Investigating the Effect of Ergonomic Interventions on Work Postures by REBA Method in Small Workshops of Sabzevar City

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Received: 2020/09/07
Accepted: 2020/09/30

Abstract

Introduction: One of the most important factors causing musculoskeletal disorder is awkward body posture during work. Ergonomic interventions to improve working posture are essential. Improving posture is effective in promoting health, reducing stress and reducing work discomfort, it is also an important factor in terms of work efficiency and job performance. There is a close relationship between posture and work efficiency, which has led to improved posture, increased efficiency and job performance.

Materials and Methods: The present quasi-experimental research is a descriptive-analytical study that has been performed on 164 employees of small workshops. This study was performed in three stages including ergonomic evaluation of employees' posture using REBA, implementing the interventions and re-evaluation of the postures. WILCOXON statistical method was used to analyze the results.

Results: The results of this study showed the improvement of posture in the organs of neck, trunk, arm, forearm, wrist and legs. Also, the comparison of overall score and risk level before and after the intervention was significant (P <0.005). The highest effect of the interventions was in the posture of legs (84%) and trunk (77%).

Conclusion: The present study showed that ergonomic interventions in small union workshops can have an effective and significant improvement in work postures.

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Keywords: REBA Assessment Method, Posture, Ergonomic Interventions

Introduction

Human resources in workplaces, including employees and workers, is one of the greatest assets of any country. Therefore, paying attention to the health of workers is of great economic and social importance. The high prevalence of musculoskeletal disorders is considered one of the most common occupational diseases among working groups. According to statistics from the World Health Organization (WHO) in 2013, musculoskeletal injuries accounted for 48% of all work-related illnesses. Improving posture is effective in promoting health, reducing stress and reducing work-related physical discomfort; this also affects work efficiency and job performance. A close relationship has been established between posture, work efficiency, and improving work posture increases job efficiency and performance. Controlling and reducing musculoskeletal disorders in the workforce is currently one of the most important tasks of ergonomics professionals around the world. According to OSHA (Occupational Safety and Health Administration) definition, ergonomics is primarily intended to prevent these work-related complications. According to studies, despite the increasing spread of mechanized processes, work-related musculoskeletal disorders are the main cause of lost time, increased costs and injuries of the workforce and one of the biggest occupational health problems in industrial countries. Findings have shown that the lumbar and knee areas had the highest prevalence of the disorder, followed by ankles and neck, back, shoulders and thighs. In general, these disorders are a multi-causal phenomenon in which different physical and psychosocial factors are effective in its occurrence and exacerbation. Studies have shown that the prevalence of pain, pain location and other symptoms may be affected by body condition and work habits as well as other demographic factors.

In industrialized developing countries, a large part of industrial units is small industries. The Center for Environmental and Occupational Health reports that 45 to 95 percent of the workforce is employed in small enterprises. In Iran, according to the statistics of the Social Security Organization in 2005, more than 96% of the workshops were small work units and these units have more than 85% of the labor force. Musculoskeletal disorders are highly prevalent in this group of industries. Legg et al. observed that there is a general consensus that safety intervention models developed for larger companies are ineffective with Small and Medium Enterprises. Owners of small businesses must play many roles in order for the business to be successful. Apart from overseeing day-to-day business operations, owners must also take on other work-related roles, such as bookkeeping, marketing, and health and safety. In developing industrial countries, the large size of small industries, especially the informal sector, and the high volume of the workforce in them, necessitate more and more attention to health and safety issues in this sector. Traditional occupational health tends to focus on factory workers and miners in urban industrial areas, and occupational health is neglected in small industries, especially in the informal sector, where a large percentage of the workforce in industrialized developing countries lives and works. Although many studies have detailed the risk factors for the occurrence and prevalence of MSDs, this does not provide sufficient guarantees for a significant reduction in MSDs after ergonomic interventions. Low commitment of managers, unwelcome workers and supervisors, high cost of ergonomic interventions and incompatibility of interventions with risk factors are the main reasons for the low impact of ergonomic interventions in the workplace. It should also be noted that these problems have been reported for large industries that have advanced safety and health systems with adequate and available resources.

Therefore, the implementation of intervention programs in these industries is very important due to the high number of employees. Despite the lack of valid data, experience has shown that the characteristics of small industries have increased the risk of musculoskeletal disorders, accidents and poisoning in these industries. Research and experience have shown that workers in small industries make up a population devoid of occupational health services. However, working conditions in small industries are such that the probability of accidents, musculoskeletal injuries and poisonings is very high.

Numerous studies have been performed to provide ergonomic intervention programs. Hesam et al. indicated that ergonomic interventions in the poultry slaughterhouse industry significantly reduce the level of corrective measures and improve the working condition of employees in different parts of the company. Due to the importance of ergonomic interventions in small workshops, the present study was conducted to evaluate work-related musculoskeletal disorders and provide suggested solutions.
Methodology

The present study was performed descriptively-analytically in two stages. 1. The evaluations of the workstations before the interventions; 2. The implementation of ergonomic corrections. Samples were selected by random sampling method which included 41 workshops and 154 workers.

To conduct research, the nature of work, stages of program implementation, key measures and monitoring mechanisms were examined. The REBA method, introduced in 2000 by Hignett and McAtamney is a general body assessment method used for the combined analysis of the upper limbs (arms, forearms, and wrists), torso, neck, and legs. In this method, other factors such as displaced force or load, type of gripping load and muscle activity are also considered in this evaluation. After determining the final score by performing ergonomic interventions such as changing the height of the work surface, improving access to tools and equipment, preparing the desk instead of kneeling, work mechanization, preparing a chair, changing the physical space of the workshop by re-evaluating the method REBA, we saw the effectiveness of corrective actions and reduction of the final score. In establishing the interventions, the scores of each section were also considered. Wilcoxon statistical method was used to evaluate and evaluate ergonomic interventions in the workshops and paired t-test method was used to analyze postures. To analyze the data, first, descriptive statistics including mean ± standard deviation of risk were summarized and frequency was used for qualitative data. Analysis of covariance was used to compare before and after paired t-test and to compare the effect of each of the underlying variables on posture. For analysis, SPSS software version 24 was performed at a significant level of 0.005.

Results

The subjects selected in this study were all male and the mean age of participants and work experience were 41.6 ± 12.96 and 17.33 ± 12.50 years, respectively. 90.8% of the statistical population were married, 68.2% had less than a diploma and only 30.4% of the statistical population had a diploma or higher. The results of the evaluation of postures using REBA showed that there is the highest level of risk in the limbs, arms and legs. Therefore, suggested interventions were proposed to improve these organs. The most effective interventions were in the feet (138 cases), trunk (127 cases), neck (64 cases), arms (57 cases), forearms (49 cases) and wrists (44 cases), respectively. The final score of body areas improved after the intervention. Also, the results of the Wilcoxon test in comparison with the results before and after the implementation of the interventions showed that the total score and level of risk and posture were significant in the trunk, neck, legs, arms, wrists and forearms. The level of risk before the intervention was clearly at a moderate level (68% of the assessed postures ranged from 4 to 7). After implementing the intervention, 62% of the evaluated postures were in the range of 2 to 3 (low risk).

Discussion

The results of ergonomic interventions, which was the most important purpose of this study, show the positive effects of measures taken to solve the problems of postures. One of the important points of this study is the tangibility of the results of the interventions, including the intervention according to the findings. One of the reasons for the optimal implementation of interventions is face-to-face training for the target groups. This result is consistent with the study of Abarqoui et al., which examined ergonomic interventions in an educational complex.

In the present study, it was shown that by performing the ergonomic intervention, workers' postures improved satisfactorily. Before the intervention, 68% of the postures evaluated were in the medium risk zone, 26.6% were in the high-risk zone and 65.3% were very high. After the intervention, 62% were in the low-risk zone and 37% were postures in the medium risk zone. Was located and one percent was assessed in the low-risk range. Also, the results of this study are in line with the results of the study of Motamedi Zadeh et al. Among the classes, the worst posture was obtained before the interventions related to the welding profession, which is also consistent with the studies of Reza Khoshk Daman in a manufacturing company and with Lukzadeh's study in the study of the welding profession. In a study by Jahangiri et al. conducted in a lead mine, studies of pre-ergonomic interventions showed that physical interventions on how things were done improved ergonomics compared to pre-intervention. Also, the findings of several studies showed that the application of ergonomic interventions in accordance with the interventions and technical-engineering
considerations has a better effect. Also, the results of this study were in line with the findings of Kalateh Arabi et al. On the subject of comparative evaluation of work postures of employees of an industrial company before and after ergonomic intervention with a participatory approach in neck, trunk, arm and wrist and overall score and risk level. Dehghan et al., after evaluating the posture using REBA method and providing engineering solutions in a transportation process, converted correction levels 3 and 4 to correction levels 2. Mesbah et al. Also studied the effect of ergonomic intervention on the reduction of musculoskeletal disorders in office workers.

**Conclusion**

This study showed that there is a significant relationship between increasing awareness of ergonomic principles and improving the workstation and ergonomic intervention can improve the condition of the body, workstations and also reduce the prevalence of musculoskeletal disorders among employees. It is mentioning that studies of external interventions have also examined the effect of various interventions on reducing the complications of musculoskeletal disorders. One of these studies is the study of Hartvigsen et al., which showed that teaching patient transfer techniques has been effective in reducing nurses' low back pain and assisting nurses. In the study of Ketola et al., The positive effect of intervention and ergonomics training on the staff of the Video Display Units (VDU) was shown. The interventions used also reduced discomfort, especially in the shoulders, neck and upper back.

In this study, only postural risk factor has been studied and it is suggested that researchers study a wider and more comprehensive range of various risk factors affecting musculoskeletal disorders, because improving posture, which results in ergonomic interventions, is a big step in order to reduce musculoskeletal disorders in the workplace. Small businesses, as a group, also have higher accident risks and higher exposures than larger enterprises, but often an individual employer will not be faced with a claim for years because of the limited number of workers.

**Acknowledgment**

Finally, the researchers thank all the patients who participated in this study and made this research possible.

**Conflict of Interest:** There is no conflict of interest between the authors of the article.
بررسی تأثیر مداخلات ارگونومیک بر پوسچرهای کاری به روش REBA در کارگاه‌های کوچک

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تاریخ پذیرش: 1999/06/07

چکیده

منابع و هدف: این مطالعه مطالعه غربالی از نوع توصیفی- تحلیلی بود که بر روی 316 نفر از شاغلین کارگاه‌های کوچک انجام پذیرفته است. این مطالعه طی سویلیه شاخص ارزیابی ارگونومیکی پوسچرهای آشاغی‌تر بیان، انجام مداخلات و ارزیابی نهایی روش ارزیابی REBA انجام شد.

روش: این مطالعه در کارگاه‌های کوچک با بسته‌بندی و شرایط سازمانی مناسب انجام گردید. انجام مداخلات به روش نهایی طراحی و اجرای آن در طی 4 هفته صورت گرفت.

نتیجه‌گیری: این مطالعه نشان داد که مداخلات ارگونومیک در کارگاه‌های کوچک بیشترین بهبود و افزایش رضایت از طرف کارگران درمی‌آید.

کلیدواژه‌ها: REBA، پوسچر، مداخلات ارگونومیک

1. مقدمه

نیروی انسانی در محیط‌های کاری شامل کارگران و کارکنان در بزرگ‌ترین سرمایه‌های در کشور محسوب می‌شود. این روش توجه به سلامت نیروهای کار و کنترل اختلالات و پیامدهای طبیعی از نظر اقتصادی و بهبودی و رضایت از طرف کارگران اهمیت دارد.

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ریسک‌افکتورهای ایجاد اختلالات عضلانی و پوکوری مانند از جمله میزان خون‌سوزی، مواردی که بهبود پس‌بیماری بر ارتقای سلامت کاهش یابد و از آنجایی که برسی به‌طور کلی هر ارزیابی‌ها از نظر بهبود یافته نیز اثر منفی‌تری دارد، به‌طور کلی می‌تواند بر ارتقای رانندگی و عملکرد شغلی نیز اثر منفی‌تری دارد. 

مکانیزم‌ها: بهبود پس‌بیماری کار کار در افزایش عملکرد و ارزیابی‌های از نظر بهبود یافته نیز اثر منفی‌تری دارد. بهبود پس‌بیماری کار کار در افزایش عملکرد و ارزیابی‌های از نظر بهبود یافته نیز اثر منفی‌تری دارد. بهبود پس‌بیماری کار کار در افزایش عملکرد و ارزیابی‌های از نظر بهبود یافته نیز اثر منفی‌تری دارد.
بررسی تأثیر مداخلات ارگونومیک بر پوستچرخه‌های کاری...

روش

کیفیت تحقیق این طرح، دارای مطالعه‌ای در حوزه ارگونومیک و ارتباط با همکاری اتاق اصداف و پرسنل مهندسی بیداشت حرکات سیستم‌های پوستچرخه‌ها (REBA) است. آزمون‌هایی که در هیات مسئول از منابع مختلف و جامعه‌شناسی و جوهربندی، تغییرات متوسط ویژگی‌ها، میزان فاصله، ویژگی‌های راهبردی پوستچرخه‌ها را نشان می‌دهد. در سبک سمت‌های کاری، مشخص شد که در این بخش از ارتباط با پوستچرخه‌ها، بیشترین شاخصی که در پایان مطالعه نسبت به شاید در نتیجه این اطلاعات و دیگری از این امرها، ارتباط پوستچرخه‌های اسکلتی و دیگری که در نهایت امتیاز نهایی طبق جدول 1 محسوب می‌گردد.

(12)

جدول 1. سطح و اولویت اقدام‌های اصلاحی در روش REBA

<table>
<thead>
<tr>
<th>شاخص</th>
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<td>شاخص</td>
<td>4</td>
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<td>شرط و نشانه‌های سیستمی</td>
<td>11-15</td>
</tr>
</tbody>
</table>


\[
\left(\frac{z_{\alpha} + z_{\beta}}{\sigma}^2\right)^2 = 38, \mu_{\text{pre}} = 13.6, \mu_{\text{post}} = 6.5, \sigma_r^2 = 244, \alpha = 0.05, \beta = 0.2
\]

رابطه 1

براساس رابطه 1 تعداد 38 خوشه بعنوان کارگر کوچک انتخاب شد. اگر تعداد نمونه در هر کارگر 4 نفر باشد بطور متوسط 152 نمونه داریم.

در این تحقیق ابتدا ماهیت کار، کلیت مباحث، محیط اجرای برنامه اقامت‌های کلیدی و مکانی‌های نظامی با همکاری هماهنگ و توانایی در اجرای خودشان که در نهایت امتیازات ارگونومیک و میزان شدة در پایان امتیاز نهایی طبق جدول 1 محسوب می‌گردد.

سن شرکت کنندگان و سابقه کاری به ترتیب 41/18 و 135/6 و 0/8 بود و درصد جامعه افراد متأهل به ترتیب 56/2 و 12/7 درصد زیر دیپلم و تساوی 30/1 درصد جامعه افراد متأهل به ترتیب 138/2 درصد دیپلم و 3/9 درصد دیپلم دانشگاه آموزش تربیتی انجام شده‌است. تفاوت ارتباط پوستچرخه با استفاده از کاهش دانه که با انتخاب سطح خطر در اندازه‌های کم‌تر، دسترسی و بازگشت دارد. از این رو، مداخلات پیشنهادی برای بهبود انتخابهای را ارائه شد. جدول 2 شرایط نامطلوب و مداخلات پیشنهادی را نشان می‌دهد.

2 شرایط نامطلوب و مداخلات پیشنهادی را نشان می‌دهد.

پس از تعیین امتیاز نهایی با انجام مداخلات ارگونومیک نظیر تغییر ارتقاء سطح کار، بهبود حداکثری در ابزار و لوازم، تهیه بیماری که با جای نشانی‌ها به حالات زلو، مکانی‌های ساختن کار، بهبود صدای، تغییر در فضاهای فیزیکی کارگاه با اجرای جهت‌گیری ارتباطات REBA، ارائه‌های اقدامات REBA ایجاد که احتمال امتیاز نهایی راله به دیدگاه و استقلال مداخلات، نمره‌های زیادی از این ارتباط با استفاده از روش‌های ویژه مداخلات ارگونومیک در کارگاه‌ها، گردد.

برای تجربه و تحقیق این استادی برنامه‌های متابولیک و مصرفی روش‌های با روش‌های پیشنهادی می‌تواند با بطور مطالعه، همکاری مورد بررسی و اجرای ایفای این ارتباط با استفاده از اصول و روش‌های میانگین‌گیری و با توجه به آینده، ارائه‌های اقدامات REBA با استفاده از روش‌های بهبودی. در نظر گرفته شد.

3.1. بافت‌های پژوهش

افراد انتخاب شده در این مطالعه، همکار مرد بودند و میانگین

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جدول ۲ پوشه‌های نامناسب و اقدامات مداخله‌ای پیشنهادی

<table>
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| استفاده از خرک | تهیه توده‌های سطح کاری 
| همکاران | با اشاره به میزان دقت و محدوده نتیجه‌گیری |
| مکانیسرسیون (استفاده از بارا) | کمیته خرد (مکانیکی) |
| مکانیسرسیون (استفاده از بارا) | کمیته خرد (مکانیکی) |

شکل ۱ میانگین امتیاز کسب شده با روش REBA در هر ناحیه بر (قبل و بعد از اجرای مداخلات ارگونومی)

نمودار تأثیر مداخلات بهصورت قبل و بعد

مینایت نتایج مداخلات ارگونومی که مهم‌ترین هدف اجرای این مطالعه بود، نشان داده که بهبود اقدامات اجتماعی در راستای رفع مشکلات پوشه‌های کاری در صورت مردان میانسال بیش از نکات مهم بهبود می‌یابد. نتایج حاصل از مداخلات ارگونومی با توجه به افزایش و افزایش میزان مصرف و افزایش میزان مصرف در ژانراه‌های زن در ۱۲۳۲ از ۹۰ درصد میانسال بین ۲۱۷۵ تا ۳۷۵ درصد بهبود افتاد. نتایج حاصل از مداخلات با توجه به افزایش و افزایش میزان مصرف در ژانراه‌های زن در ۱۲۳۲ از ۹۰ درصد میانسال بین ۲۱۷۵ تا ۳۷۵ درصد بهبود افتاد.
References


