Impact of an interactive methodology for ergonomics awareness

Impacto de uma metodologia interativa de ergonomia de conscientização

Impacto de una metodología interactiva de ergonomia de concientización

Joyce Ribeiro Rothstein[1], Angélia Berndt[2], João Carlos de Souza Moraes[3], Fábio Juner Lanferdini[4]

ABSTRACT | Ergonomics has demonstrated advancements by being proactive in the conception of ergonomically adequate spaces, and by promoting awareness of the correct use of work spaces. In this context, the role of ergonomics awareness is highlighted, which confers a central role to the individual in the process of health education. The present study aimed at evaluating the impact of an interactive methodology for ergonomics awareness upon the knowledge of workers in a textile factory. The sample was selected from the report provided by the company's ergonomics committee. 328 workers participated in the study (age: 33.94±9.15 years old). Interactive interventions were applied on the topics: the Human Body, Vision, Hearing, Vertebral spine, Upper Limbs, and Lower Limbs. The impact of the methodology was measured through the application of a questionnaire created and validated for this study. For the comparison of the score before and after the interventions, the Student t test was used (paired) and analyzed with the statistical package SPSS 19.0 for *Windows* with significance of p<0.05. The qualitative questions were categorized, and the frequency of information verified. An increase in the total score of the questionnaire was observed (from 8.07±1.03 to 8.76±0.50; p<0.001), which demonstrates that the program had an impact upon the workers' acquisition of knowledge in relation to safety and health.

Keywords | human engineering; workers' health; knowledge; textile industry.

RESUMO | A ergonomia tem demonstrado avanços ao ser pró-ativa com a concepção de ambientes ergonomicamente adequados e com a conscientização do uso correto dos postos de trabalho. Nesse contexto, destaca-se o papel da ergonomia de conscientização, que confere ao indivíduo papel central no processo de educação em saúde. O presente estudo teve como objetivo avaliar o impacto de uma metodologia interativa de ergonomia de conscientização no conhecimento de trabalhadores de uma indústria têxtil. A amostra foi selecionada a partir do parecer do comitê de ergonomia da empresa. Participaram do estudo 328 trabalhadores (idade: 33,94±9,15 anos). Foram aplicadas intervenções interativas nos temas: Corpo Humano, Visão, Audição, Coluna vertebral, Membros Superiores e Membros Inferiores. O impacto da metodologia foi mensurado com a aplicação de um questionário criado e validado para o estudo. Para a comparação da pontuação antes e após as intervenções foi utilizado o teste *t* de Student (pareado), analisado no pacote estatístico SPSS 19.0 para *Windows* com significância de p<0,05. As questões qualitativas foram categorizadas, e a frequência das informações constatada. Observou-se aumento na pontuação total do questionário (8,07±1,03 para 8,76±0,50; p<0,001), o que demostra que o programa teve impacto na aquisição de conhecimento por parte dos trabalhadores em relação a segurança e saúde.

Descritores | engenharia humana; saúde do trabalhador; conhecimento; indústria têxtil.

Study carried out at the Social Services of the Industry of Santa Catarina – SESI (DR) – Florianópolis (SC), Brazil.
[1]Physical therapist, MSc in Human Movement; Consultant at SESI/SC; Director of the Project Ergonomics Awareness – Florianópolis (SC), Brazil.
[2]PhD in Production Engineering; Coordinator at the Social Technology Center at SESI/SC – Florianópolis (SC), Brazil.
[3]MSc in Environmental Engineering; Civil and Work Safety Engineer at Marisol, Professor at the Franciscan Education Association Senhor Bom Jesus – Blumenau (SC), Brazil.
[4]Physical Educator, MSc in Human Movement – Florianópolis (SC), Brazil.

Correspondence to: Joyce Ribeiro Rothstein – Rodovia Admar Gonzaga, 2.765 – CEP: 88034-001 – Florianópolis (SC), Brazil – E-mail: joyce.ribeiro@sesisc.org.br
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RESUMEN | La Ergonomía tiene demostrado avances al ser proactiva con la concepción de ambientes ergonómicamente adecuados y con la concientización del uso correcto de los puestos de trabajo. En éste contexto, se destaca el papel de la ergonomía de concientización, que confiere al individuo el papel central en el proceso de educación en salud. El presente estudio tiene como objetivo evaluar el impacto de una metodología interactiva de ergonomía de concientización en el conocimiento de trabajadores de una misma industria textil. La muestra fue seleccionada a partir de la opinión del comité de ergonomía de la empresa. Participaron del estudio 328 trabajadores (Edad: 33,94±9,15 años). Fueron aplicadas educaciones interactivas en los temas: Cuerpo Humano, Visión, Audición, Columna Vertebral, Miembros Superiores y Miembros Inferiores. El impacto de la metodología fue medido con la aplicación de un cuestionario creado y validado para el estudio. Para la comparación de la puntuación Pre y Post intervenciones fue utilizado el Test *t* de Student (pareado), analizado en el paquete estadístico SPSS 19.0 para Windows con significancia de p<0,05. Las preguntas cualitativas fueron categorizadas y la frecuencia de las informaciones constatadas. Se observó aumento en la puntuación total del cuestionario (8,07±1,03 para 8,76±0,50; p<0,001), el que demostró que el programa tiene impacto en la adquisición del conocimiento por parte de los trabajadores en relación con la seguridad y salud.

Palabras clave | ergonomía; salud del trabajador; conocimiento; industria textil.

INTRODUCTION

Brazil has the highest rate of occupational illnesses and work accidents in Latin America[1]; these are responsible for high social security costs and production decrease[2-5].

One of the ways of preventing occupational illnesses is the adoption of ergonomic practices[6-9]. Bom Sucesso[10] reports that ergonomic practice is essential to a company's success because it impacts its workers' life quality. Scientific literature has indicated that the majority of ergonomic programs offered by companies focus on ergonomic correction and conception. In summary, these programs aim at creating and planning the work space, respecting production flow and the individual's physical features, as well as making adaptations to the work space when necessary[11.12].

Ergonomics awareness[13] complements ergonomic conception and correction, given that, by means of training sessions, workers will be able to learn the adequate way of using the work space, caring for his/her body through the adoption of correct posture during the performance of tasks, as well as how to use protection gear, among other necessary measures for the prevention of illnesses and accidents. While ergonomic correction and conception focus on the alterations in the work space, ergonomics awareness brings to light the importance of having the individual as the central focus, and the necessity of prompting awareness[13,14].

It is possible to verify the description of programs that involve ergonomics awareness in scientific literature[4,7,11.13,15]; however, the interventions described are usually partial and informative, such as lectures or dialogued expositional classes, and the worker is a mere spectator, which evokes the necessity of interactive and differentiated interventions, inserted in a structured methodology in which the worker is an active agent in the construction of knowledge, with a central role in the process of health promotion.

Based on the aforementioned factors, the present study aimed at evaluating the impact of an interactive methodology for ergonomics awareness upon the knowledge of the workers of a textile factory.

METHODOLOGY

The present study is characterized as pre-experimental research because its objective was to investigate the cause-effect relation between the phenomenon investigated and its consequences[16,17]. The study was developed at Marisol Clothing Industry Ltd., a textile company and one of the largest national industries in the clothing segment, at its head office in Jaraguá do Sul (SC).

The project was approved by the Research and Ethics Committee of the Santa Catarina State University (number 83/2011). The sample was not probabilistic and intentional, given that the choice of the production sector was based on the decisions made by the company's ergonomics committee.

Seeking the prevention of muscle-skeletal illnesses, the company performed an ergonomic analysis, and elaborated and executed a plan of adequacy of its work spaces. The implementations initially occurred in the confection and folding sectors of the company, chosen to be part of this study when the ergonomics committee observed the necessity of making their workers aware of the importance of using the ergonomic resources implanted, considering that the team responsible for observing the workers' posture or performing ergonomic

analysis reported, several times, the lack of use or the incorrect use of the resources available.

400 workers were part of the study population, and the sample was composed of 328 of them. The criteria for the sample selection were the following: being an active member of the company's staff during the period of interventions, signing the free and informed term of consent, and being willing to participate in the ergonomics awareness interventions. The sample loss of 72 workers was due to lay-offs, sector transfer, or sickness or parental leave.

In order to test the methodology for ergonomics awareness, these steps were followed: pre-evaluation, sensitization, interventions, and final evaluation.

The pre-evaluation of the workers' level of knowledge was performed through a questionnaire composed of nine closed questions, four objective multi-choice questions, and the support of illustrations that clarified each option. As well as the interventions, the questionnaire was devised by an interdisciplinary team (engineer, safety technician, physiotherapist, physical educator, and psychologist, all with experience in the area of ergonomics), and the validation of face (0.88) and clarity (0.98) was performed[18,19].

Question 1 (Q1) approached the Vision topic; question 2 (Q2) the hearing topic; questions 3 (Q3), 5 (Q5), 6 (Q6) and 7 (Q7) the Vertebral Spine topic; questions 4 (Q4) and 8 (Q8) the Upper Limbs topic, and question 9 (Q9) approached the Lower Limbs topic. More specifically, Q1 questioned aspects of vision care; Q2, hearing care; Q3, posture care when picking up an object off the floor; Q4, posture care when reaching for a high object; Q5, posture care while sitting down; Q6, posture care while sleeping; Q7, posture care when standing up; Q8, care while carrying objects; Q9, care while sitting down on the floor for a few minutes.

The questionnaire also had two descriptive questions about the workers' opinion on whether they found that the knowledge acquired during the project's interventions had helped them to improve the way they performed their tasks at work and at home. The second question sought information on the aspects of the intervention that could be improved. The questionnaire was applied before and after the interventions, and the two descriptive questions were answered during the second evaluation only.

If the worker answered all the closed questions (from Q1 to Q9) correctly, he/she would score nine, the maximum score. For data analysis, besides the total score, the percentage of right answers given by the workers in each of the questions was also considered.

A sensitization by means of theatre and challenge dynamics was performed in order to inform the objective and characteristics of the project, accompanied by 13 educational interventions with 20 minutes of duration about the following topics and respective resources: the Human Body (games); Vision (experimental activity and obscurity challenge game); Hearing (visit to an inflatable ear, and sound intensity game); Human Movement, Vertebral Spine (prototypes and spine games); Upper Limbs (video and activity with wooden puppet); and Lower Limbs (video and real posture game). The interventions occurred from August to December 2012.

In relation to the topics, focus was placed on postures in general and on individual protection measures, with emphasis on the necessity of self-care in regards to movements on the worker's part, regardless of the context.

All activities performed had the differential factor: brief, experiential interventions, with innovative pedagogical resources and accessible language. The worker was an active agent in the process of knowledge construction.

The results analysis was performed through the Student´s *t* test for dependent samples (paired). The significance level defined for the present study was 0.05 (5%). For the statistical analysis, the software SPSS 19.0 for *Windows* was used.

In regards to the analysis of qualitative data, an analysis of content and meaning was performed[20]. In possession of the categories, a codification of the material gathered was performed, and the frequency of information was verified. The categories obtained after the codification were: (A) improvement in the performance of tasks at work and/or at home; (B) knowledge appropriation; (C) improvement in health care; (D) improvement of posture care; (E) change of habits; (F) other (reduction of body pains, improvement of life quality, dissemination of the knowledge acquired).

RESULTS

Regarding the socio-demographic characteristics of the sample, there was predominance of female individuals (n= 326, 99%), and the individuals' age varied between 17 and 44 years, average of 33.94±9.15.

The results indicated that there was an impact of the Methodology for Ergonomics awareness upon the workers' knowledge, with significant

increase in the score of questions: Q3; Q6; Q7; Q9 and in the total questionnaire score (Table 1).

By observing the questions according to the topic they referred to, we verified that there was an increase in the number of right answers to the questions related to the topics Vertebral Spine (from 4.39±0.79 to 4.88±0.34; p<0.001), and Lower Limbs (from 0.74±0.44 to 0.93±0.26; p<0.001).

When questioned about whether the knowledge acquired through the project helped them to improve the way they perform their activities, 10 workers did not answer the question and 318 workers answered affirmatively. In addition, 233 described upon which aspects this knowledge impacted their lives (Figure 1).

DISCUSSION

The results observed demonstrated that there was a significant increase in the percentage of correct answers to the questionnaire questions (Table 1), which confirms that the workers increased their level of knowledge in relation to safety and health.

These results indicate the importance of the impact of the Methodology for Ergonomics awareness upon the workers' knowledge, given that, according to researchers[21,22], the knowledge acquired might lead to a change of habits, and, as a consequence, to an improvement in life quality due to the prevention of lesions and accidents.

The questions that identified a significant gain of knowledge dealt with the topics: picking up an object off the floor, sleeping, sitting on the floor. The questions that did not show significant impact dealt with the themes: vision care, hearing care, posture care when sitting down, and reaching for high objects. Possibly, the impact on the questions was not so expressive because the company had initiated, in the past, educational practices that might have approached the topic in question, providing the workers with previous knowledge.

Another possibility that might have interfered with this impact is the workers' personal lack of interest in a given topic because s/he is not exposed to those risks in the work place — for instance, sound exposure. It is possible that the effect of this intervention in sectors that require caution in regards to hearing is more significant.

Besides the impact on their knowledge, the workers demonstrated improvement in other aspects, such as the way they use their bodies in labor activities and in daily life, seeking to accomplish them more correctly. They also reported improvement in life quality, and reduction of pain, among other positive impacts. Similar discoveries to the ones in this study have been unveiled by other researchers[21-23].

However, it is important to highlight that the programs described by other researchers differentiate themselves from the methodology for ergonomics awareness in that they relied on physical exercises and relaxation sessions, regarding the educational aspect as complementary, which prevents a specific evaluation of the impact of educational interventions.

Researchers[24-26] describe programs of the Back School method. In the studies selected, the fact that this method focuses on people with a history of back pain and that it is composed of theoretical classes complemented by

Table 1. Percentage of correct answers in relation to the questionnaire questions about health and safety in the work environment before and after the interventions for ergonomics awareness

Questions	Correct answers Pre-Interventions	Correct answers Post-Interventions	Dependent *t* test (p-value)
Q1	0.99±0.08	0.99±0.10	0.665
Q2	0.98±0.12	0.99±0.08	0.257
Q3	0.77±0.42	0.96±0.19	<0.001*
Q4	0.99±0.08	1.00±0.00	0.158
Q5	0.99±0.08	1.00±0.00	0.158
Q6	0.91±0.28	0.99±0.11	<0.001*
Q7	0.72±0.45	0.93±0.26	<0.001*
Q8	0.97±0.18	0.97±0.18	1.000
Q9	0.74±0.44	0.93±0.26	<0.001*
Total	8.07±1.03	8.76±0.50	<0.001*

*significant difference between the percentage of correct answers before and after the interventions (p<0.001).

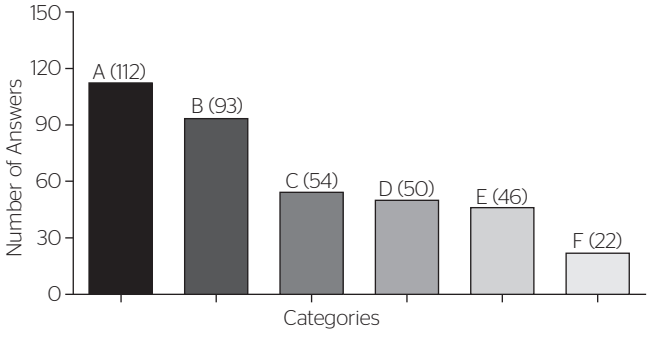

Figure 1. Results of the answer to the question: Do you think that the knowledge acquired in the Project Ergonomics Awareness helped to improve the way you perform your tasks at work and at home? (A) Improvement of task performance at work and/or at home; (B) knowledge appropriation; (C) improvement of health care; (D) improvement of posture care; (E) change of habits; (F) other (reduction of body pains, improvement of life quality, dissemination of the knowledge acquired)

physical exercises is observed. As in the present study, the authors observed a positive impact of the program upon their objectives, which, in their case, were the sensation of well-being, improvement of spine mobility, and improvement of functional capacity. Heymans et al.[27], however, report that the majority of studies related to the Back School method presented positive results in relation to a decrease in pain and improvement in functional performance when compared to other programs that relied solely on exercises, which leads one to believe that this result must be related to the fact that the Back School method considers the individual as an active agent that participates in the health process.

On the other hand, studies conducted by Lim et al.[28], and Garmer, Sperling and Forsberg[14] were composed of essentially educational interventions. The methodology used in both studies is similar to the one proposed here because it provides learning practical experiences that generated positive impact. Lim et al.[28] analyzed the impact of an intervention program for ergonomics awareness on the prevention of repeated patient handling injuries; they found reduction in body pain and a reduction of 38.1% in the probability of occurrence of lesions in the experimental group. Garmer, Sperling and Forsberg[14] proposed to work with the workers' reflexive choice in relation to the choice of hand tools, naming the program "learning by doing".

Nogueira e Navega[29] mention that the impacts of health education programs are extremely relevant to health promotion and to the improvement of life quality. In order to promote health and safety education in a differentiated way, the methodology for ergonomics awareness dealt with technical content by means of brief, interactive and ludic interventions with contents that portrayed the workers' reality. This methodology fulfilled a need mentioned in the scientific literature, which is that of health workers contemplating the reality in which the individuals are inserted, and replacing the traditional forms of knowledge transmission through interactive strategies that made the transferred knowledge meaningful to the receptor[13,28,30.31].

Weintraub, Hawlitschek and João emphasize that, for more efficient learning, it is necessary to sensitize the individual to the knowledge imparted, taking into consideration its active construction and promoting its synthesis. Pedagogical resources, such as games, provide concept fixation and dynamic learning due to the use of animation and images, which attracts more attention from the individuals. Knowledge retention goes from 20% during an exhibition that uses multimedia resources to 75% in an activity focused on practice.

Therefore, the effectiveness of Ergonomic programs is intimately attached not only to the presence of a safe work environment, but equally to the presence of an informed staff capable of utilizing their potentialities and knowing their restrictions. Such result leads to the thought that the educational process has a determining role in the improvement of ergonomic conditions, given that, several times, the company might invest in the improvement of the conditions in the work environment but the workers are not capacitated to deal with the proposed improvements. A company's investment might be put at risk if the workers do not know the way their own bodies function and their limits.

Lastly, it is worthy highlighting that, with the mobilization and sensitization of a small part of the population to health problems, such as muscle-skeletal injuries, the first step is taken towards small modifications that will gradually unchain new actions that will be reflected on the whole[12].

CONCLUSION

The results of the use of the Methodology for Ergonomics Awareness pointed to its effectiveness in regards to the level of knowledge. We conclude that informing industry workers about safety and health, ergonomics, and body conscience, with the support of interactive and ludic didactic resources that contemplate the individuals' reality, might be a promising alternative in the prevention of occupational illnesses, considering that it is necessary to sensitize them to the question of self-care in and out of the work environment.

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