

**148 - INVESTIGATION OF MUSCULOSKELETAL DISCOMFORT AND DECREASE OF MUSCLE FLEXIBILITY IN WORKERS OF DRY PORT OF THE SOUTHERN REGION OF BRAZIL**

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### 1. INTRODUCTION

Over time, the means of work were being modified structured to leave the worker more sedentary, especially when dealing with activities in computerized terminals. Thus, the health of the worker became increasingly susceptible to a series of muscular tensions, addictions and postural constraints arising from this condition (Santos et al., 2003). The man in the sitting position tries to keep the trunk erect, subjecting the paravertebral muscles to a constant tension, which are responsible for the decrease of the flexibility of the locomotor system (Soucard, 1996).

Increased pressure on the disks, thighs and buttocks, plus inadequate posture, when maintained for long periods of time, are fundamental factors in the onset of physical problems, fatigue, pain and discomfort (Carson, 1993).

Although many symptoms are associated with musculoskeletal disorders, one of the most reported is pain (Putz-Anderson, 1997; Strazdins, 2004). Painful symptoms can progressively worsen and progress to loss of function (Strazdins, 2004). Pain and loss of function may persist for years and, in some cases, become permanent (Putz-Anderson, 1997; Keogh et al., 2000). Thus, the adoption of measures to control these dysfunctions becomes essential, both socially and economically (Coury et al., 2009).

The Gymnastics Labor consists of the practice of specific stretching exercises, muscle strengthening, motor coordination and relaxation exercises performed in different sectors or departments of a company, in order to prevent and reduce the incidence of musculoskeletal disorders (DME), decrease the number of work accidents, prevent muscle fatigue, correct postural defects, increase employee disposition, promote greater integration in the work environment (Oliveira, 2006).

Mendes et al. (2004) classified of labor gymnastics in three ways, according to the time at which it is applied. The preparatory gymnastics, done at the beginning of the day, aims to warm up, prepare the muscles and joints to be used at work, preventing accidents, muscle strains and occupational diseases. The compensatory gymnastics, applied during the workday, has the purpose of preventing fatigue resulting from repetitive movements, activities with muscular overload and decrease the muscular tensions caused by work. Relaxing gymnastics is performed at the end of the day with the objective of overcoming the tensions accumulated in the various regions of the body.

The physical activity with stretching reduces muscle atrophy, increases flexibility, decreases the risk of joint muscle injury and improves static and dynamic posture, where in work environments, static stretching is the most indicated because it decreases muscle tension and pressure easily performed and with little risk of injury (Achour, 1995).

Therefore, the objective of this study was to investigate the presence of musculoskeletal symptoms and reduction of muscular flexibility in workers with administrative functions in a company that provides logistics services in the dry port of Uruguaiiana-Brazil, currently the third largest dry port in the world, to apply a workout program and verify its effects.

### 2. MATERIALS AND METHODS

The present study had the participation of active workers with reports of complaints of muscular pains (upper limbs, lower and spine) and that presented general reduction of muscular flexibility. They then underwent a workout intervention program during a two-month pre and post-test period. The sample consisted of 30 workers (both sexes), 15 of the Experimental Group (EG) and 15 of the Control Group (CG), who worked in the customs and administrative sectors of a company that provides logistic services in the Port Dry of the city of Uruguaiiana, Brazil.

The following inclusion criteria were used: workers aged between 20 and 50 years, reports of musculoskeletal complaints, decreased muscle flexibility, working in the seated position for most of the workday and not practicing any type of physical activity. Workers with inflammatory diseases, fractures, recent surgeries, neurological disorders, signs indicating systemic diseases and cognitive disorders were excluded from the sample.

The initial tests (pre-test) were performed using the Body Discomfort Map (BDM) and Visual Analogue Scale (VAS) adapted from Corlett and Manenica (1980). This map divides the human body into several body segments facilitating location in regions where workers reported discomforts or pains and quantified them. Muscle flexibility was verified through the Sit and Reach Test developed by Wells and Dillon (1952).

To carry out the test it was necessary a wooden box measuring 30.5cm x 30.5cm x 30.5cm. In the upper part of the box where the scale (VAS) was located, there was an extension of 26.0 cm where the worker touched with the soles of the feet. Then he would sit with his knees extended, touching his bare feet in the box under the scale. Then he would place his hands one on top of the other with his arms extended over the scale and performed a flexion of the trunk ahead. At this moment, was measured in centimeters, the maximum point reached by the hands.

From the results, a workout program was developed. The intervention was performed through physical exercises with a postural and functional approach, based on stretching, aiming at the relief of musculoskeletal pain and improvement of muscle flexibility. The gymnastics was applied at the end in the morning (before lunch) with duration of 15 minutes and frequency of three days a week (monday, wednesday and friday) in the staff training room within the company itself, totaling 20 sessions.

Three different types of classes were elaborated in order to keep the group motivated to perform the exercises and not to abandon the intervention. Nine types of global stretching exercises were given in all sessions, which were held for thirty

seconds and repeated twice each. During the exercises, the worker received instructions on how to perform the exercises and the necessary corrections. The final tests (post-tests) were performed after the end of the intervention through the tools used in the pre-test.

This was an interventional study realized out in the administrative sector of a company that provides logistics services in Dry Port of Uruguaiana, Brazil, currently the largest of the gender in Latin America and the third largest Dry Port in the world. The study was approved by the Research Ethics Committee of the Federal University of Pampa, Brazil (Process number: 004.201). After clarifying the procedures that would be performed, each worker signed a free and informed consent form of study participation.

The data obtained were tabulated in Microsoft Excel and later analyzed by the statistical package SPSS (Statistical Package for Social Sciences) for Windows (version 18.0). The normality test of the data was performed using the Shapiro-Wilk test. The data were checked by a descriptive analysis for the pain, discomfort and muscle flexibility, through the average and standard deviation and analysis of the frequencies for the variables pain, discomfort and muscle flexibility by corporal region. It was held "t" test for dependent and independent variables and the adopted significance level was  $p < 0,5$  (95%).

3. RESULTS

Among the 15 participants of the EG eight were male (53.3%) and seven were female (46.7%), of the participants of the CG eleven were males (73.3%) and four were of the sex women (26.7%). The mean age of the EG participants was 32.53 years ( $SD \pm 7.180$ ) and of the CG was 31.40 years ( $SD \pm 6.82$ ).

All participants in the survey were sedentary workers who spent most of their working hours sitting. Table 1 shows the variation of the workers' muscular flexibility.

Tables 1 Variation of the workers' muscular flexibility

Group	Pre		Post	
	average (cm)	DP	average (cm)	DP
Experimental	24.13	9,448	27.73	8.413
Control	24.60	7,735	24.60	8,407

Table 2 shows the frequency of pain incidence between body regions according to the Body Discomfort Map (CDM) and the mean intensity of pain for each body region according to the Visual Analogue Scale (VAS).

Tables 2 Frequency of pain incidence between body regions and average pain intensity

Regions	Experimental						Control					
	Pre			Post			Pre			Post		
	f	Average (VAS)	DP ±	f	Average (VAS)	DP ±	f	Average (VAS)	DP ±	f	Average (VAS)	DP ±
Neck	6	5.50	2,881	2	6.50	,707	4	6.75	1,500	5	6.20	1,304
Back Upper	0	-	-	2	4.50	,707	2	3.50	,707	3	6.00	2,000
Back medium	2	5.50	,707	2	4.50	,707	1	6.00	-	3	6.00	2,000
Back Lower	5	3.40	,894	3	3.00	1,000	3	3.33	1,155	4	4.75	1,893
Hip	1	7.00	-	2	4.50	3,536	3	7.33	2,082	3	7.33	1,155
Shoulder R	2	5.50	2,121	1	1.00	-	0	-	-	2	6.00	2,828
Arm R	0	-	-	0	-	-	4	7.50	,577	1	8.00	-
Forearm R	0	-	-	0	-	-	1	8.00	-	2	6.00	2,828
Handle R	0	-	-	1	7.00	-	1	8.00	-	1	5.00	-
Hand R	0	-	-	0	-	-	0	-	-	1	9.00	-
Shoulder L	2	5.50	2,121	0	-	-	4	6.75	1,893	3	7.67	1,528
Arm L	0	-	-	0	-	-	2	7.50	,707	1	8.00	-
Forearm L	0	-	-	0	-	-	0	-	-	3	6.67	2,309
Handle L	1	7.00	-	0	-	-	0	-	-	0	-	-
Hand L	0	-	-	0	-	-	0	-	-	1	8.00	-
Thigh R	1	4.00	-	1	2.00	-	2	8.00	,000	1	9.00	-
Leg R	1	4.00	-	1	3.00	-	1	5.00	-	1	5.00	-
Foot R	1	5.00	-	0	-	-	1	8.00	-	0	-	-
Thigh L	3	4.67	2,082	1	4.00	-	1	8.00	-	2	7.50	2,121
Leg R	0	-	-	1	4.00	-	1	5.00	-	0	-	-
Foot R	1	5.00	-	0	-	-	0	-	-	0	-	-

Table 3 compares the total incidence of pain among all body regions and the mean total pain intensity in the pre- and post-test in each group.

Table 3 Overall incidence of complaints in the corporal regions and the average of pain total intensity.

	Experimental		Control	
	Pre	Post	Pre	Post
Overall incidence of complaints	26	17	31	37
Pain total mean	5,17	04	6,57	6,83

4. DISCUSSION

For muscle flexibility in the pre-test, the mean of the EG was 24.13 cm ( $\pm 9.448$ ), classified as very small for both sexes, since according to Morrow Jr. et al. (2003) these results are in agreement with the study carried out by Mendes et. al. (2001) where the results also remained low. In the post-test, the EG presented an increase in muscle flexibility with a mean of 27.73 cm ( $\pm 8.413$ ), still classified as very small for women and small for men, results that are similar to other studies, for example the study by Martins et al. (2000) performed with 26 workers, for four months, with frequency of three days per week and fifteen minutes of duration in each workout session, the workers presented increased muscle flexibility. In another study (REIS et al., 2003a) performed with 10 seamstresses for six months, there was improvement in muscle flexibility levels after applying gymnastics.

In the CG, there was no significant difference in muscle flexibility ( $p=1.0$ ), as this variable had a mean of 24.60cm ( $\pm 7.735$ ) in the pre-test, as well as in the post ( $\pm 8.407$ ), being classified as very small for both sexes. Ribeiro-Júnior et al. (2001) in a study with 263 practicing and non-practicing men, found that: non-practitioners in the 25 to 39 age group achieved an average muscle flexibility of 20.92 cm ( $\pm 8.98$ ) and those aged between 40 to 55 a mean of 19.23 cm ( $\pm 11.05$ ).

In the pre-test comparing the experimental group with the control group, it was observed that there was no significant

change in muscle flexibility values ( $p=0.883$ ), the same result appeared, comparing post experimental group test with the control group, where there was no significant difference between values ( $p=0.316$ ).

According to Dantas (1984), by maintaining good muscle flexibility in the main joints, a great improvement in musculoskeletal complaints can be observed, since the more muscular flexibility the individual has, the lower the propensity to the incidence of musculoskeletal pain, especially in the region of the dorsal and lumbar spine. Carvalho (2005) performed a three-month GL program, frequency five times a week and fifteen minutes duration per day, and there was a significant improvement in muscle flexibility where the mean of 23.8cm was to 38.4cm and also showed a significant improvement in the incidence of body pain with reduction from 100% to 61.5%.

According to the results, it was observed that the largest sites with musculoskeletal complaints were the spine and shoulder, as found by Trelba et al. (2004), in a study conducted with employees of a hypermarket, with a greater predominance of painful symptomatology in the region of the spine and upper limbs. In another study, carried out by Carvalho et al. (2006), with teachers, it was also verified that these regions were the most affected.

According to Reis et al. (2003b), in seated work activities, 24% of pain complaints occur in the neck and shoulder region, and 57% occur in the spine, findings similar to the present study. According to Zapater et al. (2004), for the worker who performs his activities in the seated position, who maintain an incorrect posture for long periods, the postural alterations will be potentiated, with an intradiscal pressure increase of up to 70%. As a result, they may predispose to higher levels of general discomfort such as pain, feeling of heaviness and paresthesias in different parts of the body.

In the pre-test, GE workers had an incidence of 26 complaints of musculoskeletal pain and an average pain intensity of 5.17 (EVA scale), while the post-test of the same group showed that there was a reduction for these variables where complaints of musculoskeletal pain became 17 and the mean intensity of pain increased to 04 (EVA scale), with a 34.61% reduction in the incidence of musculoskeletal pain and a reduction of 1.7 in pain intensity. These results are similar to those found in other studies. Moreira et al. (2005), observed in his study a significant reduction of musculoskeletal complaints due to a prevention program with emphasis on labor gymnastics.

In the pre-test, CG workers had an incidence of 31 complaints of musculoskeletal pain and an average pain intensity of 6.57 (EVA scale), in the post-test the CG had an incidence of 37 complaints of musculoskeletal and average pain of the intensity of pain of 6.83, which shows that the group that did not participate in the intervention obtained a 16.21% increase in the incidence of musculoskeletal pain complaints and a mean increase in pain intensity of 0.26.

When comparing the initial tests between the groups, it was observed that the EG presented 16.12% less incidence of musculoskeletal complaints than the CG and the mean of the intensity of pain was lower by 1.4 points in relation to the CG. In the final tests the EG had 45.94% less musculoskeletal complaints than the CG and the mean of the pain intensity was lower by 2.83 points in relation to the GC. This shows that the group that participated in the gymnastics obtained a reduction in the complaints and the intensity of musculoskeletal pain.

Takara et al. (2008) reported in their research that a workout program lasting four months, twice-weekly frequency with duration of 10 minutes in each session, showed a decrease in the musculoskeletal pain reported by the workers. Other studies have found that the implementation of a workout program is associated with a reduction in the frequency and severity of complaints of pain and musculoskeletal discomfort in the work environment.

## 5. CONCLUSION

Regular physical activity in the workplace serves as an important strategy to reduce sedentary lifestyle, discomfort and musculoskeletal pain, and improve muscle flexibility. Labor gymnastics was implemented in organizations as a relevant measure to promote workers' health.

It was verified that, in spite of the short period of this intervention, the labor gymnastics generated benefits to the workers, since there was improvement of the muscular flexibility and reduction of the pain intensity in the EG.

However, it would be relevant to carry out studies with a larger number of participants and over a longer period of time for a better evaluation of interventions with labor gymnastics. Ergonomic adequation in the work stations and workers' awareness of the corporal postures would also be relevant points for future research.

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#### ABSTRACT

The presence of musculoskeletal symptoms and reduced muscle flexibility are among the main musculoskeletal complaints that most affect workers who spend most of their time working in the sitting position. Labor gymnastics has been used to generate health benefits for workers. Objectives: to investigate the presence of musculoskeletal discomfort and decrease of muscle flexibility among workers who performed activities predominantly in the seated position and, later, to perform an intervention with labor gymnastics and to analyze the effects of this intervention. Methods: The sample consisted of 30 workers, 15 of the Experimental Group (EG) and 15 in the Control Group (CG), applying pre and post-test. The EG was subjected to a program of physical exercise in the workplace. Data collection was performed using the Discomfort Body Map (MDC), Visual Analogue Scale (VAS) and Sit and Reach Test Wells. Results: In the post-test, the EG significantly different muscle flexibility ( $p=0,003$ ). In the post-test, the CG was not significantly different muscle flexibility ( $p=1,0$ ). In comparing the post-test between groups, there was no significant difference in muscle flexibility ( $p=0,316$ ). In the post-test, EG reduced 34,61% the musculoskeletal complaints and obtained a reduction of average pain intensity at 1,7. In the post-test, the CG increased in 16,21% the musculoskeletal complaints increasing also of average pain intensity in 0,26. Conclusion: It was verified increase of musculoskeletal complaints without improvement of muscle flexibility in the CG. In the EG was found significant reduction of musculoskeletal complaints and muscle flexibility.

Keywords: Musculoskeletal, Muscle flexibility, Sedentary, Physical activity, Workplace.

#### SOMMAIRE

La présence de symptômes musculo-squelettiques et la réduction de la flexibilité musculaire sont parmi les principales affections musculo-squelettiques qui touchent le plus les travailleurs qui passent le plus clair de leur temps assis en position assise. Gymnastique du travail a été utilisé pour générer des avantages pour la santé des travailleurs. Objectifs: étudier la présence d'inconfort musculo-squelettique et la diminution de la flexibilité musculaire chez les travailleurs qui ont exercé des activités principalement en position assise et, plus tard, effectuer une intervention avec gymnastique du travail et d'analyser les effets de cette intervention. Méthodes: L'échantillon était constitué de 30 travailleurs, 15 du groupe expérimental (EG) et 15 du groupe témoin (CG), appliquant avant et après le test. L'EG a été soumis à un programme d'exercices physiques sur le lieu de travail. La collecte des données a été effectuée à l'aide de la carte de l'inconfort corporel (MDC), de l'échelle visuelle analogique (EVA) et des puits de test Sit and Reach. Résultats: Dans le post-test, l'EG diffère significativement de la flexibilité musculaire ( $p = 0,003$ ). Dans le post-test, le CG n'était pas significativement différent de la flexibilité musculaire ( $p = 1,0$ ). En comparant le post-test entre les groupes, il n'y avait pas de différence significative dans la flexibilité musculaire ( $p = 0,316$ ). Dans le post-test, EG a réduit de 34,61% les plaintes musculo-squelettiques et a obtenu une réduction de l'intensité moyenne de la douleur à 1,7. Dans le post-test, le CG a augmenté de 16,21% les plaintes musculo-squelettiques augmentant également de l'intensité moyenne de la douleur en 0,26. Conclusion: Il a été vérifié une augmentation des plaintes musculo-squelettiques sans amélioration de la flexibilité musculaire dans le CG. Dans l'EG a été constaté une réduction significative des plaintes musculo-squelettiques et la flexibilité musculaire.

Mots clés: Musculo-squelettique, Souplesse musculaire, Sédentaire, Activité physique, Lieu de travail.

#### RESUMEN

La presencia de síntomas musculoesqueléticos y la reducción de la flexibilidad muscular se encuentran entre los principales trastornos musculoesqueléticos que más afectan a los trabajadores que pasan la mayor parte del tiempo trabajando en posición sentada. La gimnasia laboral se ha utilizado para generar beneficios de salud para los trabajadores. Objetivos: investigar la presencia de molestias musculoesqueléticas y disminución de la flexibilidad muscular entre los trabajadores que realizan actividades predominantemente en posición sentada y, posteriormente, realizar una intervención con gimnasia laboral y analizar los efectos de esta intervención. Métodos: la muestra consistió en 30 trabajadores, 15 del Grupo Experimental (EG) y 15 en el Grupo de Control (CG), aplicando pruebas previas y posteriores. El EG fue sometido a un programa de ejercicio físico en el lugar de trabajo. La recolección de datos se realizó utilizando el Mapa del cuerpo de malestar (MDC), la Escala análoga visual (VAS) y los Pozos de prueba Sit and Reach. Resultados: En la prueba posterior, el EG significativamente diferente flexibilidad muscular ( $p = 0,003$ ). En la prueba posterior, el GC no fue significativamente diferente flexibilidad muscular ( $p = 1,0$ ). Al comparar la prueba posterior entre los grupos, no hubo diferencias significativas en la flexibilidad muscular ( $p = 0,316$ ). En la prueba

posterior, EG redujo 34,61% las molestias musculoesqueléticas y obtuvo una reducción de la intensidad promedio del dolor a 1,7. En la prueba posterior, el GC aumentó en 16,21% las quejas musculoesqueléticas aumentando también la intensidad promedio del dolor en 0,26. Conclusión: se verificó aumento de molestias musculoesqueléticas sin mejoría de la flexibilidad muscular en el CG. En el EG se encontró una reducción significativa de las molestias musculoesqueléticas y la flexibilidad muscular.

Palabras claves: Musculoesquelético, flexibilidad muscular, sedentaria, actividad física, lugar de trabajo.

#### RESUMO

A presença de sintomas musculoesqueléticos e a flexibilidade muscular reduzida estão entre as principais queixas musculoesqueléticas que mais afetam os trabalhadores que passam a maior parte do tempo trabalhando na posição sentada. A ginástica do trabalho tem sido utilizada para gerar benefícios para a saúde dos trabalhadores. Objetivos: investigar a presença de desconforto musculoesquelético e diminuição da flexibilidade muscular entre os trabalhadores que realizaram atividades predominantemente na posição sentada e, mais tarde, realizar uma intervenção com ginástica trabalhista e analisar os efeitos dessa intervenção. Métodos: a amostra consistiu em 30 trabalhadores, 15 do Grupo Experimental (EG) e 15 no Grupo de Controle (CG), aplicando pré e pós-teste. O EG foi submetido a um programa de exercícios físicos no local de trabalho. A coleta de dados foi realizada usando o Mapa do Corpo de Incapacidade (MDC), a Escala Analógica Visual (VAS) e Sit and Reach Test Wells. Resultados: no pós-teste, a EG flexibilidade muscular significativamente diferente ( $p = 0,003$ ). No pós-teste, o GC não apresentou flexibilidade muscular significativamente diferente ( $p = 1,0$ ). Ao comparar o pós-teste entre os grupos, não houve diferença significativa na flexibilidade muscular ( $p = 0,316$ ). No pós-teste, EG reduziu 34,61% as queixas músculo-esqueléticas e obteve uma redução da intensidade média da dor em 1,7. No pós-teste, o CG aumentou em 16,21% as queixas musculoesqueléticas aumentando também a intensidade média da dor em 0,26. Conclusão: verificou-se aumento das queixas músculo-esqueléticas sem melhora da flexibilidade muscular no CG. No EG, encontrou-se redução significativa das queixas musculoesqueléticas e flexibilidade muscular.

Palavras Chaves: Musculoesquelético, flexibilidade muscular, sedentária, atividade física, local de trabalho.

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