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THE EFFECT OF BOOSTER BREAKS ON NON-SPECIFIC LOW BACK PAIN IN OFFICE WORKERS

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ABSTRACT

Purpose: *Prolonged sitting has a negative effect on office workers, and non-specific low back pain (NSLBP) is one of the most common consequences of an inactive lifestyle and prolonged sitting. Active breaks are a promising intervention to reduce the negative effects of office work.*

Methods: *Forty-two office workers from a Slovenian company were divided into an experimental group (24 office workers who had been taking active breaks for one and a half years) and a control group (N=18, no active breaks). The participants were not randomly allocated to the groups; allocation was based on availability and voluntary participation.*

An online survey was conducted using the Oswestry Disability Index 2.0 (ODI 2.0) and the Visual Analog Scale (VAS). This was a non-randomized, two-arm longitudinal study. Questionnaires were administered once, 1.5 years after the intervention. Statistical analyses were conducted using the Mann-Whitney and Wilcoxon signed--rank tests, with the level of significance set at $p \leq 0.05$.

Results: *The results showed that 81% of office workers had experienced NSLBP at least once in their lives. The ODI 2.0 scores were not significantly lower in the experimental group ($p = 0.155$). However, pain intensity was lower in office workers who took active breaks ($p = 0.001$). All the participants in the experimental group reported that active breaks had a positive effect on their well-being (100%). Furthermore, 37.5% of*

the participants stated that they had become more physically active outside the office as a result of the active breaks.

Conclusion: *Introducing active breaks into the daily routine of office workers is a viable and effective intervention to mitigate the risk of NSLBP. Active breaks offer a comprehensive solution: they not only reduce the negative effects of prolonged sitting, but also reduce stress, improve work efficiency and focus, and promote better moods.*

Keywords: *non-specific low back pain, ergonomics, booster breaks, prolonged sitting, office workers.*

VPLIV AKTIVNIH ODMOROV NA POJAV NESPECIFIČNE BOLEČINE V KRIŽU PRI PISARNIŠKIH DELAVCIH

IZVLEČEK

Cilj: *Dolgotrajno sedenje negativno vpliva na pisarniške delavce, nespecifična bolečina v križu (NBVK) pa je ena najpogostejših posledic neaktivnega načina življenja in dolgotrajnega sedenja. Aktivni odmori so učinkovita intervencija za zmanjšanje negativnih posledic pisarniškega dela.*

Metode: *V raziskavi je sodelovalo 42 pisarniških delavcev podjetja Intra Lighting d. o. o., ki so bili razdeljeni v dve skupini: eksperimentalno (24 pisarniških delavcev, ki že leto in pol izvajajo aktivne odmore) in kontrolno (18 pisarniških delavcev, ki ne izvajajo aktivnih odmorov). Udeleženci niso bili naključno razporejeni v skupine, temveč je razporeditev temeljila na razpoložljivosti in prostovoljni udeležbi. Anketiranje je bilo izvedeno prek spletnega vprašalnika 1Ka, pri čemer smo uporabili Oswestry Disability Index (ODI 2.0) in vidno analogno lestvico (VAL). Študija je bila nerandomizirana longitudinalna študija z dvema skupinama. Vprašalniki so bili izpolnjeni enkrat, leto in pol po intervenciji. Statistične analize so bile izvedene z uporabo Mann–Whitneyjevega in Wilcoxonovega testa, pri čemer je bila raven statistične značilnosti določena na* $p \leq 0{,}05$.

Rezultati: *Rezultati so pokazali, da je 81 % pisarniških delavcev vsaj enkrat v življenju doživelo NBVK. Število točk na lestvici ODI 2.0 pri eksperimentalni skupini ni bilo signifikantno nižje (*$p = 0{,}155$*). Vendar pa se je stopnja bolečine po VAL pri eksperimentalni skupini znižala (*$p = 0{,}001$*). Vse raziskovane osebe v eksperimentalni skupini so potrdile, da so se zaradi aktivnih odmorov bolje splošno počutile (100 %). Poleg tega je 37,5 % anketirancev poročalo, da so zaradi aktivnih odmorov med delom postali bolj telesno dejavni tudi zunaj službe.*

Zaključek: *Uvajanje aktivnih odmorov v dnevno rutino pisarniških delavcev je učinkovita in izvedljiva intervencija za zmanjšanje tveganja za nastanek NBVK. Zato je priporočljivo, da se ta praksa uvede v čim več podjetjih s pisarniškim delom. Aktivni odmori so vsestranska rešitev. Poleg zmanjšanja negativnih posledic dolgotrajnega sedenja, zmanjšujejo tudi stres, izboljšujejo delovno učinkovitost in pozornost in blagodejno vplivajo na splošno počutje.*

Ključne besede: *nespecifična bolečina v križu, ergonomija, aktivni odmori, dolgotrajno sedenje, pisarniški delavci.*

INTRODUCTION

Sedentary office work has a detrimental effect on an individual's physical and mental well-being. Prolonged sitting and extensive computer use significantly contribute to vision impairment, musculoskeletal disorders, headaches, and stress. These symptoms often arise due to poor workplace ergonomics and the nature of office work, which requires extended periods of sitting without sufficient physical activity breaks (Balci & Aghazadeh, 2004). One of the most common health issues among office workers is low back pain (LBP). Within 12 months of employment, between 34% and 51% of office workers experience LBP. This condition affects an individual's well-being, productivity, and overall quality of life. Prolonged static muscle activation while sitting can lead to increased muscle tension, fatigue, soft tissue disorders, and damage to ligaments and intervertebral discs. Additionally, prolonged sitting often causes discomfort in the lumbar region, which often progresses into pain (Waongenngarm, Areerak, & Janwantanakul, 2018).

Non-specific low back pain (NSLBP) refers to LBP without a known specific physical cause. In contrast, LBP can also result from identifiable causes such as radicular syndrome (nerve root compression), trauma, infection, or tumors. NSLBP accounts for 90% of all LBP cases. It is a widespread issue, affecting 60%–90% of the population at least once in their lifetime (Bekkering et al., 2003). Recurrent pain is defined as multiple episodes of LBP within one year, with each episode classified as acute (0–6 weeks), subacute (7–12 weeks), or chronic (lasting more than 12 weeks) (Bekkering et al., 2003). Acute episodes of low-intensity pain are more common, but in some cases, pain persists for months or even years, becoming chronic (Tidy, 2020). In such cases, physiotherapeutic treatment aims to restore the individual's functional capacity to the highest possible level or to the level of physical activity they had before the onset of the NSLBP. The most critical aspect of the treatment is educating patients about the causes and nature of their pain and motivating them to engage in physical activity. Research has demonstrated (Waddell et al., 1997; Van Tulder, Malmivaara, Esmail, & Koes, 2000; Hagen, Hilde, Jamtvedt, & Winemm, 2000) that bed rest is not an effective treatment for acute NSLBP and may even prolong rehabilitation. Instead, remaining physically active during the subacute phase has been shown to accelerate recovery and facilitate an earlier return to work. Furthermore, physically active individuals have a lower risk of developing chronic NSLBP (Bekkering et al., 2003).

Kinesiotherapy is the most effective method for managing NSLBP. Although the optimal type of physical activity has not entirely been established,

muscle-strengthening, stabilization, and flexibility exercises are crucial components of treatment (Bekkering et al., 2003). An effective strategy to reduce both physical (including NSLBP) and psychological issues in the workplace is the appropriate scheduling of work and breaks. Research indicates that frequent short breaks are more beneficial for workers' psycho-physical well-being than fewer, longer breaks. Studies suggest that "micro" breaks every 15 minutes help alleviate muscle tension in the neck, back, and arms, reduce eye strain from computer use, and improve cognitive performance in terms of speed and accuracy. Therefore, frequent short breaks contribute significantly to the overall comfort and efficiency of office workers who rely on computers (Balci & Aghazadeh, 2004).

Additionally, the type of break taken—active or passive—is important. An active break, also known as a "Booster Break", is an organized break designed to enhance physical and mental health. It has been shown to improve the employees' well-being and productivity. An active break typically lasts 10–15 minutes and is led by either a trained employee or an external instructor. It includes stretching exercises for muscles that remain contracted while sitting, and strengthening exercises for muscles that are overstretched in a seated position, as well as breathing exercises. Other forms of active breaks include yoga, Tai Chi, or meditation. Engaging in active breaks can also encourage employees to adopt a healthier lifestyle and become more physically active outside the workplace (Taylor, 2005).

The aim of this study was to examine whether active breaks can reduce the level of NSLBP and/or prevent its occurrence among office workers due to prolonged sitting. Based on the existing literature, we hypothesized that: (1) active breaks will reduce the intensity of NSLBP as measured by the VAS; (2) office workers who engage in active breaks will report more physical activity outside of work; and (3) the experimental group will score better on the ODI 2.0 and VAS compared to the control group.

METHOD

Sample

The sampling method was opportunistic. Data was collected from office workers at Intra Lighting d.o.o., located in Šempeter pri Gorici (Slovenia). The participants were not randomly allocated. The division into groups was based on voluntary participation and accessibility, which may introduce selection

bias. Our study was a non-randomized two-arm longitudinal study, the questionnaires were collected once, after 1.5 years of the intervention. The experimental group consisted of office workers who had been taking 10-minute active breaks twice a week for a year and a half (n = 24). The control group comprised other office workers in the company who had not participated in the active breaks (n = 18). The exclusion criterion was a diagnosed pathology in the lumbar region (not NSLBP).

Intervention

The intervention consisted of 10-minute guided active breaks, conducted twice a week for a duration of one and a half years. The sessions were led by a licensed kinesiologist and included a combination of breathing exercises, stretching of shortened muscles (e.g., hip flexors and chest), strengthening exercises for underactive muscles (e.g., gluteal and core muscles), and posture correction activities. The exercises were designed to address the effects of prolonged sitting and were modified according to the participants' needs. The sessions were performed in the office during working hours and required no special equipment.

The study was conducted in January 2021. A total of 67 respondents completed the online questionnaire, of whom 45 submitted valid responses. Three respondents were diagnosed with specific pathologies in the lower back region (disk herniation, vertebral collapse, and an undisclosed condition) and were excluded from statistical analysis. The final sample consisted of 42 office workers, including 11 women (26%) and 31 men (74%). The average age of the respondents was 39.8 ± 8.6 years, with the youngest being 24 and the oldest 60.

Instruments

The online questionnaire was created using EnKlikAnketa (1KA, Arnes, Slovenia). The questions were designed based on the study's three hypotheses, with the exception of questions 5, 12, and 13. Question 5 represents the Oswestry Disability Index 2.0 (ODI 2.0), while questions 12 and 13 correspond to the Visual Analog Scale (VAS).

Oswestry Disability Index (ODI 2.0)

The ODI 2.0 questionnaire consists of 10 categories of daily activities, with the respondents selecting one answer per category (0–5). The ODI score (index) is calculated using the formula: (total score / total possible score) × 100 = %.

Interpretation of the scores:

- 0%–20%: minimal disability – The patient can cope with most daily activities,
- 21%–40%: moderate disability – Increased pain and difficulty with sitting, lifting, and standing; work and social life may be affected,
- 41%–60%: severe disability – Pain significantly affects daily activities; further investigation is required,
- 61%–80%: crippled – Pain interferes with all aspects of life, requiring intervention,
- 81%–100%: either bed-bound or exaggerating symptoms (Physiopedia, 2021).

The ODI 2.0 questionnaire has been validated and translated into Slovenian and its reliability has been confirmed and its use permitted for this research (Klemenc-Ketiš, 2011). The questionnaire was used to compare NSLBP between employees who participated in active breaks and those who did not.

Visual Analog Scale (VAS)

The Visual Analog Scale (VAS) was used to assess self-reported pain intensity. The participants were asked to indicate their current level of low back pain on a 10-point horizontal line, where 0 represents “no pain” and 10 represents the “worst imaginable pain.” The score was measured in centimeters from the left end of the line. The participants completed this assessment independently online as part of the survey. VAS is a widely used tool for self-assessing pain intensity (Jakovljević & Puh, 2014). This study used the VAS results to compare NSLBP intensity in the experimental group before and after participating in active breaks for a year and a half.

Assessment of Physical Activity

Self-reported physical activity was assessed using multiple-choice questions included in the online questionnaire. The questions (except for questions 5, 12, and 13) inquired about the frequency, duration, and type of physical activity performed outside working hours. The participants were asked to compare their current level of physical activity to the period before the COVID-19 pandemic. The responses were used to assess changes in physical activity patterns and lifestyle.

Statistical Analysis

Statistical analyses were conducted using Microsoft Excel (Microsoft Office 365, 2019) and SPSS (version 26.0, IBM, 2018). Due to the non-normal distribution of data, non-parametric tests were used. The Mann-Whitney U test was applied to hypothesis 2, while the Wilcoxon Signed Ranks test was used for hypothesis 3. A significance level of $p \leq 0.05$ was adopted for all the analyses. For non-normally distributed data, the results were reported using median and interquartile range (IQR), as appropriate for non-parametric analyses.

RESULTS

Table 1 presents data on the presence and duration of NSLBP among office workers in the company. The results indicate that a significant majority (81%) of office workers have experienced NSLBP at least once in their lifetime. In most cases (85%), the duration of the NSLBP was short, with workers experiencing the acute phase (0–6 weeks). Only 6% of all NSLBP cases lasted longer than 12 weeks and became chronic.

Table 2 presents the ODI scores for the experimental group, consisting of office workers who participated in active breaks, and the control group, consisting of office workers who did not participate in active breaks. There were no differences between the groups. Furthermore, all the participants in both groups had an ODI index of between 0% and 20%, indicating minimal disability, meaning that they were able to perform most daily activities without major limitations.

Table 3 presents the VAS scores for the experimental group (n = 24) before and after participating in active breaks for a year and a half. The results show a decrease in the pain levels on the VAS after this period (p = 0.001).

Table 4 presents additional data from the online questionnaire regarding the effects of active breaks on well-being, physical activity outside of working hours, and a comparison of physical activity before and during the COVID-19 era. All office workers in the experimental group (n = 24) reported improved well-being as a result of taking active breaks at work. Additionally, 37.5% of them reported increased physical activity outside of work due to their participation in active breaks. However, the COVID-19 era had an impact on physical inactivity among office workers. In total, 46% of office workers in the company reported being less physically active, while 38% maintained the same level of physical activity as before the pandemic.

Table 1: The presence of NSLBP and its duration in office workers of Intra Lighting d.o.o.

NLBP	**N**	**%**
Yes	34	81
No	8	19
Duration of NLBP	**N**	**%**
0-6 weeks	29	85
7-12 weeks	3	9
> 12 weeks	2	6

Table 2: ODI scores of office workers in Intra Lighting d.o.o., and the p value of the Mann-Whitney Test

ODI	**N**	**M**	**IQR**	**P**
Active breaks	24	2.3	0.49–4.49	0.155
No active breaks	18	1.8	0.46–2.29	

* $p \leq 0.05$

Table 3: VAS scores comparison before and currently in office workers who have been taking active breaks, and the p value of the Wilcoxon Signed Ranks Test

VAS	N	M	IQR	min	max	P
Before active breaks	24	3.3	1.58–4.95	0	10	0.001
Current	24	1.9	1.29–2.61	0	4	

* $p \leq 0.05$

Table 4: The impact of active breaks on better well-being, physical activity outside working hours, and a comparison of physical activity in the COVID-19 era vs before

Taking active breaks N (%)			
Yes		No	
24 (57)		18 (43)	
Better well-being due to taking active breaks N (%)			
Yes		No	
24 (100)		0 (0)	
More physical activity outside working hours because of taking active breaks N (%)			
Yes	No	The same	
9 (37.5)	3 (12.5)	12 (50)	
Physical activity in the COVID-19 era VS. Before N (%)			
More	Less	Same	Do not know
6 (14)	19 (46)	16 (38)	1 (2)

DISCUSSION

Our study yielded results similar to previous research on NSLBP. Most of the office workers in the company had experienced NSLBP at least once in their lifetime, which aligns with findings from earlier studies (Bekkering et al., 2003; Waongenngarm et al., 2018). Additionally, our study confirmed that NSLBP is the most prevalent form of LBP (Tidy, 2020).

We initially hypothesized that office workers who participated in active breaks would score significantly lower on the ODI 2.0 compared to those who did not participate. However, the results did not support this hypothesis, as there was no difference in the ODI 2.0 scores between the experimental and control groups. Interestingly, the control group had slightly lower ODI 2.0 scores on average. A possible explanation for this outcome is that office workers experiencing NSLBP might have been more motivated to engage in active breaks as a strategy to reduce their pain and disability. Conversely, those who did not suffer from NSLBP may have perceived active breaks as unnecessary or ineffective.

Furthermore, our study may have been limited by the overall low ODI scores among participants, which prevented effective comparison. All the office workers in the study had ODI scores within the minimal disability range (0%–20%), indicating that their ability to perform daily activities was not impaired. Expanding the study to include office workers from other companies or those with higher ODI scores would improve the comparison and strengthen the findings.

The primary goal of this study was to determine whether taking active breaks at work could reduce NSLBP among office workers. The results indicate that office workers who participated in active breaks experienced a reduction in pain levels, as measured by the VAS, after a year and a half of participation ($p = 0.001$). Additionally, all the participants in the experimental group reported that the active breaks positively affected their well-being, which is consistent with findings from previous studies (Balci & Aghazadeh, 2004). Furthermore, a notable portion (37.5%) of the participants stated that engaging in active breaks at work encouraged them to be more physically active outside the workplace (Taylor, 2005).

One of the limitations of this study is the lack of randomization between groups. This non-random group assignment may have introduced selection bias, limiting the internal validity of the findings.

Future research on active breaks should consider both the strengths and limitations of the current study. Our study could be expanded by comparing different types of active breaks and their effectiveness in reducing NSLBP.

The active breaks in our study consisted of breathing exercises, core activation exercises, stretching for tense muscles, and strength exercises for weaker muscles. However, active breaks can include a variety of physical activities. For example, previous research (Kim, Lee, Oh, Kim, & Yoon, 2019) has shown that simulated horseback riding (SHR) systems effectively reduce chronic NSLBP and improve functional disability. Additionally, alternative workplace interventions, such as sit-stand workstations (Agarwal, Steinmaus & Harris-Adamson, 2018), active standing (Marusic, Müller, Alexander, & Bohnen, 2020; van Emde Boas et al., 2024), and cycling workstations (Koren, Pišot, & Šimunič, 2016), have been explored as strategies to reduce the negative effects of prolonged sitting. While higher intensity activity (80W cycling) at work may be detrimental to cognitive performance (Koren et al., 2016), standing or engaging in controlled medio-lateral dynamic movement while standing is unlikely to impair cognition—particularly selective attention and cognitive control (Šömen, Peskar, Wollesen, Gramann, & Marusic, 2023; Marusic et al, 2020). Future research might investigate the combined effects of active breaks and adjustable standing desks to determine the most effective strategy for mitigating NSLBP.

CONCLUSION

NSLBP is one of the most common musculoskeletal issues associated with prolonged sitting in office workers (Waongenngarm et al., 2018). Physical activity is a well-established intervention for mitigating the negative effects of prolonged sitting (Balci & Aghazadeh, 2004). Our study confirmed that 81% of office workers in the company had experienced NSLBP at least once in their lifetime. Importantly, office workers who engaged in active breaks for a year and a half reported a reduction in pain levels as measured by the VAS. Moreover, all the participants in the experimental group unanimously agreed that active breaks positively impacted their overall well-being. However, there was no difference in the ODI 2.0 scores between the experimental and control groups. It is important to note that the study did not use random allocation to groups, which may limit the generalizability of the results.

Future Directions

The implementation of active breaks in as many office-based companies as possible could lead to a reduction in healthcare burdens, including fewer sick days due to NSLBP and other musculoskeletal disorders. More importantly, regular active breaks could promote a healthier and more active lifestyle among office workers, leading to increased motivation, job satisfaction, and overall well-being.

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