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ORIGINAL RESEARCH

Relationship between chronic non-specific low back pain with disability, static posture and flexibility

Relação entre a dor lombar crônica não específica com a incapacidade, a postura estática e a flexibilidade

La relación entre dolor lumbar crónico inespecífico e incapacidad, postura estática y flexibilidad

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ABSTRACT | Among the types of chronic musculoskeletal pain, low back pain is one of the most common symptoms, with lifetime prevalence of 84%. Despite its high incidence, its causes and risk factors are not well understood. The objective of this study was: (1) compare the flexibility and characteristics of static posture between individuals with and without chronic non-specific low back pain; and (2) check for any relationship between the presence and intensity of chronic non-specific low back pain and disability, flexibility and static posture characteristics. A total of 104 adult subjects, aged 18 to 60 years, participated in the study. The sample was divided into two groups: patients with chronic non-specific low back pain (GWP – group with pain; n=52) and patients without low back pain (GWOP – group without pain; n=52). Data collection consisted of four steps: (1) anamnesis; (2) static postural assessment by photogrammetry using the Digital Image-based Postural Assessment (DIPA©) software protocol; (3) special body flexibility tests; and (4) application of the Oswestry Disability Index (ODI) questionnaire. Pain intensity showed a significant correlation with the disability index (r=0.42; p=0.00) and Wells flexibility test (r=–0.32; p=0.02). No correlation was observed between the presence of pain and static posture and flexibility, and no difference was observed between the groups. Individuals with greater intensity of chronic non-specific low back pain presented greater disability and lower scores in the Wells flexibility test.

Keywords | Low Back Pain; Posture; Chronic Pain; Physical Therapy.

RESUMO | Dentre as dores musculoesqueléticas crônicas, um dos sintomas mais comuns, com uma prevalência de 84% durante a vida, é a dor lombar. Apesar de sua elevada incidência, suas causas e fatores de risco são pouco conhecidos. O objetivo deste trabalho foi: (1) comparar a flexibilidade e as características da postura estática entre indivíduos com e sem dor lombar crônica não específica; e (2) verificar se existe relação entre a presença e intensidade da dor lombar crônica não específica com a incapacidade, a flexibilidade e as características da postura estática. Participaram do estudo 104 indivíduos adultos, com idade entre 18 e 60 anos. A amostra foi dividida em dois grupos: grupo com dor lombar crônica não específica (GCD; n=52) e grupo sem dor lombar (GSD; n=52). A coleta de dados consistiu em quatro etapas: (1) anamnese; (2) avaliação postural estática por fotogrametria, utilizando o protocolo do *software* Digital Image-based Postural Assessment (DIPA©); (3) testes especiais de flexibilidade corporal; e (4) aplicação do questionário *Oswestry Disability Index* (ODI). A intensidade da dor apresentou correlação significativa com o índice de incapacidade (r=0,42; p=0,00) e com o banco de Wells (r=–0,32; p=0,02). Não houve correlação entre a presença de dor e postura estática e flexibilidade, como também não houve diferença entre os grupos. Indivíduos com maior intensidade de dor lombar crônica não específica apresentaram maior incapacidade e menores resultados no teste do banco de Wells.

Descritores | Dor Lombar; Postura; Dor Crônica; Fisioterapia.

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RESUMEN | Entre los dolores musculoesqueléticos crónicos, el dolor lumbar es uno de los síntomas más comunes, con una prevalencia del 84 % durante la vida. A pesar de su alta incidencia, poco se conocen sus causas y factores de riesgo. Este estudio pretende: (1) comparar la flexibilidad y las características de la postura estática entre individuos con y sin dolor lumbar crónico inespecífico; y (2) comprobar si existe relación entre la presencia e intensidad del dolor lumbar crónico inespecífico con la incapacidad, la flexibilidad y las características de la postura estática. Del estudio han participado 104 sujetos adultos, entre 18 y 60 años de edad. La muestra se dividió en dos grupos: grupo con dolor lumbar crónico inespecífico (GCD; n=52) y grupo sin dolor lumbar (GSD; n=52). La recolección de datos consistió en cuatro fases: (1) anamnesis; (2) evaluación postural estática por fotogrametría utilizando el protocolo del *software* Digital Image-based Postural Assessment (DIPA©); (3) pruebas especiales de flexibilidad corporal; y (4) aplicación del cuestionario *Oswestry Disability Index* (ODI). La intensidad de dolor presentó correlación significativa con el índice de incapacidad (r=0,42; p=0,00) y con el banco Wells (r=-0,32; p=0,02). No hubo correlación entre la presencia de dolor y la postura estática y flexibilidad, pero tampoco entre los grupos. Los individuos con dolor lumbar crónico inespecífico de mayor intensidad presentaron una mayor incapacidad y menores resultados en las pruebas del banco Wells.
Palabras clave | Dolor Lumbar; Postura; Dolor Crónico; Fisioterapia.

INTRODUCTION

Chronic musculoskeletal pain has a high prevalence among population and, therefore, it is considered a public health problem. It is closely associated with economic and personal issues for the individual, such as negative impact on quality of life and functionality, medical leave and disability retirement[1]. Among the types of musculoskeletal pain, those related to the spine are the most frequent[2], and one of the most common symptoms is low back pain, with lifetime prevalence of 84%[3]. In addition, pain becomes chronic in 23% of these cases, that is, it persists for more than 12 weeks[3,4]. Also, about 85% of chronic back pain does not have a specific cause or diagnosis, so they are called chronic non-specific back pain[4].

Several episodes of low back pain occur spontaneously in activities of daily living[5], and its multifactorial etiology implies strong interaction of biological, sociodemographic and behavioral factors, characterizing the heterogeneity of individuals complaining of such pain[6-8]. In addition, its causes and risk factors are still not well understood, largely because their present and future symptoms are not associated with pathology and imaging tests[9,10]. Also, indiscriminate imaging tests are expensive and may cause unnecessary exposure and damage[1].

According to the guidelines for low back pain and therapeutic diagnosis[12], a postural assessment should be conducted as one of the essential clinical investigations for the patient with such pain and consider postural changes among the risk factors for the disease. However, there is no example in the study – nor in the current literature – which postural changes are the most important in the assessment (for example, in the spine, pelvis or lower limb region) and which postural changes are among the risk factors for the development of chronic non-specific low back pain.

A systematic review with meta-analysis and a randomized clinical trial shows that stretching exercises improve low back pain[13,14]; however, there are no studies that associate low back pain with flexibility to identify risk factors for such pain. The studies[15,16] found in the literature associate pain with impaired flexibility of restricted musculature, such as hamstrings and quadriceps, not involving the spine and other various possibilities of hip movement.

One of the challenges clinicians face on a daily basis is the investigation of the cause of patient symptoms, and it is a priority in studies on low back pain[17]. Then, considering the existing gap regarding the correlation between risk factors, such as flexibility and static posture, for chronic non-specific low back pain, further studies are required. For this reason, the objectives of this study were: (1) compare the flexibility and characteristics of static posture (alignment of body segments) between individuals with and without low back pain; and (2) check for any relationship between the presence and intensity of chronic non-specific low back pain and disability, flexibility and static posture characteristics.

This study used the hypothesis that individuals with chronic non-specific low back pain present impaired flexibility and changes in static posture and that, the greater the intensity of low back pain, the greater the disability, the impairment of flexibility and static posture.

METHODOLOGY

This is an observational study whose sample was defined based on the family of z-tests (Pearson's correlation), assuming a two-tailed test, large effect size (f=0.65), α of 0.05, and power of 80%, resulting in minimum 41 participants in each group.

A total of 104 adult individuals, aged 18 to 60 years, participated in the study after signing an informed consent term. The participants were divided into two groups: patients with chronic non-specific low back pain (GWP; n=52) and patients without low back pain (GWOP; n=52).

The inclusion criterion for the GWP was: patients with non-specific low back pain for three months or more, with minimum intensity of 2 cm by the visual analogue scale (VAS) during the evaluation week. This level of pain intensity was selected in this study as it is clinically relevant18. To be included in the GWOP, participants could not report low back pain. Individuals with a history of spinal surgery were excluded from both groups.

Data collection consisted of four stages: (1) anamnesis; (2) static postural assessment by photogrammetry using the Digital Image-based Postural Assessment (DIPA©)[19] software protocol; (3) special tests of body flexibility[20]; and (4) application of the Oswestry Disability Index (ODI)[21] questionnaire. The evaluations were all performed by a team with previous training.

Anamnesis was used to identify the pain site using a body map; pain intensity was evaluated through VAS, duration of symptoms and demographic information, such as height and body mass index.

A static postural assessment was conducted in the sagittal plane by photogrammetry using the DIPA© software, with confirmed intra- and inter-rater validity and reproducibility[19]. The variables measured here were: thoracic and lumbar arrows (horizontal distance between the spinous processes of T6 and L4, respectively, and a vertical line originating from the S2 vertebra), pelvic angle (angle between a line connecting the upper anterior and posterior iliac spines and the horizontal plane), pelvis drive (horizontal distance between the great trochanter of the femur from a vertical line connecting the lateral malleolus, the tuberosity of the lateral condyle of the femur and the acromion), and knee angle (angle between the great trochanter of the femur, the lateral condyle of the femur and the lateral malleolus)[19].

The flexibility assessment included five tests from the "American Physical Therapy Association's Low Back Pain Guidelines"[20], which are: (1) active flexion and extension of low back (lumbar flexion and extension), standing position, with the inclinometer placed at the lower end of the waist; (2) passive flexion of the hip in dorsal decubitus with knee extension (RH and LH flexion KExt) and knee flexion (RH and LH flexion KFlex), and inclinometer placed in the thigh area; (3) passive hip extension (Thomas tests – D and E), with the inclinometer placed in the thigh area; (4) passive hip rotations (external and internal rotation of RH and LH) in ventral decubitus, with the reference knee bent at 90° and the inclinometer placed in the leg area.

The individuals were evaluated with (5) the Wells flexibility test (sit and reach test), which evaluates the flexibility of the posterior chain. The shorter the distance in the test, measured in centimeters, the smaller the flexibility. To perform the test the participants were instructed to sit on the floor with extended knees and try to reach the greatest distance with their hands on the instrument without knee bending and compensation with the shoulder girdle. One measurement was performed and recorded for every participant.

Functional disability was assessed using the Oswestry Disability Index (ODI) questionnaire. The final score, in percentage, is classified as minimal disability (0% to 20%), moderate disability (21% to 40%), severe disability (41% to 60%), crippling back pain (61% to 80%), and bed-bound patients (81% to 100%)[21].

A statistical analysis was performed using the SPSS software version 20.0, with mean and standard deviation. Data normality was confirmed by the Kolmogorov-Smirnov test, and the t-test was used to compare both groups (GWP and GWOP).

The tests used for the correlations between the group with pain (GWP) and the group without pain (GWOP), pain intensity (GWP only) and the variables of interest were Kendall's Tau-b (for correlation between categorical and continuous variables) and the Pearson correlation coefficient (for correlation between continuous variables); they were interpreted according to the Hopkins classification[22], where 0 to 0.1 means very small correlation, 0.1 to 0.3 means small correction, 0.3 to 0.5 means moderate correlation, 0.5 to 0.7 means large correlation, 0.7 to 0.9 means very large correlation, and 0.9 to 1 means practically perfect correlation[22]. This study adopted $\alpha<0.05$ for all tests.

RESULTS

The GWP had 35 women and 17 men, and it presented minimal disability 15.4 (9.6)% (min. 2%, max. 46%), and mean pain intensity of 5.2 (2.1) cm (min. 2, max. 10 cm). The GWOP had 32 women and 20 men.

The comparison between the groups showed no difference for any of the variables (Table 1). No correlation was observed between presence of pain and static posture and flexibility (Table 2).

Pain intensity showed a significant moderate correlation with disability (r=0.42; p=0.00), so that the greater the pain intensity, the greater the disability (Table 3).

A significant moderate negative correlation was observed between pain intensity and posterior chain flexibility (r=–0.32; p=0.02), obtained through the Wells flexibility test. It demonstrated that the greater the pain intensity, the lower the posterior chain flexibility. For the other variables, no correlation was observed (Table 3).

For the correlations between pain intensity and the variables of interest (disability, static posture and flexibility), only the GWP was evaluated.

Table 1. Sample description and comparison between the group with pain (GWP, n=52) and group without pain (GWOP, n=52)

Variables		GWP Mean (SD)	GWOP Mean (SD)	p[a]
Demographic data	Age (years)	33.5 (14.6)	31.4 (12.7)	0.75
	Body mass index (kg)	68.5 (11.8)	70.1 (14.5)	0.49
	Height (cm)	166.6 (10.6)	167.7 (9.1)	0.48
Static posture	Thoracic arrow (cm)	1.6 (3.6)	1.2 (3.5)	0.53
	Lumbar arrow (cm)	2.6 (1.2)	2.8 (1.3)	0.43
	Pelvic angle (º)	11.7 (5.7)	12.2 (4.6)	0.45
	Knee angle (º)	175.0 (5.8)	177.4 (8.0)	0.05
Flexibility	Wells test (cm)	22.2 (10.5)	22.7 (12.2)	0.84
	Lumbar flexion (º)	53.6 (25.7)	47.1 (20.0)	0.28
	Lumbar extension (º)	21.1 (10.2)	18.8 (9.6)	0.35
	RH flexion KExt (º)	85.3 (17.5)	86.7 (19.7)	0.64
	LH flexion KExt (º)	88.8 (20.7)	85.5 (20.1)	0.54
	RH flexion KFlx (º)	117.3 (11.0)	118.7 (11.6)	0.62
	LH flexion KFlx (º)	121.8 (12.2)	120.4 (12.4)	0.51
	Thomas D (º)	–0.3 (9.3)	–1.21 (9.3)	0.69
	Thomas E (º)	–0.6 (9.0)	–0.8 (8.8)	0.91
	RH external rotation (º)	45.7 (10.6)	41.6 (10.2)	0.06
	LH external rotation (º)	41.7 (9.6)	42.6 (9.5)	0.90
	RH internal rotation (º)	35.9 (9.7)	38.6 (11.8)	0.37
	LH internal rotation (º)	38.6 (10.0)	38.2 (9.9)	0.75

[a] t-test; SD: standard deviation; RH: right hip; LH: left hip; KExt: knee extension; KFlx: knee flexion.

Table 2. Correlation between presence of pain and static posture and flexibility.

	Variables	Presence of pain	
		Correlation[a]	p
Static posture	Thoracic arrow (n=104)	−0.06	0.48
	Lumbar arrow (n=104)	0.06	0.49
	Pelvic angle (n=104)	0.07	0.36
	Knee angle (n=104)	0.15	0.06
	Pelvis drive (n=104)	0.00	1.00
Flexibility	Wells test (n=104)	0.00	0.96
	Lumbar flexion (n=87)	−0.09	0.30
	Lumbar extension (n=87)	−0.08	0.38
	RH flexion KExt (n=87)	0.04	0.66
	LH flexion KExt (n=87)	−0.05	0.58
	RH flexion KFlx (n=87)	0.07	0.42
	LH flexion KFlx (n=87)	−0.03	0.72
	Thomas D (n=87)	−0.05	0.56
	Thomas E (n=87)	−0.02	0.81
	RH external rotation (n=87)	−0.16	0.08
	LH external rotation (n=87)	0.02	0.80
	RH internal rotation (n=87)	0.06	0.51
	LH internal rotation (n=87)	−0.01	0.92

[a]Kendall's Tau-b (τ); RH: right hip; LH: left hip; KExt: knee extension; KFlx: knee flexion.

Table 3. Correlation between pain intensity and postural variables and flexibility, only for individuals with low back pain.

	Variables	Pain intensity	
		Correlation	p
Disability	Oswestry Disability Index (ODI) (n=59)	0.42[a]	0.00*
Static posture	Thoracic arrow (n=52)	0.22[a]	0.12
	Lumbar arrow (n=52)	0.05[a]	0.72
	Pelvic angle (n=52)	−0.16[a]	0.26
	Knee angle (n=52)	−0.26[a]	0.06
	Pelvis drive (n=52)	−0.01[b]	0.91
Flexibility	Wells test (n=52)	−0.32[a]	0.02*
	Lumbar flexion (n=41)	0.08[a]	0.60
	Lumbar extension (n=41)	0.09[a]	0.58
	RH flexion KExt (n=41)	−0.08[a]	0.62
	LH flexion KExt (n=41)	−0.05[a]	0.76
	RH flexion KFlx (n=41)	−0.17[a]	0.28
	LH flexion KFlx (n=41)	−0.02[a]	0.90
	Thomas D (n=41)	−0.01[a]	0.94
	Thomas E (n=41)	0.02[a]	0.90
	RH external rotation (n=41)	−0.17[a]	0.27
	LH external rotation (n=41)	−0.16[a]	0.31
	RH internal rotation (n=41)	0.02[a]	0.92
	LH internal rotation (n=41)	−0.01[a]	0.95

[a]Pearson correlation; [b]Kendall's Tau-b; RH: right hip; LH: left hip; KExt: knee extension; KFlx: knee flexion.

DISCUSSION

Individuals with chronic non-specific low back pain did not present impaired flexibility and changes in static posture of the spine when compared to individuals without pain, thus rejecting the initial hypothesis. However, according to the correlation tests, the findings showed that the greater the pain intensity, the greater the disability, and the lower the results in the Wells flexibility test, suggesting smaller flexibility of the posterior chain. Therefore, these results partially confirm the initial hypothesis.

In relation to the moderate negative correlation between pain intensity and posterior chain flexibility, Esola et al.[23] evaluated the pattern of forward movement of the lumbar spine and hip joint, obtaining correlations of flexibility of the hamstring muscles in the group of patients with low back pain; however, they did not find differences between the GWP and the GWOP, in agreement with this study. Nogueira and Navega[24] conducted a school posture program with individuals presenting non-specific low back pain, providing healthcare and stretching guidance for the lumbar spine, cervical spine, hamstrings, piriformis and abdominal muscles. The participants achieved significant reduction of pain intensity and disability, improving their quality of life and flexibility, as assessed by the Wells flexibility test.

However, Soares et al.[25] found no differences in the Wells flexibility test between individuals with and without low back pain. Then, although the results of this study are significant, the correlation was moderate and the literature presents distinct findings, thus further studies are required that analyze the relationship between chronic non-specific low back pain and posterior chain flexibility. In addition, this study also assessed the flexibility of the lumbar spine and hamstring muscles alone and found no other correlations besides the full flexibility of the posterior chair, as recommended by the Wells test (or sit and reach test). Of note, the whole sample of this study fits the parameters of normality for the flexibility tests mentioned above.

Pain intensity presented a significant moderate correlation with the ODI, so that the more intense the pain, the greater the participant's disability. Previous studies confirm this finding, showing a moderate correlation between disability and pain intensity in individuals with low back pain[26-28]. In addition, Rabini et al.[29] found a significant correlation between disability and quality of life in this population. In fact, this relationship with low back pain seems to be well documented and the results of this study confirm this fact.

Despite ongoing investigations and the development of new interventions, musculoskeletal pain in the spine remains a clinical challenge, due to its multifactorial condition and high incidence[30,31]. For this reason, correlating chronic non-specific low back pain with some postural variables and flexibility tests was a difficult task. One limitation of this study is the low level of pain as an inclusion criterion. Perhaps if these criteria were more detailed, with control of age, gender, body mass index, type of work activity, degree of physical conditioning and level of pain, the results showed differences between the groups and/or more robust correlations.

The clinical importance of current findings is to ensure the relationship between chronic non-specific low back pain and disability, a factor that clinicians need to take into account when treating their patients, considering this eminent social problem, as well as the relationship with global flexibility of the posterior chain, as it seems to be negatively affected in the population with low back pain. The strengths of this study are: the expressive sample in each group and the number of variables analyzed together, including static posture through validated and reproducible software[19], the flexibility tests recommended by the American Physical Therapy Association's lumbar pain guidelines[20] and disability measured by the ODI[21] questionnaire, which is well documented in the literature.

CONCLUSION

The groups with and without chronic non-specific low back pain (GWP and GWOP) presented no difference for flexibility and static posture. Also, no correlation was observed between the presence of pain and static posture and flexibility. However, for the GWP, a correlation was observed between pain intensity and the level of disability. In addition, the greater the pain intensity, the smaller the posterior chain flexibility.

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