

## Effects of exercise therapy for workers with chronic osteomuscular symptoms from a sector of Federal University of Paraná

### Efeitos da cinesioterapia laboral nos sintomas osteomusculares crônicos de servidores universitários de um setor da Universidade Federal do Paraná

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**ABSTRACT | INTRODUCTION:** University employees spend long periods in a row during a working day, they can change flexibility and trigger symptoms of discomfort and / or musculoskeletal pain. Exercise therapy for workers, with physical exercises performed at the workplace, can be an IMPORTANT strategy to improve comfort and prevent the symptoms of this population. **OBJECTIVE:** To verify the effects of exercise therapy for workers on the range of motion and chronic musculoskeletal symptoms in university sector employees. **CASUISTRY AND METHODS:** This is a cohort study of known intervention. has been done the assessment of range of motion (ROM) of the shoulder, hip and trunk was performed using fleximetry and for musculoskeletal symptoms, or Nordic questionnaire. Labor kinesiotherapy lasted 20 minutes per visit, twice a week, for 7 months. **RESULTS:** 13 workers, of both sexes, aged between 22 and 65 years participated in the study. There was a significant 73% increase in ROM in the joints assessed. One month after the end of labor kinesiotherapy, a new assessment with flexometry was performed, resulting in a 50% decrease in amplitude of joints. The Nordic questionnaire indicates that 90% of the participants reported musculoskeletal problems in the last 12 months. **CONCLUSION:** exercise therapy for workers proved to be effective in the musculoskeletal disorders of servers, without increasing and maintaining range of motion. However, physical activity must be adopted as a life habit for the perpetuated results.

**KEYWORDS:** Occupational exposure. Work-related musculoskeletal disorders. Exercises.

**RESUMO | INTRODUÇÃO:** Os servidores universitários passam longos períodos sentados durante a jornada de trabalho, podendo alterar a flexibilidade e desencadear sintomas de desconforto e/ou dor osteomuscular. A cinesioterapia laboral, com exercícios físicos realizados no local de trabalho, pode ser uma estratégia importante para melhorar o conforto e prevenir os sintomas a essa população. **OBJETIVO:** Verificar os efeitos dos exercícios de cinesioterapia laboral na amplitude de movimento e nos sintomas osteomusculares crônicos em servidores do setor universitário. **CASUÍSTICA E MÉTODOS:** Trata-se de um estudo de coorte de intervenção conhecida. Realizou-se avaliação da amplitude de movimento (ADM) de ombro, quadril e tronco por meio de fleximetria e para os sintomas osteomusculares, o questionário Nórdico. A cinesioterapia laboral teve duração de 20 minutos por atendimento, duas vezes por semana, durante 7 meses. **RESULTADOS:** Participaram do estudo 13 servidores, de ambos os sexos, com idades entre 22 e 65 anos. Observou-se aumento significativo da amplitude de movimento de 73% nas articulações avaliadas. Após 1 mês do término da cinesioterapia laboral, realizou-se nova avaliação com a fleximetria, resultando em diminuição da amplitude em 50% das articulações. O questionário Nórdico indicou que 90% dos participantes relataram problemas osteomusculares nos últimos 12 meses. **CONCLUSÃO:** A cinesioterapia laboral se mostrou eficaz nos distúrbios osteomusculares dos servidores, no aumento e manutenção da amplitude de movimento. Porém, a atividade física deve ser adotada como hábito de vida para que os resultados perpetuem.

**PALAVRAS-CHAVE:** Exposição ocupacional. Distúrbios osteomusculares relacionados ao trabalho. Exercícios.

## Introduction

Exercise therapy for employees, also known as labor gymnastics, is the performance of physical exercises for warm-up, muscle strengthening, motor coordination, stretching, and relaxation performed at the workplace, taking into account the needs of the workers for whom it is intended, encouraging and sensitizing them to the importance of practicing physical activities and promoting health, as well as improving work performance<sup>1</sup>.

With the realization of exercise therapy for workers, physical benefits are expected, such as reduced sedentary lifestyle and stress and improved quality of life, even if sessions are considered "fast" (8–12 min)<sup>2</sup>. Thinking of the action in relation to the prevention of musculoskeletal disorders and reduction of emotional and physical overload of workers, what we want to achieve with exercise therapy for workers is the relief of possible bodily pain and consequently the increase in productivity<sup>2,3</sup>. Factors such as the environment, shifting schedules, effort in tasks during work, and interpersonal relationships can affect working conditions as well as the physical and emotional loads that are acquired from external/personal environments<sup>4,5</sup>.

Regarding the importance of exercise therapy for university employees, 40% of those evaluated in another public university in Paraná indicated having musculoskeletal pain, and at least 5% of them considered extreme pain or discomfort. We can relate this pain to the repetitive movements performed during the workday or to the poor ergonomic posture adopted<sup>6</sup>.

In addition, health promotion programs are useful to avoid future problems in the work environment, as they facilitate the connection between the company and workers<sup>7,8</sup>.

Data from Dieese<sup>9</sup> show that in 2015, 44,097 people who worked in public administration in general were removed from work due to occupational or work-related disease, followed by professionals in the treatment and disposal of nonhazardous waste with 24,612 leaves of absence and activities of hospital care, except the emergency room and units for emergency care with 5,345 leaves. In view of this information, the aim of this study was to verify the

effects of exercise therapy on range of motion (ROM) and chronic musculoskeletal symptoms in university sector employees.

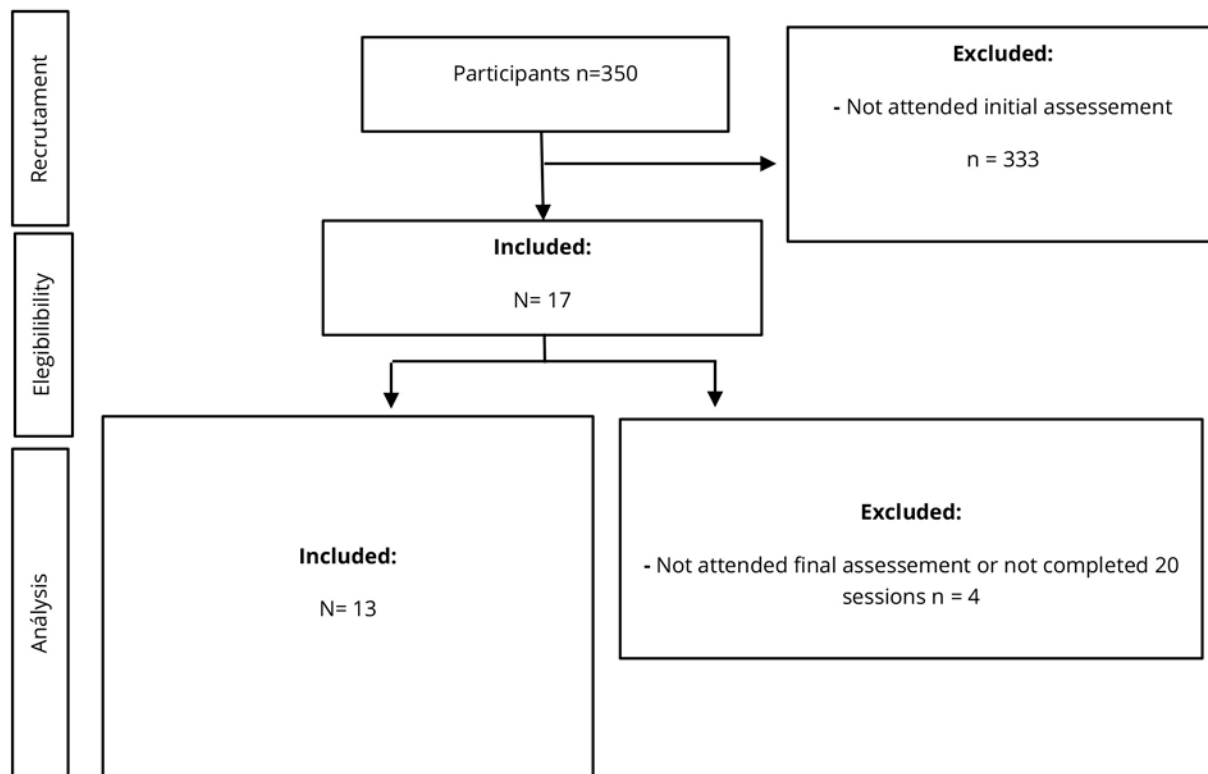
## Methods and Materials

This is a well-known, cross-sectional cohort study with descriptive design, of an analytical quantitative type, approved by the institution's Ethics and Research Committee (approval no. 1343168/2015 and CAAE no. 48185615.7.0000.0102). According to the sample power calculation  $n = Z\alpha/2 \cdot \sigma/E$ , with "n" as the number of individuals, " $Z\alpha/2$ " as the critical value that corresponds to the desired degree of confidence, " $\sigma$ " as the standard deviation population of the studied variable, and "E" as the error margin, 145 participants would be needed, for a sample error of 5% and 95% reliability; however, the sample was for convenience and had 13 workers, knowing that in the sector there are approximately 100 technicians and 250 teachers. The following were the inclusion criteria: workers of both sexes, aged between 18 and 70 years, with or without work-related pathologies, and exclusive employees of the Biological Sciences Sector of the university under study. Exclusion criteria were as follows: in postsurgery without medical authorization to perform physical activity; presence of acute pain in the shoulder, hip, and lumbar spine; pregnant woman (without proper medical clearance); and uncontrolled hypertension (without medical clearance).

The evaluations were conducted in the employees' own workplace, taking an average of 20 min each participant, having two applicators, one for the evaluation of fleximetry (evaluator dependent) and one for application of the Nordic questionnaire.

Figure 1 illustrates the selection, inclusion, or exclusion of the participants. A total of 350 possible participants were identified. At first, 17 participants attended, but some dropped out and others did not reach the number of 20 occupational kinesiotherapy visits during the period in which they were applied or did not attend for the reevaluation; therefore, four participants were excluded from the study.

Figure 1. Flow chart



## Proceeding

The shoulder, hip, and trunk ROM of motion joints was assessed using fleximetry (Sanny FL6010)<sup>10</sup>. ROM assessment was performed by a single previously trained researcher.

Musculoskeletal disorders were assessed using the Nordic questionnaire<sup>11</sup>. The instrument allows the recognition of the history of possible musculoskeletal disorders, consultation with health professionals, diagnosis related to this consultation, and possible limitations regarding the performance of physical exercises.

The questionnaires were applied by the same evaluator to avoid different interpretations of the questions and doubts regarding the content of the topics covered.

At the end of 20 sessions, the instruments were applied again to reassess and measure the effects of the exercises proposed for the participants. A new reassessment of fleximetry after one month of completion of exercise therapy for workers was conducted, in order to analyze the effects after closure of activities.

## Interventions

The physical therapy intervention was carried out from April to October 2016, for 20 weeks, totaling 5 months. Exercise therapy for workers was applied with the group of participants, twice a week, 20 min per service, totaling 40 sessions.

The protocols applied in exercise therapy for workers were developed by the authors, taking into account the participants' work activities and concepts in the literature, such as type of activity (distension), time, place of performance, and modality of exercises to be applied<sup>12</sup>. Participants performed the activity proposals, most of the time, individually. However, in some instances, the exercises were performed in pairs to allow interaction and socialization among the group members. All consultations used music and light play selected by the researchers as a way to encourage and promote interactivity with the practices. These protocols included three stages – warm-up, strengthening, and relaxation – lasting approximately 5 min each. Four protocols were developed: two for the first 10 weeks and two for the last 10 weeks, one for each day of the week.

The individual exercises consisted of warming up with aerobic activities such as dancing, walking, jumping, and cycling, followed by muscle strengthening of the biceps, triceps, deltoids, carpal flexors, external oblique, quadriceps, glutes, hamstrings, and gastrocnemius, with three sets of 12 repetitions, ending the stretching activities lasting 20 s for each segment and the practice of massages, such as kneading and tapping (performed in pairs)<sup>13,14,15</sup>.

## Statistical analysis

The data are presented as mean  $\pm$  standard deviation (SD) and absolute and relative frequency in percentage. The collected data were analyzed using descriptive statistics utilizing SPSS 20.0. The normality of the sample was assessed using the Shapiro-Wilk test. Student's t-test was performed in pairs comparing pre- and post-intervention and after 1 month.

## Outcome

The sample consisted of personnel of both genders, 11 of which were female and 2 were male, aged between 20 and 55 years, divided into three different professional categories, professor (1), administrative assistant (11), and laboratory technician (1), each with their respective characteristics in the work activities as well as hours worked in the week – teacher with 20 hours per week, and laboratory technicians and administrative assistants 40 hours per week (Table 1).

**Table 1.** Socio-demographic characteristics

<b>Variables</b>	<b>Workers (n = 13)</b>
Female	11 (84,6%)
Male	2 (15,4%)
Age (years)	43,30 $\pm$ 13,97
<b>Occupational data</b>	
Worked hours /week -teacher	20 hours
Worked hours /week -administrative technician	40 hours
Worked hours /week- laboratory technician	40 hours
<b>Activity type</b>	
Teacher	1 (7,7%)
Administrative assistant	11 (84,6%)
Laboratory technician	1 (7,7%)

## Fleximetry

With fleximetry, it was possible to evaluate the main joints: shoulder, hip, and trunk.

Table 2 shows the values obtained in the shoulder fleximetry (pre- and postexercise therapy for workers). After 1 month without exercise therapy for workers, there was a significant difference in right and left shoulder flexion, left shoulder extension, right and left shoulder adduction, and right and left shoulder abduction, compared with those workers with postexercise therapy.

**Table 2.** Shoulder fleximetry

Moviment	Before (average/SD)	After (average/SD)	p	After 1 month	p
Right shoulder flexion	146,15±7,68	162,31±10,33	0,00*	157,69±8,80	0,00*
Left shoulder flexion	147,15±8,06	161,92±9,03	0,00*	157,30±7,25	0,032*
Right shoulder extension	32,54±10,58	39,62±6,60	0,001*	35,38±6,91	0,003*
Left shoulder extension	34,77±11,06	42,69±4,8	0,017*	40,38±4,77	0,002*
Right shoulder aduction	27,62±12,15	37,31±4,83	0,002*	36,53±5	0,001*
Left shoulder aduction	30±8,89	37,69±5,25	0,004*	34,23±4,49	0,028*
Right shoulder abduction	122,62±23,21	159,23±13,97	0,00*	155,38±12,82	0,00*
Left shoulder abduction	123,38±21,98	158,47± 8,86	0,00*	151,53±17,48	0,00*
Right shoulder external rotation	79,08±10,57	88,85±2,96	0,001*	75,76±4,93	0,807
Left shoulder external rotation	78,77±13,33	88,08±2,53	0,030*	74,23±5,34	0,141
Right shoulder internal rotation	61,31±16,79	83,85±5,82	0,00*	78,46±4,27	0,637
Left shoulder internal rotation	63,77±16,28	82,69±5,25	0,00*	74,38±5,62	0,099

\* = significative difference (p<0,05)

Table 3 displays the results of hip fleximetry (pre-exercise and postexercise therapies), showing an increase in the internal rotation movements of the right hip at 45.30% and the left at 32.73%, abduction of the right hip at 33.31% and the left at 32.87%, and adduction of the right hip at 0% and the left hip at 1.49%. When comparing the postexercise therapy and after 1 month without exercise therapy for workers, we noticed significant differences (decrease) in the flexion movements of the right and left hip and abduction of the right and left hip.

**Table 3.-** Hip fleximetry

<b>Moviment</b>	<b>Before (average/SD)</b>	<b>After (average/SD)</b>	<b>p</b>	<b>After 1 month</b>	<b>p</b>
Right hip flexion	72,92±22,75	113,08±16,01	2,48	101,53±13,90	0,027*
Left hip flexion	72,15±18,06	113,08±14,65	1,47	102,30±12,00	0,016*
Right hip extension	9,62±3,80	9,62±1,39	1	6,15±6,15	0,606
Left hip extension	9,46±2,50	9,62±1,39	0,84	6,53±2,40	0,529
Right hip aduction	10,38±2,47	14,23±2,77	0,001*	8,46±2,40	0,139
Left hip aduction	10,77±4,00	14,23±1,88	0,009*	7,69±3,30	0,195
Right hip abduction	28,85±6,50	38,46±8,99	0,004*	34,61±7,20	0,005*
Left hip abduction	28,54±8,45	37,92±10,18	0,017*	36,15±3,62	0,00*
Right hip external rotation	27,23±6,46	40,00±5,40	1,27	33,84±5,82	0,717
Left hip external rotation	25,92±5,31	39,00±7,28	2,31	35,38±5,93	0,251
Right hip internal rotation	27,00±7,58	39,23±7,87	0,00*	35,38±3,79	0,955
Left hip internal rotation	29,85±4,56	39,62±7,49	0,00*	35,38±5,57	0,092

\* = significative difference (p<0,05)

Table 4 shows the average trunk flexion before CL (75.5), after CL (90.0), which corresponds to 19.20%; after 1 month without CL, this figure dropped to 80.76

**Table 4.** Trunk fleximetry.

<b>Moviment</b>	<b>Before (average/SD)</b>	<b>After (average/SD)</b>	<b>p</b>	<b>After 1 month</b>	<b>p</b>
Trunk flexion	75,5 ± 12,3	90,0±5,0	0,00*	80,76±5,34	0,806
Trunk extension	25,8 ± 8,4	40,4±4,8	1,47	38,07±4,80	0,002*

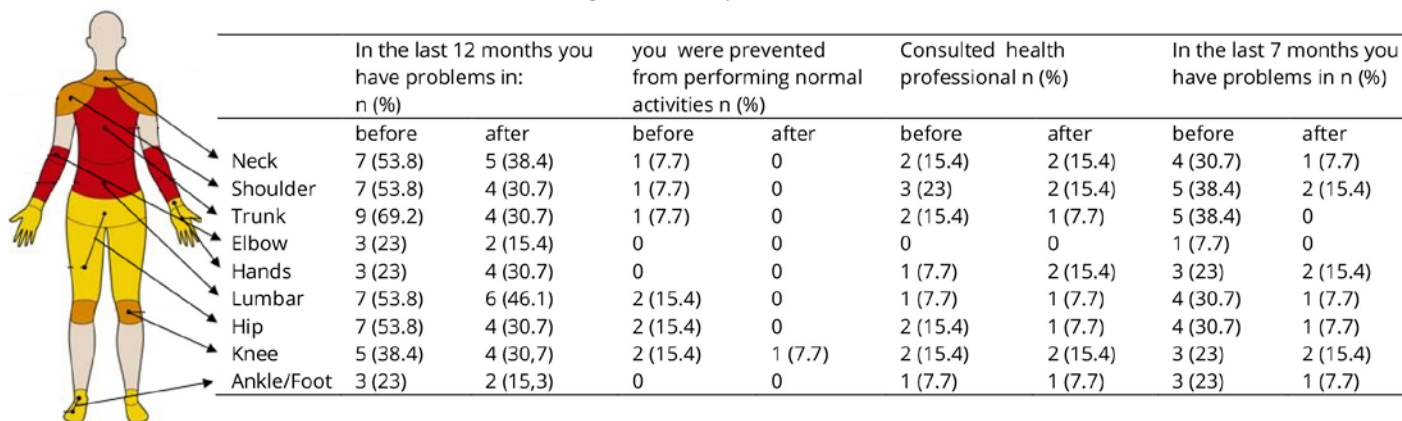
\* = significative difference (p<0,05)



## Nordic questionnaire

The results obtained with the Nordic questionnaire are shown in Figure 2.

Figure 2. Nordic questionnaire



## Discussion

The study participants were relatively young, mainly women, with a weekly workload of predominantly 40 hours, mostly administrative assistants.

In the study, it was observed that there was a significant improvement in the shoulder joint in all evaluated movements. After 1 month without exercise therapy for workers, there was a significant difference in right and left shoulder flexion, left shoulder extension, right and left shoulder adduction, and right and left shoulder abduction, compared with workers with postexercise therapy.

When comparing the postexercise therapy and after 1 month without exercise therapy for workers in the hip joint, we noticed significant differences (decrease) in the flexion movements of the right and left hip and abduction of the right and left hip, as well as flexion of the torso.

In the evaluation of the shoulder, hip, and torso joints, most participants presented results below the reference value found in the literature. In the data presented in the reassessment, an important

improvement in the joints mentioned above is observed.

One month after the end of the exercise therapy, the participants presented results below the reference value (50%), compared to the reassessment, in the period of exercise therapy for workers.

In most companies, the break already exists; what is needed is the justification through benefits, which often do not show immediately economically or through increased productivity gains, but with increased provision for labor activity, satisfaction, organizational interactions, and social relationships and encouraging good habits to cultivate a good quality of life for these people<sup>14</sup>.

The main positive factor achieved by interventions with exercise therapy for workers in this study was the increased ROM. These results are extremely important, considering that the ROM of the joints of the body in functional measures is necessary in the performance of activities of daily living, in the practice of exercises, and above all in the prevention of injuries<sup>15</sup>.

A negative factor was that a month after the completion of exercise therapy for workers, participants showed a decreased ROM. When decreased, it can lead to movement limitations causing pain and other musculoskeletal symptoms<sup>16,17</sup>.

The exercise therapy for workers, when applied to teachers in 20-min sessions, dividing the time into compensatory, preparation, and relaxation exercises, has improved performance and well-being, as well as better integration between coworkers<sup>18</sup>.

Ergonomics, promotion of a healthy lifestyle, and a specific prevention program for injuries were effective in decreasing pain in the neck, shoulder, neck, and lumbar regions when carried out by nurses and nursing assistants in two hospitals in Barcelona, similar to the results obtained in our study<sup>12</sup>.

Studies have shown complex variables, such as pain, style, and quality of life, related to mental health, among many others, which are generally associated with the results of exercise therapy for workers. Quantitative designs can provide data for the analysis of the effectiveness and efficiency of the therapy used. However, for themes of this modality, the literature suggests qualitative and participatory analysis, in which the opinion of workers can be heard in a comprehensive and inclusive way<sup>19</sup>.

The quoted research used a different technique than the one in this study, applying the exercises that make up exercise therapy for workers separately during the performance period. The sessions had the objective of preventing chronic pain, lasting 3 months, with five weekly interventions of warm-up gymnastics (10–15 min daily), 5 min of pause gymnastics (10–15 min daily), both done in the work environment, as well as three weekly sessions of compensatory gymnastics (30–60 min per session). We concluded that the number of tender points in the participants studied decreased, with only carpal pain remaining. Even so, physical activity within the company proved to be a strong aid in maintaining work quality<sup>20</sup>.

The quoted study correlated with the incidence of mental fatigue and the number of musculoskeletal complaints, exposing workers who reported that mental fatigue had a higher number of musculoskeletal complaints, thus concluding that the two aspects are often interconnected, showing the importance of interventions that will provide the worker with the best quality in work activity and in psycho-cognitive aspects, which will reflect both the productivity and life quality of these individuals<sup>21</sup>.

One of the most common illnesses in workers who remain seated for a long period, as is the case of the population studied, is low back pain. In a study, a program of ten exercise therapies for workers, for 10 min, twice a week, for 5 weeks, was applied. The research results showed that exercise therapy for workers improved low back pain, decreasing the intensity and improving the functional capacity of torso stabilizing the muscles and the range of articular movement<sup>22</sup>.

The quoted literature corroborates this study about the difficulty of adherence of participants, indicating a greater number of interventions that cover most workplaces and workers<sup>14</sup>.

In addition, physical activity produces neuroprotective effects as it induces greater secretion of neurotrophic factors linked to the glia, acting positively for the neuroprotection and neuroplasticity of dopaminergic neurons<sup>23</sup>. The authors of the quoted research report the effects of physical activity on the promotion and integration of multiple brain neuronal impulses, allowing plastic changes benefiting the injury prevention and positive action on damaged structures<sup>24</sup>.

The convenience sample did not reach 10% of the population of the university sector studied, constituting a limitation of the research; therefore, new approaches need to be carried out with a larger sample size. In this study, no descriptive analysis was performed that divided the participants who did or did not interact and their different outcomes. Therefore, it is suggested that in future studies, the research protocol should be unique to avoid variations between individuals.



## Conclusion

From the results of the study, it was observed that therapy for workers proved to be an effective therapeutic intervention for illnesses caused by poor posture, immobilization, repetitive gestures, and preservation of ROM.

As most participants work in offices or laboratories, environments conducive to repetitive, minute movements and postural compensations, which can lead to musculoskeletal and psychosocial disorders, a professional approach that aims to prevent or treat these symptoms is important.

In this way, an increase was observed in the flexibility of participants with exercise therapy performed twice a week, lasting 20 min. In order to obtain better results, a greater number of participants and a greater number of sessions are suggested, in addition to investigations that assess these workers' quality of life, a greater number of weekly interventions, a greater number of sessions, incentives regarding the performance of the exercise therapy, benefits to workers, and the productivity of the company itself.

## Author contributions

Braga RS, Lima RS participated in the conception, design, acquisition of consent forms, collection and analysis of research data, interpretation of results and writing of the scientific article. Bacil LF participated in the review of the scientific article, reviewing of the literature, corrections and translation. De Macedo ACB, Motter AA participated in the conception, design, analysis and interpretation of results, review of the scientific article and approval of the final version.

## Competing interests

No financial, legal or political competing interests with third parties (government, commercial, private foundation, etc.) were disclosed for any aspect of the submitted work (including but not limited to grants, data monitoring board, study design, manuscript preparation, statistical analysis, etc.).

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