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The influence of physical exercise on behavioral habits, kinesiophobia, and disability in people with low back pain: A retrospective cross-sectional study

Bianca Andrade Monteiro da Silva , Grazielle Martins Gelain *, Cláudia Tarragô Candotti

School of Physical Education, Physical Therapy and Dance, Federal University of Rio Grande do Sul, Porto Alegre, Brazil

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Introduction: Physical exercise improves physical fitness and health, helping to reduce pain and prevent low back pain. This study aims to compare the intensity of low back pain (LBP), behavioral habits, and the level of disability and kinesiophobia among exercising and non-exercising subjects with LBP.
Methods: Consecutive sample of 102 individuals was divided into exercising group (EG) and non-exercising group (NEG). The data was extracted from the answers to the questionnaires Back Pain and Body Posture Evaluation Instrument (BackPEI-A), Oswestry Disability Index (ODI) and Fear-avoidance Beliefs Questionnaire (FABQ-Brazil). For statistical analysis, the chi-square test was used, $\alpha \leq 0.05$.
Results: Both groups presented predominance of mild to moderate pain intensity and absence of kinesiophobia in the practice of physical activity, with no statistically significant difference. However, there was significant difference between the groups for the risk of occurrence of LBP and for levels of incapacity and kinesiophobia related to work.
Conclusion: Exercising individuals appear to present with a lower risk for occurrence of LBP, lower level of disability, and absence of work-related kinesiophobia.

1. Introduction

Low back pain, understood as a symptom of pain and discomfort localized below the costal margin and above the inferior gluteal buttocks, with or without leg pain (Burton et al., 2006), can have one or multiple causes, with or without significant correlations (Cruz and Nunes, 2012; Santos et al., 2019). Often physical inactivity has been directly and indirectly related to back pain, considering the combination of deficient muscle-skeletal fitness and the demands required by this region (Cruz and Nunes, 2012). Besides, mechanical factors have been associated to muscle impairment and are among the causes of LBP (Bozorgmehr et al., 2018; Delitto et al., 2012; Nourbakhsh and Arab, 2002).

The practice of physical exercise, which consists of a planned physical activity (Meade et al., 2019), is commonly prescribed as treatment for LBP (Buchbinder et al., 2010), aside from improving physical fitness, promoting reduction in pain intensity (Baiamonte et al., 2017; Martins and Longen, 2017; Naugle et al., 2012), and improving depression, stress, and anxiety, for its effects extend to organs and bodily functions and are not limited to muscles (Sanches et al., 2016). Physical exercise also prevents LBP aggravations (Steffens et al., 2016), which reduces treatment costs as well as contributes to the maintenance of the adequate posture and gestures necessary for the fulfilling of activities of daily living (ADL) (Candotti et al., 2018; Fonseca et al., 2016).

Kinesiophobia — the excessive fear of movement — results from feelings of vulnerability to pain or to the recurrence of an injury (Santos et al., 2019). In the acute phase of LBP fear-avoidance behaviors, such as resting, are common. However, if such protective behaviors persist, they may become actions of anticipation of pain, instead of being a response to it. In the long run, avoidance may cause disuse, depression, and increased disability. Thus, an active attitude facing the activities of daily living (ADLs) emerges as an adaptive response that may lead to the reduction of fear and the promotion of recovery (Trocoli and Botelho, 2016).

Furthermore, behavioral habits such as the posture adopted for sitting down to write or using the computer, when inadequate and recurring throughout life, can produce postural alterations that are

* Corresponding author. Rua Joaquim Pedro Soares, 500 / 84, Novo Hamburgo/RS, CEP: 93510-320, Brazil.
E-mail address: graziellegelain@gmail.com (G.M. Gelain).

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initially asymptomatic but can potentially cause LBP and affect the ADLs, even leading to temporary incapacitation (Balagué et al., 2012; Candotti et al., 2018; Kanchanomai et al., 2015).

Thus, the hypothesis is that regular and guided physical exercise can interfere in the presence and relevance of LBP, even influencing the practice of good behavioral habits. There is also the belief that individuals who practice physical exercise will have absence of kinesiophobia and absence or lower levels of disability. Although LBP may be present both in individuals who practice physical exercise and who do not, for those who are physically active, pain intensity and frequency may be lower. Therefore, the objective of the present study is to compare the intensity of LBP, as well as behavioral habits, level of disability, and presence of kinesiophobia among individuals who do and who do not practice physical exercise.

2. Materials and methods

This retrospective cross-sectional research with comparative *ex post facto* design (Thomas et al., 2011) followed the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) guideline (Elm et al., 2007). The sample size was determined with G* Power 3.1.7 software (University of Kiel, Germany), considering the chi square (χ^2) test group (contingency tables), medium to large effect size (0.31), $\alpha = 0.05$, $\beta = 0.20$, for tables with two degrees of freedom, which resulted in a total sample of 102 individuals. The research project was approved by the Research Ethics Committee of the University.

Information on the individuals was extracted from the database of an umbrella project on body posture that is run by the university where this study was conducted. The data collected referred to years 2016–2019 and accounted for the answers to three questionnaires: Back Pain and Body Posture Evaluation Instrument (BackPEI-A) (Candotti et al., 2018), Oswestry Disability Index (ODI) (Ludwig et al., 2019), and Fear-avoidance Beliefs Questionnaire (FABQ-Brazil) (Feitosa et al., 2016). The inclusion criteria were presence of chronic LBP in the last 3 months (answer “yes” to question 13 in the BackPEI-A questionnaire) and occurrence of monthly or weekly episodes of LBP (answers extracted from question 14 of BackPEI-A), ages between 18 and 59 years-old and completion of all information from the three questionnaires. The exclusion criterion was previous spinal surgery. We classified the individuals into the exercising group (EG), when the individual answered “yes” to the question 6 in the BackPEI-A questionnaire or into the non-exercising group (NEG), when the individual answered “no” to this question. Each group had 51 individuals.

The BackPEI-A questionnaire assesses the presence of back pain and its associated risk factors such as behavioral and postural habits like the posture adopted by a person when sitting on a chair, sitting at a desk to write, sleeping, using a computer, picking up objects from the floor, reading or studying in bed, hours per week practicing physical exercise, hours per day spent seated using the computer and sleeping hours. The BackPEI-A provides a risk-factor index for back pain occurrence in which the higher the score, the better the behavioral habits are and the lower the risk factor for pain occurrence is. The overall score ranges from 0 to 10. Ten points is the maximal score possibly obtained in BackPEI-A (Candotti et al., 2018). The higher the score obtained, the lower the exposure to risk-factors of pain occurrence. Considering the score range of the BackPEI-A, individuals presenting higher scores (5 points or higher) were categorized as having a lower risk of pain occurrence while individuals presenting lower scores (4 points or lower) were categorized as having a higher risk. Thus, from this questionnaire, the following variables were extracted: (a) frequency of pain; (b) intensity of pain (scale of 0–10): no pain (0 score), mild pain (0.1–3.99), moderate pain (4–6.99), and severe pain (7–10); (c) which varies from 0 to 10, the closest to 10 indicating lower risk for occurrence of LBP. This index was categorized as high risk, when the risk factor was equal to four or lower, and low risk, when the index was equal to five or higher.

From the ODI questionnaire we had the level of disability. The percentage values were converted to a categoric variable, and they were classified in accordance with the questionnaire scores: minimal disability (0–20%), moderate disability (21–40%), severe disability (41–60%), crippled (61–80%), and bed-bound or exaggerating symptoms (81–100%).

The FABQ-Brazil questionnaire assesses the fears and beliefs in two sub-scales, one related to work and the other to physical activity, in which scores higher than 15 in the physical activity scale and higher than 34 in the work scale indicate fear-avoidance belief. From the answers to this questionnaire, we extracted the scores of fear beliefs and converted them into a dichotomic variable (presence or absence of kinesiophobia), according to the classification originally proposed by the FABQ-Brazil.

For statistic treatment the SPSS 20.0 software was used. We used the chi-square (χ^2) test for comparison between the groups because the variables are categorical. The variables of analysis and their respective categories are: (1) intensity of pain (categorized as no pain, mild, moderate, or severe); (2) risk-factor index for pain (categorized as high or low); (3) level of disability (categorized as minimal, moderate, severe, crippled, or exaggerating symptoms); and (4) kinesiophobia (categorized as present or absent). Anthropometric variables were tested for confounding using *t*-test and chi-square test. For categorical variables with an expected frequency lower than 5 in any of the cells, we used the likelihood ratio (Özdemir and Eyduran, 2005). The effect size was calculated and rated as presented in Table 1 (Field, 2011; Kim, 2017). The significance level was $\alpha \leq 0.05$.

3. Results

Individuals in the groups were mostly women being 70.6% (n = 36) in the EG group, and 66.6% (n = 34) in the NEG group. Anthropometric data of the groups are described in Table 2. There was statistically significant difference between the age and BMI of the groups. When tested for confounding, age and BMI are similar between the EG and NEG groups (Tables 3 and 4).

The groups were similar as for the occurrence of LBP: in the EG group, 13 (25.5%) participants reported one LBP episode a month and 38 (74.5%) reported weekly episodes. In the NEG, 15 (29.4%) participants reported one LBP episode a month and 36 (70.6%) reported weekly episodes (Table 5).

The risk-factor index for pain occurrence provided by the BackPEI-A questionnaire was statistically different between the groups, with large and statistically significant effect size. In the NEG, 88.2% of individuals presented high risk for the occurrence of LBP, while 68.6% of the EG showed low risk (Table 5).

As for the level of disability due to LBP, the groups showed statistically significant differences, with a medium to large and significant effect size. The distinction is at moderate and severe disability, where we have around 30% of the NEG participants, in comparison with around 10% of the EG participants (Table 5).

Table 1
Interpretation of the effect size.

Test	Df	Small	Medium	Large
Cramer's V/Phi	1	0.10	0.30	0.50
Cramer's V	2	0.07	0.21	0.35

df = degrees of freedom.

Table 2
Anthropometric data: comparison of the distribution between groups.

	Total sample		
	EG (n = 51)	NEG (n = 51)	p
Age (years)	28.5 ± 9.0	36.5 ± 13.9	0.001*
Body mass (kg)	67.7 ± 15.3	70.5 ± 14.6	0.235
Height (cm)	168 ± 9.9	167 ± 9.8	0.473
BMI	23.4 ± 4.0	25.3 ± 4.9	0.040*

EG = exercising group; NEG = non-exercising group; *p ≤ 0.05.

Kinesiophobia related to work was not found in the EG, but it was found in 3.9% of individuals of the NEG, with statistically significant difference and effect size from small to medium, also significant. However, kinesiophobia related to physical activity was similar between the groups and it was present in roughly a third of participants in both groups (Table 5). We compared pain intensity with presence or absence of kinesiophobia in the practice of physical activity in the EG, but it did not result in a significant association ($\chi^2 = 0.497$; $p = 0.780$).

The exercise modalities practiced by the EG are listed in Table 6. The most common being weight training/gym, followed by Pilates, yoga, global postural reeducation (GPR), or stretching.

Only five individuals trained competitively and four of them presented moderate (n = 2) or severe (n = 2) pain. Eleven individuals (19,6%) practiced two modalities of exercise, and two individuals practiced three modalities (Table 7).

Most individuals in the EG (88.2%) informed a minimum level of disability and among them are those who practice two or three modalities of physical activity. Only 15,7% (n = 8) of the individuals practice a modality of exercise other than sports as the first or only modality. Four individuals (7.8%) who reported moderate disability practiced only one modality of physical activity, and two of them play sports. Two individuals with severe disability (3.9%) practiced physical activities that are not considered sports, such as stretching.

4. Discussion

This study compared, among groups of exercising (EG) and non-exercising (NEG) individuals, the intensity of LBP, level of incapacity, presence of kinesiophobia, and behavioral habits. The outcomes strengthen the scientific evidence found in literature.

Firstly, around 70% of participants in both groups accused the weekly occurrence of mild to moderate LBP during three months before the assessment. This result agrees with the Global Burden of Disease Study (James et al., 2018), a wide intersectional study that highlighted LBP as one of the main pathologies that affect both men and women in the world, supporting the findings of other cross-sectional studies and also systematic reviews that indicate high levels of occurrence of pain episodes in the world population (Ferreira et al., 2011; Hoy et al., 2012; Zanuto et al., 2015).

For one third of the individuals in the NEG, disability was rated between moderate and severe. The lack of attitude towards facing

Table 3
Comparison of the variables intensity of low back pain, risk-factor index for pain, level of incapacity and presence of kinesiophobia between the categories of sample age: young adults (18–24 years old) and adults (above 25 years old).

Variables		Age 18–24 (n = 40)		Age above 25 (n = 62)		χ^2	p	Effect size
		Freq	%	Freq	%			
Pain intensity	Mild	16	15.7	17	16.7	2.032	0.362	0.14
	Moderate	17	16.7	29	28.4			
	Severe	7	6.9	16	15.7			
Risk-factor index for pain[a]	High	22	21.6	39	38.2	0.632	0.427	−0.08
	Low	18	17.6	23	22.5			
Level of disability	Minimal	34	33.3	42	41.2	1.844	0.398	0.13
	Moderate	8	7.8	12	11.8			
	Severe	1	1.0	5	4.9			
Kinesiophobia – physical activity	Present	16	15.7	19	18.6	0.944	0.331	0.10
	Absent	24	23.5	43	42.2			
Kinesiophobia – work	Present	0	0.0	4	3.9	2.686	0.101	−0.16
	Absent	40	39.2	58	56.9			

Freq = absolute frequency; % = relative frequency; [a] This index is obtained based on behavioral habits.

Table 4
Comparison of the variables intensity of low back pain, risk-factor index for pain, level of incapacity and presence of kinesiophobia between the categories of BMI: normal weight (BMI ≤ 24.9) and overweight/obese (BMI ≥ 25.0).

Variables		Normal weight (n = 72)		Overweight/ Obese (n = 30)		χ^2	p	Effect size
		Freq	%	Freq	%			
Pain intensity	Mild	20	19.6	13	12.7	4.052	0.132	0.20
	Moderate	37	36.3	9	8.8			
	Severe	15	14.7	8	7.8			
Risk-factor index for pain[a]	High	42	41.2	19	18.6	0.220	0.639	−0.05
	Low	30	29.4	11	10.8			
Level of disability	Minimal	56	54.9	20	19.6	1.877	0.391	0.14
	Moderate	13	12.7	7	6.9			
	Severe	3	2.9	3	2.9			
Kinesiophobia – physical activity	Present	25	24.5	10	9.8	0.018	0.893	0.01
	Absent	47	46.1	20	19.6			
Kinesiophobia – work	Present	2	2.0	2	2.0	0.850	0.357	−0.09
	Absent	70	68.6	28	27.5			

Freq = absolute frequency; % = relative frequency.
[a] This index is obtained based on behavioral habits.

Table 5
Comparison of the intensity of low back pain, risk-factor index for pain, level of incapacity and presence of kinesiophobia between the exercising group (EG n = 51) and the non-exercising group (NEG n = 51).

Variables		EG		NEG		χ^2	p	Effect
		Freq	%	Freq	%			
Pain intensity	Mild	15	29.4	18	35.3	0.664	0.717	0.04
	Moderate	25	49.0	21	41.2			
	Severe	11	21.6	12	23.5			
Risk-factor index for pain[a]	High	16	31.4	45	88.2	34.299	<0.001[a]	−0.58[a]
	Low	35	68.6	6	11.8			
Level of disability	Minimal	45	88.2	31	60.8	10.983[b]	0.004[a]	0.32[a]
	Moderate	4	7.8	16	31.4			
	Severe/Crippled	2	3.9	4	7.8			
Kinesiophobia – physical activity	Present	21	39.2	15	29.4	1.087	0.297	0.10
	Absent	32	60.8	36	70.6			
Kinesiophobia – work	Present	0	0	4	3.9	5.709[b]	0.041[a]	−0.20[a]
	Absent	51	100	47	96.1			

*p ≤ 0,05; Freq = absolute frequency; % = relative frequency.
[a] This index is obtained based on behavioral habits.
[b] Likelihood ratio.

Table 6
Exercise modalities (n = 51).

Exercise modality	First or single modality		Second modality		Third modality	
	Freq	%	Freq	%	Freq	%
Weight training/gym	18	35.3	–	–	–	–
Soccer	4	7.8	1	2.0	–	–
Martial arts	3	5.9	1	2.0	–	–
Walking/running	5	9.8	–	–	–	–
Pilates/Yoga/GPR/Stretching	8	15.7	2	3.9	–	–
Swimming	3	5.9	2	3.9	–	–
Dancing	4	7.8	–	–	–	–
Functional training	1	2.0	2	3.9	2	3.9
Biking	1	2.0	1	2.0	–	–
Artistic gymnastics	2	3.9	1	2.0	–	–
Skate/roller-skate	2	3.9	–	–	–	–
Basketball/handball	–	–	1	2.0	–	–

Freq = absolute frequency; % = relative frequency; GPR = Global postural reeducation.

Table 7
Competitive training and number of modalities (n = 51).

Practice	Freq	%
Competitive training	5	9.8
Noncompetitive training	46	90.2
Practice of two modalities of exercise	11	21.6
Practice of three modalities of exercise	2	3.9

Freq = absolute frequency; % = relative frequency.

pain with aggravation of the condition, which can lead to disability (Santos et al., 2019; Trocoli and Botelho, 2016). In the literature as in our study, the best ratings of disability were found in exercising individuals (Lee et al., 2015).

A high risk for the occurrence of LBP was strongly prevailing in the NEG, while low risk prevailed in the EG. It is important to consider that, although pain may be exacerbated in high intensity exercises (those that are competitive) or in physical exercise without adequate guidance (Andersen et al., 2008), a guided physical exercise program can improve fitness and contribute to lessen the workload on bodily structures. This maximizes the capacity of tolerance of postural stress, consequently contributing to better daily life habits (Martins and Longen, 2017). As for behavioral habits, it is believed that an adequate posture is that which does not exceed the physiological limits on the individual and preserves the curvatures of the spine (Noll et al., 2013). Although the maintenance of inadequate sitting posture (on a bended spine, for instance) is considered a risk factor for developing postural alterations, it has been demonstrated that physical exercise on a frequency of three or more days a week can lessen the chances of alteration in thoracic kyphosis (Sedrez et al., 2015).

The absence of kinesiophobia related to physical activity was predominant in both groups, although 40% of participants in the EG presented kinesiophobia related to subjective sensations due to negative experiences with physical activity. Besides, the phenomenon of central sensitization should be taken into account when being the reason for the chronicity of pain with no anatomopathological justification (Phillips and Clauw, 2011).

No subjects presented kinesiophobia related to work in the EG. It is known that a physical exercise program can improve scores on fear and avoidance related to work (Poulain et al., 2010). Thus, it is believed that an active posture allows for facing the pain and the daily activities, leading to reduction of fear and recovery, even when some level of pain is present (Martins and Longen, 2017; Trocoli and Botelho, 2016). The evidence supports the use of short, simple exercising programs for workers with LBP (White et al., 2016). Besides, the benefit coming from the practice of physical exercise is not limited to pain sensation but should be considered in the interference of such activity in the context of the subject's quality of life.

In this study, despite the difference of age and BMI between the groups, these variables did not influence the outcomes. In addition, it is known that physical activity reduces body weight (Dombrowski et al., 2014; Fonseca-Junior et al., 2013; Grasdalsmoen et al., 2019; Willis et al., 2020), and it would expect that the exercising group would present lower BMI than the non-exercising group.

The study has some limitations. Although age has not influenced the variables of analysis, the age distribution between the EG group and NEG group was not paired. Beyond that, the total time of weekly practice of the physical exercise performed by the individuals in the EG is not known, as much as the heterogeneity in the weekly frequency of the modalities. Also, the data extracted from the answers to the questionnaires are based on the individual's perceptions, and not on clinical assessments.

The main application of this study is the contribution to the evidence that physical exercise, along with an active attitude facing pain, can provide lower levels of disability and lower chances of developing kinesiophobia. Although physical exercise can reduce the risk of future LBP episodes in up to a year, this benefit requires continuity. Exercising programs should focus on prevention aiming at behavioral changes to ensure long term results (Steffens et al., 2016).

5. Conclusion

In both groups, mild to moderate pain intensity, as well as absence of kinesiophobia prevailed, with no significant difference between them. However, exercising individuals presented lower risk factor for the occurrence of LBP, lower level of disability and higher tendency for the absence of work-related kinesiophobia.

Clinical relevance

- Physical exercise, along with an active attitude facing pain, can provide lower levels of disability and lower chances to develop kinesiophobia.
- Exercising individuals present lower risk-factor index for LBP occurrence.

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Bianca Andrade Monteiro da Silva: Conceptualization, Data curation, Formal analysis, Methodology, Investigation, Writing – original draft. **Grazielle Martins Gelain:** Conceptualization, Data curation, Formal analysis, Methodology, Investigation, Writing – original draft. **Cláudia Tarragô Candotti:** Conceptualization, Data curation, Formal analysis, Methodology, Writing – review & editing.

Declaration of competing interest

The authors have no conflict of interest to disclose.

References

Andersen, L.L., Kjaer, M., Søgaard, K., Hansen, L., Kryger, A.I., Sjøgaard, G., 2008. Effect of two contrasting types of physical exercise on chronic neck muscle pain. Arthritis Rheum. 59 (1), 84–91. https://doi.org/10.1002/art.23256.

Baiamonte, B.A., Kraemer, R.R., Chabreck, C.N., Reynolds, M.L., McCaleb, K.M., Shaheen, G.L., Hollander, D.B., 2017. Exercise-induced hypoalgesia: pain tolerance, preference and tolerance for exercise intensity, and physiological correlates following dynamic circuit resistance exercise. J. Sports Sci. 35 (18), 1–7. https://doi.org/10.1080/02640414.2016.1239833.

Balagué, F., Mannion, A.F., Pellisé, F., Cedraschi, C., 2012. Non-specific low back pain. Lancet (London, England) 379 (9814), 482–491. https://doi.org/10.1016/S0140-6736(11)60610-7.

Bozorgmehr, A., Zahednejad, S., Salehi, R., Ansar, N.N., Abbasi, S., Mohsenifar, H., Villafañe, J.H., 2018. Relationships between muscular impairments, pain, and disability in patients with chronic nonspecific low back pain: a cross sectional study. J. Exercise Rehabil. 14 (6), 1041–1047. https://doi.org/10.12965/jer.1836374.187.

Buchbinder, R., Pransky, G., Hayden, J., 2010. Recent advances in the evaluation and management of nonspecific low back pain and related disorders. Best Pract. Res. Clin. Rheumatol. 24 (2), 147–153. https://doi.org/10.1016/j.berh.2010.01.003.

Burton, A.K., Balagué, F., Cardon, G., Eriksen, H.R., Henrotin, Y., Lahad, A., Leclerc, A., Müller, G., van der Beek, A.J., 2006. Chapter 2 European guidelines for prevention in low back pain. Eur. Spine J. 15 (Suppl. 2), s136–s168. https://doi.org/10.1007/s00586-006-1070-3.

Candotti, C.T., Detogni Schmit, E.F., Pivotto, L.R., Raupp, E.G., Noll, M., Vieira, A., Loss, J.F., 2018. Back pain and body posture evaluation instrument for adults: expansion and reproducibility. Pain Manag. Nurs.: Off. J. Am. Soc. Pain Manag.Nurses 19 (4), 415–423. https://doi.org/10.1016/j.pmn.2017.10.005.

Cruz, A., Nunes, H., 2012. Prevalência e fatores de risco de dores nas costas em adolescentes: Uma revisão sistemática da literatura. Rev. Enfermagem Ref. serIII (6), 131–146. https://doi.org/10.12707/RIII1183.

Delitto, A., George, S.Z., Van Dillen, L., Whitman, J.M., Sowa, G.A., Shekelle, P., Denninger, T.R., Godges, J.J., 2012. Low back pain. J. Orthop. Sports Phys. Ther. 42 (4), A1–A57. https://doi.org/10.2519/jospt.2012.42.4.A1.

Dombrowski, S.U., Knittle, K., Avenell, A., Araújo-Soares, V., Sniehotta, F.F., 2014. Long term maintenance of weight loss with non-surgical interventions in obese adults: systematic review and meta-analyses of randomised controlled trials. BMJ 348, g2646. https://doi.org/10.1136/bmj.g2646.

Elm, E. von, Altman, D.G., Egger, M., Pocock, S.J., Gøtzsche, P.C., Vandenbroucke, J.P., 2007. The strengthening the reporting of observational studies in Epidemiology (STROBE) statement: guidelines for reporting observational studies. Lancet 370 (9596), 1453–1457. https://doi.org/10.1016/S0140-6736(07)61602-X.

Feitosa, A.S.A., Lopes, J.B., Bonfa, E., Halpern, A.S.R., Feitosa, A.S.A., Lopes, J.B., Bonfa, E., Halpern, A.S.R., 2016. A prospective study predicting the outcome of chronic low back pain and physical therapy: the role of fear-avoidance beliefs and extraspinal pain. Rev. Bras. Reumatol. 56 (5), 384–390. https://doi.org/10.1016/j.rbre.2016.03.002.

Ferreira, G.D., Silva, M.C., Rombaldi, A.J., Wrege, E.D., Siqueira, F.V., Hallal, P.C., 2011. Prevalence and associated factors of back pain in adults from southern Brazil: a population-based study. Rev. Brasileira Fisioterapia 15 (1), 31–36.

Field, A., 2011. In: Discovering Statistics Using SPSS, third ed. Sage Publications.

Fonseca, J. M. A. da, Radmann, C.S., Carvalho, F. T. de, Mesquita, L.S. de A., 2016. The influence of the Pilates method on muscular flexibility, symptoms, and quality of life in women with primary dysmenorrhea. Sci. Med. 26 (2), 23052. https://doi.org/10.15448/1980-6108.2016.2.23052.

Fonseca-Junior, S.J., Sá, C.G.A.de B., Rodrigues, P.A.F., Oliveira, A.J., Fernandes-Filho, J., 2013. Physical exercise and morbid obesity: a systematic review. Arquivos Brasileiros Cirurgia Digestiva: ABCD = Brazilian Archiv. Digest. Surg. 26 (Suppl. 1), 67–73. https://doi.org/10.1590/s0102-67202013000600015.

Grasdalsmoen, M., Eriksen, H.R., Lønning, K.J., Sivertsen, B., 2019. Physical exercise and body-mass index in young adults: a national survey of Norwegian university students. BMC Publ. Health 19 (1), 1354. https://doi.org/10.1186/s12889-019-7650-z.

Hoy, D., Bain, C., Williams, G., March, L., Brooks, P., Blyth, F., Woolf, A., Vos, T., Buchbinder, R., 2012. A systematic review of the global prevalence of low back pain. Arthritis Rheum. 64 (6), 2028–2037. https://doi.org/10.1002/art.34347.

James, S.L., Abate, D., Abate, K.H., Abay, S.M., Abbafati, C., Abbasi, N., Abbastabar, H., Abd-Allah, F., Abdela, J., Abdelalim, A., Abdollahpour, I., Abdulkader, R.S., Abebe, Z., Abera, S.F., Abil, O.Z., Abraha, H.N., Abu-Raddad, L.J., Abu-Rmeileh, N.M.E., Accrombessi, M.M.K., Murray, C.J.L., 2018. Global, regional, and national incidence, prevalence, and years lived with disability for 354 diseases and injuries for 195 countries and territories, 1990–2017: a systematic analysis for the Global Burden of Disease Study 2017. Lancet 392 (10159), 1789–1858. https://doi.org/10.1016/S0140-6736(18)32279-7.

Kanchanomai, S., Janwantanakul, P., Pensri, P., Jiamjarasrangsi, W., 2015. A prospective study of incidence and risk factors for the onset and persistence of low back pain in Thai university students. Asia Pac. J. Publ. Health 27 (2), NP106–NP115. https://doi.org/10.1177/1010539511427579.

Kim, H.-Y., 2017. Statistical notes for clinical researchers: chi-squared test and Fisher's exact test. Restorative Dentistr. Endodontics 42 (2), 152–155. https://doi.org/10.5395/rde.2017.42.2.152.

Lee, H., Hübscher, M., Moseley, G.L., Kamper, S.J., Traeger, A.C., Mansell, G., McAuley, J.H., 2015. How does pain lead to disability? A systematic review and meta-analysis of mediation studies in people with back and neck pain. Pain 156 (6), 988–997. https://doi.org/10.1097/j.pain.0000000000000146.

Ludwig, A.F., Hubner, F.P., Caovilla, A.R., Weizemann, C., Barboza, T.V., Pereira, K.E., Stachelski, R.A., Carvalho, A. R. de, 2019. Comparison of disability between risk classifications for poor prognosis in chronic lumbago: observational study. Revis. Pesquisa Fisioterapia 9 (3), 347–352. https://doi.org/10.17267/2238-2704rpf.v9i3.2451.

Martins, M. da S., Longen, W.C., 2017. Atividade física comunitária: efeitos sobre a funcionalidade na lombalgia crônica. Rev. Bras. em Promoção Saúde 30 (4), 1–7. https://doi.org/10.5020/18061230.2017.6659.

Meade, L.B., Bearne, L.M., Sweeney, L.H., Alageel, S.H., Godfrey, E.L., 2019. Behaviour change techniques associated with adherence to prescribed exercise in patients with persistent musculoskeletal pain: systematic review. Br. J. Health Psychol. 24 (1), 10–30. https://doi.org/10.1111/bjhp.12324.

Naugle, K.M., Fillingim, R.B., Riley, J.L., 2012. A meta-analytic review of the hypoalgesic effects of exercise. J. Pain: Off. J. Am. Pain Soc. 13 (12), 1139–1150. https://doi.org/10.1016/j.jpain.2012.09.006.

Noll, M., Candotti, C.T., Tiggemann, C.L., Schoenell, M.C.W., Vieira, A., 2013. Prevalência de hábitos posturais inadequados de escolares do Ensino Fundamental da cidade de Teutônia: um estudo de base populacional. Revis. Brasileira Ciências Esporte 35 (4), 983–1004. https://doi.org/10.1590/S0101-32892013000400012.

Nourbakhsh, M.R., Arab, A.M., 2002. Relationship between mechanical factors and incidence of low back pain. J. Orthop. Sports Phys. Ther. 32 (9), 447–460. https://doi.org/10.2519/jospt.2002.32.9.447.

Özdemir, T., Eyduran, E., 2005. Comparison of Chi-Square and Likelihood Ratio Chi-Square Tests, vol. 3.

Phillips, K., Clauw, D.J., 2011. Central pain mechanisms in chronic pain states – maybe it is all in their head. Best Pract. Res. Clin. Rheumatol. 25 (2), 141–154. https://doi.org/10.1016/j.berh.2011.02.005.

Poulain, C., Kernéis, S., Rozenberg, S., Fautrel, B., Bourgeois, P., Foltz, V., 2010. Long-term return to work after a functional restoration program for chronic low-back pain patients: a prospective study. Eur. Spine J.: Off. Publ. Eur. Spine Soc. Eur. Spinal Deformity Soc. Euro. Section Cervical Spine Res. Soc. 19 (7), 1153–1161. https://doi.org/10.1007/s00586-010-1361-6.

Sanches, A., Costa, R., Marcondes, F.K., Cunha, T.S., 2016. Relationship among stress, depression, cardiovascular and metabolic changes and physical exercise. Fisioterapia Movimento 29 (1), 23–36. https://doi.org/10.1590/0103-5150.029.001.AO02.

Santos, A.L., Luna, M.B., Coutinho, R.S., 2019. Influência da dor lombar inespecífica na cinesiofobia: UMA revisão integrativa. Rev. Eletrônica Estácio Recife 5 (1). Article 1. https://reer.emnuvens.com.br/reer/article/view/184.

Sedrez, J.A., Rosa, M. I. Z. da, Noll, M., Medeiros, F. da S., Candotti, C.T., Sedrez, J.A., Rosa, M. I. Z. da, Noll, M., Medeiros, F. da S., Candotti, C.T., 2015. Fatores de risco associados a alterações posturais estruturais da coluna vertebral em crianças e adolescentes. Rev. Paulista Pediatria 33 (1), 72–81. https://doi.org/10.1016/j.rpped.2014.11.012.

Steffens, D., Maher, C.G., Pereira, L.S.M., Stevens, M.L., Oliveira, V.C., Chapple, M., Teixeira-Salmela, L.F., Hancock, M.J., 2016. Prevention of low back pain: a systematic review and meta-analysis. JAMA Internal Med. 176 (2), 199–208. https://doi.org/10.1001/jamainternmed.2015.7431.

Thomas, J.R., Nelson, J.K., Silverman, S.J., 2011. In: Research Methods in Physical Activity, sixth ed. Human Kinectics.

Trocoli, T.O., Botelho, R.V., 2016. Prevalência de ansiedade, depressão e cinesiofobia em pacientes com lombalgia e sua associação com os sintomas da lombalgia. Rev. Bras. Reumatol. 56 (4), 330–336. https://doi.org/10.1016/j.rbr.2015.09.009.

White, M.I., Dionne, C.E., Wärje, O., Koehoorn, M., Wagner, S.L., Schultz, I.Z., Koehn, C., Williams-Whitt, K., Harder, H.G., Pasca, R., Hsu, V., McGuire, L., Schulz, W., Kube, D., Wright, M.D., 2016. Physical activity and exercise interventions in the workplace impacting work outcomes: a stakeholder-centered best evidence synthesis of systematic reviews. Int. J. Occup. Environ. Med. 7 (2 April), 739–761. https://doi.org/10.15171/ijoem.2016.739. –74.

Willis, E.A., Creasy, S.A., Honas, J.J., Melanson, E.L., Donnelly, J.E., 2020. The effects of exercise session timing on weight loss and components of energy balance: midwest exercise trial 2. Int. J. Obes. 44 (1), 114–124. https://doi.org/10.1038/s41366-019-0409-x.

Zanuto, E.A.C., Codogno, J.S., Christófaro, D.G.D., Vanderlei, L.C.M., Cardoso, J.R., Fernandes, R.A., Zanuto, E.A.C., Codogno, J.S., Christófaro, D.G.D., Vanderlei, L.C.M., Cardoso, J.R., Fernandes, R.A., 2015. Prevalence of low back pain and associated factors in adults from a middle-size Brazilian city. Ciência Saúde Coletiva 20 (5), 1575–1582. https://doi.org/10.1590/1413-81232015205.02162014.