Manual Therapy, Posturology & Rehabilitation Journal
ISSN: 2236-5435

RESEARCH ARTICLE

Does practicing physical activity influence functional capacity, pain intensity, and trunk extensor strength in individuals with chronic low back pain?

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ABSTRACT:

Background: Low back pain (LBP) is characterized as pain or discomfort located in the region below the rib cage and above the upper gluteal line. Some factors, such as a low level of physical activity or a sedentary lifestyle and poor posture during work activities, contribute to the chronification of pain. **Objective:** To investigate whether physical activity influences functional capacity, pain intensity and trunk extensor strength in individuals with chronic LBP. **Methods:** The sample was composed of 30 adult individuals, aged between 18 and 30 years, of both genders. They were divided into two groups, sedentary (SG, n=17) and active people (AG, n=13). The IPAq was used to classify the participants between sedentary and active people. Afterwards, the Roland Morris Disability and the SF-36 quality of life questionnaires were applied. Pain intensity was obtained by the Numerical Pain Scale (NDS). After that, the Sitting and Reaching Test (SCT) and the evaluation of the strength of the trunk extensor muscles were performed. At the end of the evaluations, a lumbar overload protocol was performed. After five minutes, pain intensity, flexibility, and muscle strength were reassessed. For data interpretation, a significance level of $p < 0.05$ was adopted. **Results:** After the lumbar overload protocol, the GS showed an increase in the flexibility of the posterior chain in the SRT and there was a increase in pain for both groups. **Conclusion:** individuals with chronic LBP, with similar levels of Quality of Life, pain intensity and disability, regardless of being active or sedentary, do not differ in pain perception, flexibility and ability to generate trunk extension force after being submitted to a lumbar overload protocol. Furthermore, the lumbar overload protocol was efficient in generating increased pain in both groups.

Keywords: Low back pain; manual dynamometry; range of motion.

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Received: 01 March, 2023.
Accepted: 11 July, 2023.
Published: 06 Dec, 2023.

BACKGROUND

Low back pain (LBP), commonly known as "lumbar pain", is characterized as pain or discomfort located in the region below the costal margin and above the upper gluteal line, with or without pain in the lower limb. The World Health Organization (WHO) believes that 80% of individuals have or will have LBP[1].

In LBP, pain is multidimensional, with different sensations, intensities and can also be affected by emotional, social and affective aspects of each individual. LBP can be classified into two types: acute or chronic. It is characterized as chronic when present for more than three months[2]. Chronic pain, which has different origins, lasts for more than 12 weeks and is treated in a multidisciplinary manner. Some factors such as a low level of physical activity or a sedentary lifestyle, poor posture during work activities, activities with repetitive effort and aging contribute to chronicity[3].

There are several causes and risk factors that may be related to LBP. Numerous researchers characterize LBP as a disease of sedentary people, due to the fact that lack of physical exercise can be a risk factor for the origin of back pain. . The biggest problem is the combination of a lack of musculoskeletal fitness with frequent activities that require excessive effort in the lower back. The musculo-articular structures are fundamental for the body's support axis, as well as for the movement axis, therefore, both excess and lack of physical exercise can contribute to possible damage to the individual's biomechanics[4].

The clinical picture of LBP consists of pain, inability or difficulty in moving and working. Physical exercise helps to improve tolerance to postural stress, eases the workload and develops greater protection against the dangers of manual work. Physical activity generates an improvement in physical fitness, contributing positively to mobility, stretching and relaxation of the muscles in the dorsal region, therefore all of these effects contribute to better posture and reduced complaints of LBP[5].

In view of the above, the main objective of the present study was to compare the functional capacity, pain intensity and strength of the trunk extensors between physically active and sedentary subjects, with LBP.

METHODS

Ethical aspects

This is a cross-sectional, quantitative study, approved by the local Ethics Committee (Protocol number: 5.700.856). All research participants were duly instructed by the researcher about the study, objectives, risks and benefits and signed the Free and Informed Consent Form.

Participants

The sample consisted of 30 adult individuals, aged between 18 and 30 years, of both sexes. The individuals were divided into two groups, one of sedentary people (GS) and the other of active people (GA). The distinction for allocation between groups was obtained using the The International Physical Activity Questionnaires (IPAQ) questionnaire. As an inclusion criterion for participation in the research, participants should be able to perform the proposed tests and have had low back pain for at least six months and LBP intensity above 3 on the numerical pain scale on the day of the assessment. Participants who reported changes in the level of physical activity in the last 6 months and those who gave up while performing the exercises would be excluded. However, no participant needed to be excluded.

Local

The research was carried out at the Specialized Rehabilitation Center – CER at Unesp de Marília, Musculoskeletal Assessment Laboratory-LAM.

Data collection, instruments and analysis of results:

A prior appointment was made with research participants to collect data and apply the assessment instruments. Data collection and evaluation began with anamnesis to obtain personal data and clinical history. Then, the IPAq was applied to distinguish between sedentary and active participants. Afterwards, the Roland Morris Disability questionnaire and the 36-Item Short Form Survey (SF-36) were applied.

Pain intensity was measured before and after the protocol and was obtained using the Numerical Pain Scale (NPS). Subsequently, three measurements of flexibility of the posterior muscular chain were carried out, using the Sit and Reach Test (SRT), using the Wells Bank. The strength of the trunk extensor muscles was assessed three times using a traction dynamometer Crown® brand (Crown Electronics systems New Delhi, Delhi, India). At the end of the evaluations, a lumbar overload protocol was carried out. After five minutes, pain intensity, flexibility and muscle strength were reassessed.

IPAQ

The IPAQ allows us to estimate the time a person spends in physical activities of different intensities. It consists of 27 questions related to the practice of physical activities (PA) weekly, classifying them as: light, moderate and vigorous, and the duration must be at least 10 continuous minutes, divided into four situations: at work, in transport, domestic activities and leisure[(6)].

SF-36

The SF-36 questionnaire, validated in Brazil by Ciconelliet al.[(7)], is used to measure quality of life in a multidimensional way, it is made up of 36 items divided into eight scales, namely: functional capacity, physical aspects, pain, general health status, vitality, social aspects, emotional aspects, mental health and another question that assesses the current health status compared to that of a year ago. Assessing the negative and positive aspects of the individual's health. The results are obtained through a score for each item, and then these individual results are added together to form a scale from 0 to 100, with one hundred being the best possible result and zero being the worst[(8)].

Numerical Pain Scale

The NPS is a simple and easy-to-measure scale, validated for Portuguese by Ferreira-Valente et al.[(9)], which consists of a sequence of numbers, from 0 to 10, in which the value 0 represents "no pain", 1 to 3 mild pain, 4 to 6 moderate pain, 7 to 10 represents intense pain.

Roland Morris Disability Questionnaire (RMDQ)

The RMDQ is a validated questionnaire for the Brazilian population[(10)], being an instrument that assesses disability related to low back pain and consists of 24 items that describe daily activities, in which each answer is quantified from 0 to 1. The higher the level of disability, the higher the total score will be. The questionnaire has a score of "14" as a cutoff point, so if the participant has a score greater than fourteen, they have a disability.

Sit and Reach Test

Using this test, it is possible to assess the flexibility of the hamstring and paravertebral muscles[(11)]. To carry it out, the Bench of Wells instrument was used, which consists of a square block of wood, with a ruler located at the top graduated in centimeters[(12)]. Each participant was positioned sitting on a mat, with knees extended, with hip flexion at 90° and with the plantar part of the feet in full contact with the anterior face of the block. With their elbows extended and their palms facing down, the participants performed a trunk flexion, in order to push the marker positioned on the ruler as far as possible, without their knees flexing. The test was carried out three times, using the highest value found in the measurements(13-15).

Lumbar dynamometry

To measure the strength of the extensor muscles of the lumbar spine, a lumbar dynamometer, brand Crown®, was used, with a capacity of 200 Kgf (kilogram-force), divided into 1 Kgf and measurement accuracy of 99% of the load. total. The participant was positioned standing on the equipment platform with full knee extension, trunk flexed at approximately 120º and the head following the extension of the trunk, with the gaze fixed ahead, hands holding the equipment bar positioned in the anterior part of the lumbar dynamometer(16). At the end of the positioning, the participant was asked to perform the greatest possible trunk extension(17).

The participant was instructed to apply the greatest possible force to the spine extension movement, using the muscles in the lumbar region, keeping the spine in an upright position. During this movement, the arms remain extended, preventing the subject from performing any type of additional movement with the upper limbs(18). This test was performed three times with submaximal force so that the patient understands how the test works, and twice with maximum force with a 1-minute interval between tests(16). For data analysis, the highest value obtained was used.

Lumbar Overload

Using the lumbar dynamometer, with a minimum load of 75% of the value obtained in the initial assessment of trunk extensor muscle strength, each participant was instructed to perform a sustained contraction for 10 seconds. A sequence of 5 contractions was requested, with 30-second intervals between each sustained contraction. During the execution, the verbal command was given "strength – maintain, strength – maintain!!"

Data analysis

The data obtained, from the evaluation and applied tests, were analyzed using exploratory statistical techniques. A pilot study with ten volunteers, five from each group, was carried out to calculate the sample. The variable used was pain after the overload protocol, with power of 0.80, probability of error α of 0.05, effect size of 0.875, estimating the need for twenty-six volunteers as a whole. After checking normality using the Shapiro-Wilk test, Student's t-test (independent) was applied to compare the groups and to compare the effects of the overload protocol, a Student's t-test (paired) was used, adopting if a significance level of $p < 0.05$.

RESULTS

It was possible to observe that the study had a predominance of females, both in GA and GS. Both groups presented similar levels of pain, trunk extensor strength and flexibility, as well as the level of disability on the Roland Morris questionnaire (Table 1).

Table 1. Characterization of Active and Sedentary Groups.

	Active Group (AG)	Sedentary Group (SG)
N	13	17
Women	53,85%	70,59%
Men	46,15%	29,41%
Age (years)	22 ± 2,65	21 ± 2,12
Pain (NPS)	4,38 ± 1,26	4,64 ± 1,65
Trunk Extensor Strength (Kgf)	83,92 ± 37,32	85,76 ± 33,45
Flexibility -SRT (cm)	29,96 ± 11,15	28,11 ± 9,30
Roland Morris Questionnaire	4,15 ± 2,54	4,64 ± 3,06

Note: Data as mean ± standard deviation; TSA= sit and reach test; Kgf= kilograms force, cm= centimeters. *p<0.05. Source: Own preparation.

Table 2 shows the results found in the eight domains of the quality of life questionnaire (SF-36). It is possible to observe that the groups did not differ in terms of their perception of Quality of Life (QoL).

Table 2. Data on Quality of Life (SF-36) of the Active and Sedentary Groups.

	Active Group (AG) (n=13)	Sedentary Group (SG) (n=17)
Functional capacity	82,30 ± 13,93	85 ± 16,86
Limitation by Physical Aspects	75 ± 30,61	64,70 ± 33,14
Pain	48,30 ± 17,05	54,05 ± 15,27
General Health Status	47,76 ± 16,68	47,76 ± 17,10
Vitality	43,46 ± 14,05	43,23 ± 25,79
Social aspects	65,57 ± 25,37	61,02 ± 21,59
Emotional Aspects	43,57 ± 43,85	35,27 ± 36,25
Mental Health	64 ± 18,90	54,73 ± 17,58

Note: Data as mean ± standard deviation. *p<0.05. Source: own elaboration.

After the lumbar overload protocol, the following aspects were reevaluated: pain, posterior chain flexibility and trunk extensor strength. In Table 3 it can be seen that the groups did not differ in the variables analyzed, indicating that being physically active did not result in better performance.

Table 3. Data as mean ± standard deviation. *p<0.05.

	Active Group (AG) (n=13)	Secundary Group (SG) (n=17)
Pain	6,5 ± 1,70	6,58 ± 1,46
Flexibilty (cm)	30,73 ± 11,81	30,11 ± 10,48
Trunk Extensor Strength (kgf)	84,53 ± 34,67	88,41 ± 31,66

Note: Data as mean ± standard deviation; Kgf= kilograms-force, cm= centimeters. *p<0.05.

In Tables 4 and 5, AG and SG, respectively, we present the results obtained before and after applying the lumbar overload protocol. Table 4 shows that AG showed a significant increase in pain level ($p<0.05$) and maintenance of trunk extensor strength and posterior chain flexibility values.

Table 4. Data from assessments of the active group (n=13), before and after lumbar overload.

	Pre Overload	Post Overload
Pain	4,38 ± 1,26	6,50 ± 1,71*
Flexibility (cm)	29,96 ± 11,15	30,73 ± 11,81
Trunk Extensor Strength (Kgf)	83,92 ± 37,32	84,54 ± 34,67

Note: Data as mean ± standard deviation; Kgf= kilograms force, cm= centimeters. *p<0.05. (T test – paired, p = 0.0032 variable Pain).

Table 5. Data from the assessments of the sedentary group (n=17), pre and post lumbar overload.

	Pre Overload	Post Overload
Pain	4,65±1,66	6,59±1,46*
Flexibility(cm)	28,12±9,30	30,12±10,49*
Trunk Extensor Strength (kgf)	85,76±33,45	88,41±31,66

Note: Data as mean ± standard deviation; Kgf= kilogram-force, cm= centimeters. *p<0.05. (T test – paired, p = 0.0026 variable pain; p=0.0039 variable flexibility).

Table 5 shows the behavior of the SG variables before and after lumbar overload, with a significant increase in pain and flexibility ($p<0.05$) and maintenance of the ability to generate force in the muscles tested. It can be observed that the applied lumbar overload protocol was able to instantly generate greater perception of pain in the lumbar region, both in active and sedentary individuals.

DISCUSSION

It was observed that the practice of PA reported through the IPAQ, in the studied sample, did not result in performance different from that obtained by sedentary individuals. Initially, one may think that these data differ from those found in the literature. The AG and SG groups did not differ in the perception of QoL and level of disability due to LBP, and the data regarding pain, flexibility and strength of the trunk extensor muscles were similar, as was possible to notice after the carrying out the sit and reach tests and lumbar dynamometry ($p<0.05$), a fact that suggests that the practice of physical activity in AG was not able to promote benefits commonly observed in physical exercise practitioners[5].

Silva et al[19], in a study that investigated the effect of physical exercise on LBP, in a systematic review consisting of 5 articles concluded that performing physical exercises is important for individuals with low back pain, improving spinal stability and LBP. This study also cites the importance of strengthening the abdominal muscles to balance dorsal and abdominal muscle strength, thus reducing the risks of a pelvic deviation that can lead to changes in the lordotic curvature that would consequently overload the vertebral discs. According to Bambrilla and Pulzatto[20], there is evidence that combined exercises, those consisting of aerobic, stretching and strengthening exercises, are important for reducing pain in the lumbar region.

It is well established in the scientific literature that staying physically active brings benefits to general health[21, 22], improves quality of life[23] and results in musculoskeletal gains, such as improving functional capacity and maintaining all physical skills[24, 25]. Therefore, the data from the present study, in addition to not differing from what is found in the literature, reinforces the idea that the intensity and specificity of physical exercises can be decisive in improving various aspects of individuals with chronic LBP[26].

For the present study, a lumbar overload protocol was developed, with the expectation of generating increased demand in this body region and analyzing musculoskeletal behavior. It can be observed that the protocol was able to promote an increase in pain intensity, approximately 2 points in the NPS, which is considered a relevant clinical change[27]. Therefore, it is believed that this protocol can be used in research that seeks to simulate an increase in musculoskeletal demand in the lumbar region, in a safe way, considering that no participant contacted us indicating an exacerbation of the pain after the day of the evaluation.

Barros, Ângelo and Uchôa[28] report that repetitive work movements, long periods of sitting, and a sedentary lifestyle are the main causes of pain in the lower back. Sakamoto et al.[29] state that there is a relationship between muscular strength and the appearance of LBP, this is due to the lower resistance of the lumbar muscles generating an increase in the frequency of pain complaints in this region. In the present study, comprised exclusively of individuals with chronic LBP, no significant differences were observed in the ability to generate trunk extension force, even after an increase in pain caused as a result of the overload protocol. However, as it is a chronic condition and there are no predicted values in the literature, according to sex, age and anthropometric data, it cannot be said whether the ability to generate force is altered. What was observed is that the immediate increase in pain intensity was not able to reduce the ability to generate strength and flexibility.

Silva et al.[30] found, in their research with rural workers, a relationship between decreased flexibility and increased pain and postural deviations. Studies indicate that lack of flexibility is related to pain level[31]. The participants in the present study, from both groups, had SRT values within acceptable normal values, and after the lumbar overload protocol, the SG showed increased posterior chain flexibility. This situation may have occurred due to the fact that the overload protocol and repetition of tests caused an increase in mobilization of the joints involved, which possibly resulted in a momentary increase in the flexibility of the posterior chain.

The present study has some limitations. The sample size and inclusion of men and women may have caused prejudice in the interpretation of the results, considering that the variables strength and flexibility were analyzed and these are normally different between the sexes. Another aspect refers to the use of IPAQ as the exclusive criterion for separating participants into the AG and SG groups, which may even overestimate the physical activity of individuals, even if the level of activity performed has not been able to cause clinically significant changes, as Roberts Lewis et al.,[32] indicate that the IPAQ should be used in conjunction with other instruments for classifying the level of physical activity. However, it is necessary to take into account that there is a difference between being considered physically active and practicing physical exercise, as according to Araújo and Araújo[33], while the former performs activities that total 150 minutes throughout the week, which may even be low-energy activities intensity, the second involves carrying out exercises with regularity, periodicity, intensity and specific objectives, preferably under the guidance/supervision of a professional in the area.

Therefore, in the sample studied, it is possible that the activities carried out by those belonging to the AG are not sufficient to promote identifiable benefits in the evaluations carried out.

CONCLUSION

Individuals with chronic LBP, with similar levels of QoL, pain intensity and disability, regardless of whether they are active or sedentary, do not differ, after being subjected to a lumbar overload protocol, in pain perception, flexibility and ability to generate trunk extension force. Furthermore, the Lumbar Overload Protocol was efficient in generating an increase in pain in both groups.

Authors' contribution: MTN and RMPF contributed to the study design; RMP performed data collection. MTN and RMPF contributed to the design and tabulation of the data. MTN and RMPF contributed to the critical review, corrections and approved the final version.

Financial support: MTN and RMP The Musculoskeletal Assessment Laboratory of the Center for Education and Health Studies (CEES) of the Faculty of Philosophy and Sciences of Marília, Universidade State of São Paulo (UNESP).

Conflict of interest: There was no conflict of interest.

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