as well as visual, hearing or any other problems that would impair communication when carrying out the tests[12].

All volunteers received verbal and written guidance on the methodology of this study and its objectives. Those who agreed to be volunteers signed the Free and Informed Consent Term (FICT). This study was approved by the Human Research Ethics Committee of the Federal University of Sergipe (*Universidade*

Federal de Sergipe - UFS), under Opinion Number 5.532.175 (CAAE: 59328022.0.0000.5546).

The assessments were carried out in the morning at the Physiology Laboratory of the Physical Education Department of the Federal University of Sergipe.

The sample calculation was carried out in the G-Power program, using the LDP outcomes based on the results of a study[13], and for a moderate correlation (r = 0.4), a test power of 80% and an alpha of 0.05, the total suggested sample was 46 participants.

Procedures

Anamnesis

The anamnesis consisted of questions related to the time of onset of low back pain, the presence of spinal dysfunctions and irradiation; in addition, the participants were asked about the intensity of pain at the time of the anamnesis and in the last week, as well as whether they had undergone pharmacological treatment or other therapies to alleviate the pain. In addition, the participants were asked about surgery on the pelvis and/or spine, cancer treatments or hormone replacement.

Pressure pain threshold (PPT)

PPT was assessed using a digital pressure algometer with an area of 1 cm^2 (Impac System®, São José dos Campos, SP, Brazil). Measurements took place 5 cm to the right and left of the spinous process of the 3rd and 5th lumbar vertebrae (L3 and L5, respectively) to assess primary pain, and 5 cm below the right tibial tuberosity in the tibialis anterior (TA) to assess secondary pain. The algometer was positioned perpendicular to the tissue in the area being assessed, after which the assessor applied increasing pressure to the area until the participant told him when the pressure became painful. PPT was quantified three times at each point, with an interval of 30 seconds; the average of the three repetitions was used for analysis[14].

Trunk instability

Trunk instability was assessed using the Stable Seat Paradigm[15] protocol, with the aim of evaluating postural control and trunk movement in a sitting position through the displacement of the center of pressure (Cop). To do this, the subject was placed on a stable wooden seat and an unstable wooden seat. The stable seat was made of wood and had an adjustable support for the legs and feet of each participant, with the aim of maintaining a 90º knee flexion. The legs were attached to the seat using two Velcro strips to prevent movement of the lower limbs, keeping the hips flexed at 110º. The unstable seat had the same structure, with a wooden semicircle attached to the bottom (diameter of the semicircle: 35 cm; height from the seat to the lowest point of the semicircle: 12 cm). These seats were on a 100 Hz force sampling platform, 90 cm above the ground and supported by a flat, stable and rigid surface[12,15].

This evaluation was subdivided into 6 experiments: (1) stable without visual feedback, in which the subject received no information about the progress of the test and was instructed to remain seated in her usual position on the seat; (2) stable with visual feedback, in which the subject followed the movement of her Cop using a monitor, with the aim of adjusting the position of the subject's Cop according to the fixed target point shown on the monitor; (3) stable with circular displacement and visual feedback, in which the subject had to make circular movements with her torso in order to follow the target point in its circular path shown on the monitor, with the volunteer following the displacement of her Cop in real time.

These same procedures were also carried out with an unstable seat. Visual feedback was provided by a monitor (Samsung, LN-32C530F1M, Manaus, AM, Brazil) positioned 2 meters in front of the participant, using a MatLab program (IMCM, Aracaju, SE, Brazil). Familiarization with the tests lasted 60 seconds, while the tests were carried out for 70 seconds each, with an interval of 1 minute between them[15]. The distance covered by the Cop during each experiment was expressed in centimeters, and the greater the distance covered, the greater the trunk instability. The full description of the test can be found in another study[12].

Trunk muscle strength

Maximum isometric strength was measured using a wooden seat that could be adjusted according to the height of each individual. Before the start of the test, the participants were instructed to cross their arms in front of their chest and place their hand on the contralateral shoulder, and to tilt their trunk discreetly to prevent the lower limbs from acting in a compensatory manner; their legs were also attached to the seat with Velcro to prevent the lower limbs from supporting the trunk movement. The data was obtained using a digital load cell (Ktoyo, 333 A, Hown Dong, South Korea) connected to the Chronojump system (Chronojump Boscosystem, Barcelona, Spain); this system provides force values in Newtons (N)[16].

Assess the isometric strength of the trunk extensor muscles, the load cell was fixed to metal hooks attached to the wall and connected to the anterior region of the volunteer's trunk using a Velcro strap placed at the level of the xiphoid process. For the test, the maximum isometric force for extension was requested, performed continuously, i.e. without oscillations of the trunk during the test (Figure 1A). To assess the flexors, the load cell was connected to the back of the volunteer's torso using a Velcro strap positioned below the scapulae, followed by the maximum isometric force for flexion, performed continuously. The participants were instructed not to bend their spine during both tests[16] (Figure 1B).

Before the test, familiarization was done and only then were the three attempts made, each lasting 5 seconds, to perform the flexion and extension test. A 15-second interval was given between each attempt and the highest value was used for data analysis. The volunteers were also given verbal stimuli such as "Go! Push! Push! Go! Go! Go!" during the assessment.

Muscular endurance of the trunk muscles

Trunk muscle strength was assessed using the protocol proposed by a research[17]. The extensors were assessed using a stretcher on which the participants were instructed to lie in a prone position, with the iliac crest positioned outside the stretcher; the arms were supported on a chair; the knee, hip and pelvis were secured

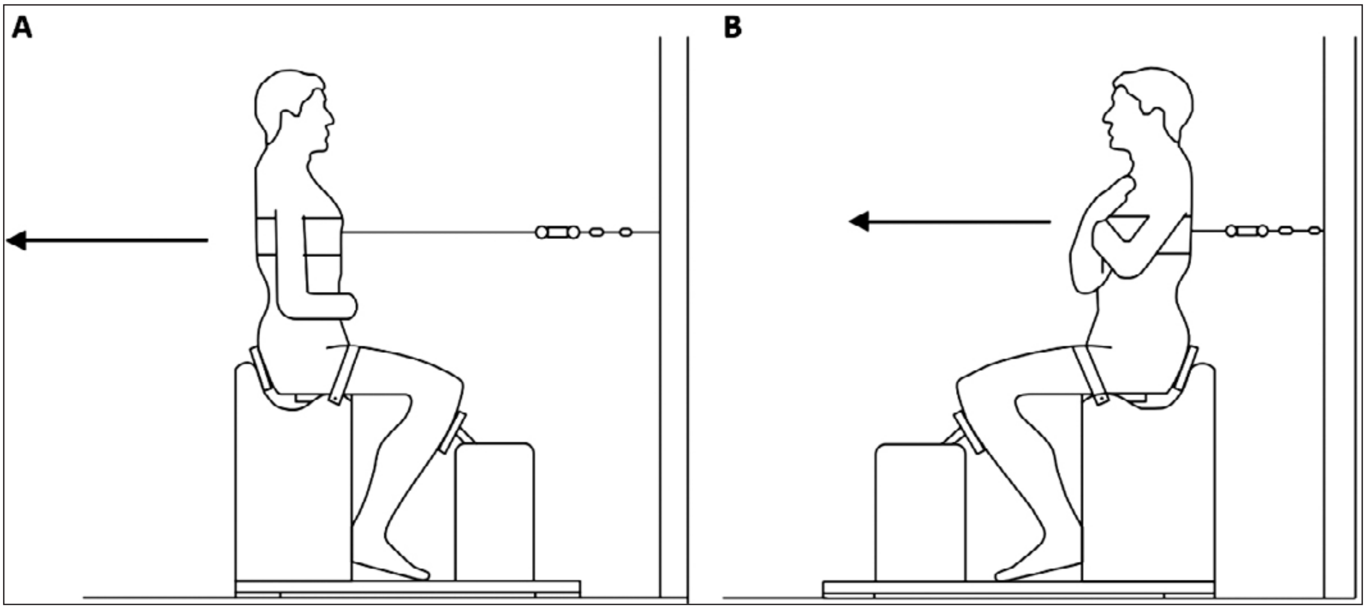

Figure 1. A) Positioning for assessing the maximum isometric strength of the extensors. B) Position for assessment of maximum flexor isometric strength.

to the stretcher with Velcro straps. At the start of the test, the volunteer was asked to remove her arms from the chair and cross them over her shoulders, after which the time the volunteer was able to remain in this position was timed.

To assess the flexors, the participant was instructed to sit on the floor and lean against a wooden wedge, creating a 60° torso angle; the hips, knees and ankles were flexed, forming a 90° angle; the arms were crossed in front of the torso with the hands on the opposite shoulder and the feet always resting on the ground. Once the positioning was complete, the wedge was removed and the subject was instructed to maintain the initial angle for as long as possible. The test ended when the subject could no longer maintain 60° of trunk flexion.

To assess the lateral flexors of the trunk, the participant was positioned in lateral decubitus, the arm on the side being assessed was supported on a 2.5 cm mattress, while the other arm was held across the chest with the hand resting on the contralateral shoulder, the legs were extended and the feet rested on the ground, one in front of the other, so that the toes of the foot on the side being assessed touched the heel of the contralateral foot. Once the positioning was complete, the subject was instructed to raise her hips off the ground and hold the position for as long as possible, without moving her pelvis.

A 5-minute interval was taken between tests to avoid changes due to fatigue, and each test was performed only once, without familiarization[17].

Statistical analysis

The data was statistically analyzed using the Statistical Package for the Social Sciences (SPSS), version 23.0. Data normality was tested using the Kolmogorov-Smirnov test. After checking the normality of the data, Pearson's correlation coefficient (r) was assessed, according to the following classification: correlation coefficient ≤ 0.2 (weak), ≤ 0.5 (moderate) and > 0.8 (strong)[18]. Data was expressed as mean and standard deviation and the value was considered significant when $p<0.05$.

RESULTS

The final sample was made up of 49 senior women with an average age of 67, with an average body mass index (BMI) indicating obesity and diagnosed with CNLBP. The characterization of the sample can be seen in table 1.

The mean, standard deviation, PPT confidence interval at L3, L5 and TA, the trunk instability variables in the stable and unstable seats in the circular experiments, with and without feedback, as well as the maximum isometric strength of the extensors and flexors and the strength of the extensors, flexors and lateral flexors of the trunk, can be seen in table 2.

There was no significant correlation between PPT measured at L3, L5 and AT and the trunk instability assessed with the stable seat in the circular experiments, with and without feedback, nor for trunk instability with the unstable seat in any of the experiments (table 3). In addition, all Pearson's correlation coefficient values indicated low correlations between the variables analyzed.

Table 1. Sample characteristics

Characteristics	Mean ± SD n (49)	CI 95%
Age (years)	67.3 ± 5.6	65.7 - 68.9
Weight (kg)	66.1 ± 12.9	62.4 - 69.8
Height (m)	1.52 ± 0.05	1.51 - 1.54
Body mass index (kg/m^2)	28.5 ± 5.26	27.0 - 30.0
Pain intensity during the day (0-10)	4.6 ± 2.3	3.9 - 5.3
Pain intensity during the week (0-10)	6.7 ± 2.9	5.9 - 7.5

Values expressed as mean and standard deviation. SD = standard deviation; CI = confidence interval.

Table 2. Description of the mean and standard deviation of all variables

Variables	Mean ± SD n (49)	CI 95%
PPT		
PPT L3(kg)	3.46 ± 0.96	3.19 - 3.74
PPT L5(kg)	3.12 ± 0.96	2.84 - 3.40
PPT AT (kg)	3.40 ± 1.07	3.09 - 3.71
Instability		
Stable instability without feedback (cm)	0.15 ± 0.49	0.01 - 0.30
Stable instability with feedback (cm)	0.41 ± 1.51	0.02 - 0.85
Circular stable instability (cm)	20. 40 ±7.15	18.30 -22.50
Unstable instability without feedback (cm)	0.89 ± 4.60	0.44 - 2.23
Unstable instability with feedback (cm)	0.95 ± 2.93	0.09 - 1.80
Circular unstable instability (cm)	25.10 ± 8.73	22.52 - 27.60
Strength		
Extensor strength (N)	209.15 ± 53.71	193.30 - 224.19
Flexor strength (N)	191.35 ± 51.47	176.89 - 206.82
Resistance		
Extensor resistance (s)	74.86 ± 58.48	57.81 - 91.82
Flexor resistance (s)	51.30 ± 50.16	36.84 - 65.95
Lateral flexor resistance (s)	16.83 ± 19.17	11.28 - 22.02

Values expressed as mean and standard deviation. PPT = pressure pain threshold; L3 = third lumbar vertebra; L5 = fifth lumbar vertebra; AT = anterior tibialis; SD = standard deviation; CI = confidence interval.

Similarly to the analysis of trunk instability, there were no significant correlations between PPT at L3, L5 and AT and the maximum isometric strength of the trunk, either for flexion or extension, nor was there any correlation between the PPT evaluated points and the strength of the extensor, flexor and lateral flexor muscles of the trunk (table 4). All the correlation coefficient values were below 0.3, indicating a weak correlation.

DISCUSSION

The results of this study show that there is no correlation between PPT, trunk instability, maximum isometric strength and trunk muscle endurance in senior women with CNLBP. This reinforces the hypothesis that patients with CNLBP have changes in pain processing, in the structure and function of the sensory-motor system in the regions of the cerebral cortex[19], and that these changes sustain pain even in the absence of the initial damage. Therefore, this study emphasizes the fact that nociplastic pain can be multifactorial and not related to lesions. Understanding which nociplastic alterations are present in these patients can lead to more effective treatments for this population.

The lack of correlation between trunk instability and pain found in this study on senior women differs from another study of people with CNLBP[20], which found that spinal instability was present in more than half of the total number of patients, and was the main cause of pain in this population. However, it is worth noting that the aforementioned study assessed spinal instability by means of segmental angulation using plain radiographs, while in the present study this assessment was carried out by means of the center of mass displacement, which requires the action of the trunk muscles. This assessment is more similar to everyday activities, since it requires activation of the trunk muscles.

Table 3. Correlation data between pressure pain threshold and trunk instability of the sample

	PPT L3		PPT L5		PPT AT	
	r	p	r	p	r	p
Stable without feedback (cm)	-0.002	0.99	-0.105	0.478	-0.126	0.395
Stable with feedback (cm)	0.260	0.074	0.162	0.272	0.161	0.274
Circular stable (cm)	0.065	0.661	-0.071	0.629	-0.173	0.239
Unstable without feedback (cm)	0.031	0.836	-0.175	0.233	-0.090	0.542
Unstable with feedback (cm)	0.202	0.169	0.164	1.265	0.137	0.353
Circular unstable (cm)	0.051	0.728	0.209	0.155	-0.155	0.293

p≤0,05. PPT = pressure pain threshold; L3 = third lumbar vertebra; L5 = fifth lumbar vertebra; AT = anterior tibialis.

Table 4. Correlation data between pressure pain threshold, maximum isometric strength and trunk muscle endurance

	PPT L3		PPT L5		PPT AT	
	r	p	r	p	r	p
Extensor strength (N)	-0.051	0.729	-0.143	0.331	0.128	0.387
Flexor strength (N)	-0.177	0.228	-0.156	0.291	0.200	0.172
Extensor resistance (s)	-0.121	0.414	-0.178	0.227	-0.232	0.113
Flexor resistance (s)	0.221	0.131	0.158	0.282	0.137	0.352
Lateral flexor resistance (s)	0.013	0.929	0.047	0.754	-0.192	0.191

p≤0.05; N (newton); S (seconds); PPT = pressure pain threshold; L3 = third lumbar vertebra; L5 = fifth lumbar vertebra; AT = anterior tibialis.

In addition, it has been shown that a delay in the response of the trunk muscles to maintain stability in response to an external stimulus is a significant risk factor for future lumbar injury[21], which further reinforces the method used to assess lumbar instability in this study. Some studies[12] have found mean displacements in the stability test similar to those found in this study, with the values for the circular tests being significantly higher than the others and with less variation between participants. According to one study[15], this smaller variation is due to the need for greater neuromuscular activation.

The literature shows that activities requiring dynamic postural control are the most relevant in everyday life, either to move from one point to another or to carry out tasks[22]. In the senior population, this control is deficient compared to young individuals. These movements that disturb the body require a combined feedback and feedforward response, which significantly recruits the trunk stabilizer muscles[23].

The activation of stabilizer muscles provides support for the spine, reducing the risk of injury, while exposure to dynamic conditions exercises motor control, improving the response to stimuli, as well as nourishing the vertebral disc and protecting the spine from external and internal stimuli. These benefits provide a favorable response in relation to pain levels, because by reducing the occurrence of painful events, central sensitization is reduced and, as a consequence, there is an increase in PPT[24]. Thus, greater instability of the spine demonstrates inefficient activation of the adjacent muscles, contributing to the recurrence of pain and a reduction in PPT, while pain can cause movement avoidance and impair muscle activation[25].

The findings of a correlation between flexor and extensor strength and PPT at L3 and L5 found in the senior women of this study are different from those found in the literature, which show that individuals with higher levels of pain were the same ones who had greater trunk muscle weakness[26]. In addition, two other studies that used the same test with people in the same age group, but in a healthy condition, found higher levels of strength compared to the sample in this study, which is another indicator that individuals with CNLBP have altered trunk muscles[28].

In the presence of pain, this alteration can be reflected in spasms of the muscles adjacent to the lumbar spine, generating an accumulation of metabolites that irritate the nerve endings in the region and sensory-motor control remains maladjusted even when the pain is stopped. Thus, individuals with CNLBP may see an improvement in muscle strength and endurance, but the delay in their activation continues, contributing to low PPT[29,30].

The present study's findings showed no correlation between the strength of the flexor and extensor muscles of the trunk and PPT at L3 and L5 and AT in the seniors. The strength of the trunk muscles is important for maintaining upright posture as they are anti-gravity muscles, as well as contributing to improving balance in the seniors by facilitating neuromuscular adjustments to the center of gravity and improving the functionality of this population, reducing the risk of injury[31]. Corroborating these results, one study[17] found that the muscle contraction of the extensors was greater than that of the trunk flexors.

The results of the association between the strength and endurance of the trunk muscles and PPT in senior women with CNLBP, which differ from what is generally found in the literature, may be justified by the post-menopausal period in which all the volunteers were, a phase in which ovarian follicular production is suppressed and there is a deficiency of sex hormones, especially estrogen, which appears to be a protective hormone for CP[32].

The growing number of senior people in the population makes this study even more relevant, given the importance of analyzing aspects related to pain in this population and thus improving their quality of life. It is well known that age-related declines occur in the body's various systems[8]. Older adults experience a reduction in sensory feedback from the stimuli to which they are exposed, due to the attenuation in the quantity and density of myelinated peripheral nerves, as well as the thickness of existing ones[33]. This scenario is reflected in an increase in response time to provocations from the internal and external environment, which is an important factor in reducing postural stability in this population[34].

In this sense, the loss in number and size of muscle fibers caused by the aging process results in the recruitment of a higher percentage of the muscle's maximum capacity to carry out activities, which is why there is less absolute muscular endurance, since the execution of tasks generates greater metabolic stress[35]. This condition also affects muscle strength, with a 35% reduction in isometric contraction having been found in older adults aged between 79 and 82, due to a reduction in muscle mass and an increase in intramuscular fat[36]. In addition, changes in pain perception and response is another point to be analyzed in this population, given the minimization in the number of afferent fibers and demyelination of existing ones, as well as in the descending mechanisms of pain inhibition, resulting in a lower tolerance to painful stimuli[37].

Furthermore, this study was only carried out with women, as they are the population most affected by low back pain. This result was different from the studies already mentioned[36], which evaluated young adult men and women. There were consistent results on the reduction of conditioned pain modulation in women, due to a lower binding of the μ-opioid receptor in various areas of the cortex[9].

In addition, women also showed a greater catastrophization of pain, since women experience more painful experiences throughout their lives, developing a schema related to pain and a consequent vigilance of the stimuli to which they will be exposed[38]. All these factors may have contributed to the results contrary to those found in the literature.

Thus, considering the various repercussions caused by the variables studied, analyzing them and correlating them with PPT in senior women with CNLBP is extremely important. The pain variable plays a prominent role as a cause of disability, depression, economic losses and reduced quality of life, so gaining a better understanding of CNLBP makes it possible to carry out more effective treatments in all biopsychosocial aspects.

However, some limitations of this study need to be taken into account, such as the fact that it only included senior women. Thus, considering that this is the population most affected by CNLBP, the results of this research provided valuable information for the scientific literature on CNLBP and aging in senior women. However, this limitation had an impact on the generalization of the results. Another limitation of this study was the failure to assess somatosensory aspects of pain, such as anxiety, depression, catastrophizing and kinesiophobia. These factors may be present in this population and directly affect the condition of CNLBP. Future studies should therefore take into account the limitations of this study.

CONCLUSION

The lack of correlation between trunk instability, maximum isometric strength and resistance of the trunk muscles and PPT in senior women with CNLBP reinforces the fact that nonspecific pain persists even after recovery from the initial damage. Further studies should be carried out to investigate psychosocial variables related to pain in other populations with CNLBP.

AUTHORS' CONTRIBUTIONS

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Data Collection, Conceptualization, Research, Methodology, Writing - Preparation of the Original
Poliana de Jesus Santos
Statistical analysis, Data Collection, Conceptualization, Research, Methodology, Writing - Review and Editing
Anne Louyse Carvalho Lins
Data Collection, Research
José Carlos Aragão-Santos
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