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RELATIONSHIP BETWEEN DAILY PHYSICAL ACTIVITY LEVEL AND LOW BACK PAIN IN YOUNG, FEMALE DESK-JOB WORKERS

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Abstract
Objectives: The purpose of this study was to investigate the relationship between daily physical activity (PA) level and low back pain (LBP) in young women. **Material and Methods:** Two hundred forty three female, desk-job workers aged 20–40 voluntarily participated in the study. The participants were assessed by the use of Oswestry Disability Index for measuring LBP disability and by the use of the short version of the International Physical Activity Questionnaire for PA assessment. The 1-way ANOVA test was used for comparing the mean values according to the physical activity level groups. Correlations between the average LBP disability score and all the other variables were obtained using Pearson's correlation analysis. The level of statistical significance was $p < 0.05$. **Results:** Significant differences were found for LBP disability score between the results of 3 different PA groups ($p < 0.05$) (low, moderate and high PA groups). The correlation between the average LBP disability score and body weight ($r = 0.187$, $p < 0.01$), body mass index ($r = 0.165$, $p < 0.01$), vigorous MET score ($r = 0.247$, $p < 0.01$) and total PA MET score ($r = 0.131$, $p < 0.01$) were significant. **Conclusions:** The main finding of this study is that there is a U-shaped relationship between PA and LBP disability score in young women. A moderate level of daily physical activity and preventing body weight and fat gain should be recommended in young, female desk-job workers in order to prevent and manage low back pain.

Key words:
Sedentary lifestyle, Physical activity, Back pain, Women, Workers

INTRODUCTION

Low back pain (LBP) is defined as "any back pain between the ribs and the top of the leg, from any reason" [1,2]. According to Ehrlich, "LBP is neither a disease nor a diagnostic entity of any sort" [3]. LBP is one of the most common problems in adults. The most recent reviews of the prevalence of LBP have shown that the point prevalence rate was estimated to be between 12–33% [1,4]. Physical activity (PA) is typically defined as "any bodily movement produced by skeletal muscles that results in energy expenditure beyond resting expenditure" [5].

Public health guidelines recommend regular PA to minimize the risk of chronic diseases [5–7]. Previous studies have demonstrated that there is a U-shaped relationship between LBP and PA [8,9]. These studies showed that sedentary lifestyle and strenuous levels of PA are more associated with LBP than moderately intense PA [10–12]. Sedentary workers who sit for a long period have a higher risk of diabetes, cardiovascular diseases as well as

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cardiovascular and all-cause mortality [13–15]. Despite these citations and their widespread acceptance, there have been few published articles [8,16] showing the relationship between LBP and daily PA levels in female desk-job workers. Scientific evidence of the role of daily PA in prevention and management of LBP was lacking in the case of young, female workers. It is hypothesized that maintaining moderate levels of daily PA will be associated with fewer LBP complaints. The purpose of this study was to investigate the relationship between daily PA levels and LBP in young, female desk-job workers aged 20–40.

MATERIAL AND METHODS

Participants and test procedures

The present study is based on the survey data collected among female workers who booked doctor appointments for a physical examination such as routine regular medication reviews and made blood test requests. Two hundred forty three female, desk-job workers within the age range of 20–40 years participated in this study voluntarily. Their mean age was 29.20±5.91 years, height – 1.63±0.05 m, body weight – 63.83±7.63 kg and body mass index (BMI) – 23.91±3.11.

Body composition assessment

Body height and weight were measured at the assessment day. Body weight of the participants in minimal clothing (underwear) was measured to the nearest 100 g with a precision scale and the body height was measured to the nearest 5 mm with a Holtain stadiometer [17]. Body mass index was calculated using the formula: weight (kg) divided by height (m) squared.

Physical activity level assessment

Physical activity was assessed using the short version of The International Physical Activity Questionnaire (IPAQ) and scored according to the method of Craig et al. [18]. The questionnaire was developed as an instrument for cross-national monitoring of physical activity and inactivity. The questionnaire was designed to be used by adults aged 18–65 years.

The short version of the questionnaire (9 items) provides information on the time spent walking, doing vigorous to moderate intensity physical activity and sedentary activity. The participants were instructed to refer to all the areas of physical activity. Data from the short IPAQ questionnaires were summarized according to the physical activities recorded (walking, moderate, and vigorous activities). Data from the questionnaires were used to estimate the total weekly physical activity by weighting the reported minutes per week within each activity category according to the metabolic equivalent of task (MET) – energy expenditure estimate assigned to each category of activity.

$$\text{Walking MET-min/week} = 3.3 \times \text{walking time (min)} \times \text{walking days} \quad (1)$$

$$\text{Moderate MET-min/week} = 4 \times \text{moderate-intensity activity time (min)} \times \text{moderate days} \quad (2)$$

$$\text{Vigorous MET-min/week} = 8 \times \text{vigorous-intensity activity time (min)} \times \text{vigorous-intensity days} \quad (3)$$

$$\text{Total physical activity MET-min/week} = \text{sum of walking} + \text{moderate} + \text{vigorous} \quad (4)$$

If the participants met at least 1 of the criteria below they were classified as ‘moderate’:

– 3 or more days of vigorous-intensity activity of at least 20 min/day,
– 5 or more days of moderate-intensity activity and/or walking of at least 30 min/day,
– 5 or more days of any combination of walking, moderate-intensity or vigorous intensity activities achieving a minimum total physical activity of at least 600 MET-min/week.

If the participants met at least 1 of the criteria cited below they were classified as ‘high’:

– vigorous-intensity activity on at least 3 days achieving a minimum total physical activity of at least 1500 MET-min/week,
– 7 or more days of any combination of walking, moderate-intensity or vigorous-intensity activities achieving a minimum total physical activity of at least 3000 MET-min/week.

The participants who did not meet criteria for moderate or high categories were considered to have a 'low' physical activity level.

Low back pain assessment

The participants were assessed by the use of the Turkish version of the Oswestry Disability Index for measuring disability. The Oswestry Disability Index is one of the most commonly used and validated scales for measuring disability for people with LBP. The questionnaire consists of 10 items addressing different aspects of function. Each item is scored from 0 to 5, with higher values representing greater disability. The total score is multiplied by 2 and expressed as a percentage [19,20].

ETHICS

The participants signed an informed consent before commencement of the study and the author confirms that this study meets the guidelines of the Helsinki Declaration.

STATISTICS

Means and standard deviations are given as descriptive statistics. The One-way ANOVA test was used for comparing the mean values according to the 3 different physical activity level groups. The Tukey *post hoc* test was used to follow-up with the group factor. Correlations between the average LBP disability score and all the other variables were obtained using Pearson's correlation analysis. For all statistics the significance level was set at $p < 0.05$. The data were analysed using the Statistical Package for Social Sciences (SPSS) MS Windows Release 17.0.

RESULTS

There are no significant differences for age, body weight, body height and BMI between the 3 physical activity groups. However, significant differences were found for LBP disability score between the results of the 3 physical activity groups ($p < 0.05$) (Figure 1). LBP disability score in the moderate physical activity group was significantly lower ($p < 0.05$) than in the low and high physical activity groups. There is no significant difference for LBP disability score between the low and high physical activity groups (Table 1).

Although, the correlation coefficient between the average LBP disability score and body weight ($r = 0.187$, $p < 0.01$), body mass index ($r = 0.165$, $p < 0.01$), vigorous MET score ($r = 0.247$, $p < 0.01$) and total physical activity MET score ($r = 0.131$, $p < 0.01$) were significant, there is no significant relationship between the LBP disability score and age, body height, Moderate MET score and Walking MET score ($p > 0.05$) (Table 2).

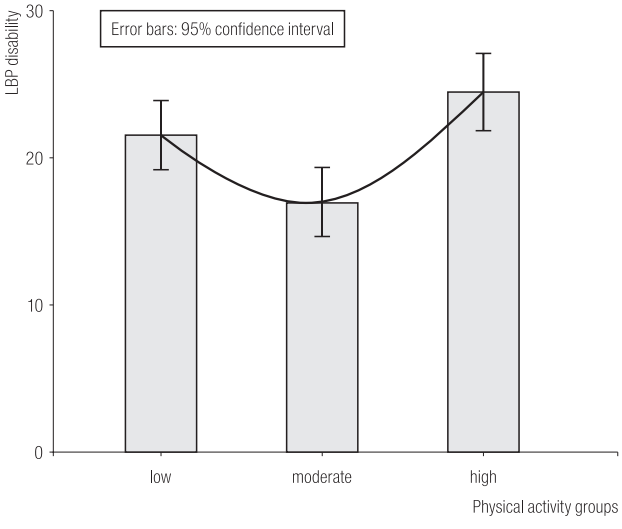

Fig. 1. Low back pain (LBP) disability score in the study groups

Table 1. The means (M) and standard deviations (SD) of all dependent variables according to the physical activity groups

Variable	Physical activity (M±SD)			L–M difference		L–H difference		M–H difference		p[2]
	low (L) (N = 88)	moderate (M) (N = 81)	high (H) (N = 74)	M±SD	p[1]	M±SD	p[1]	M±SD	p[1]	
Age (years)	30.03±5.92	28.78±5.32	28.66±6.47	1.26±0.91	ns.	1.37±0.93	ns.	0.12±0.95	ns.	ns.
Body weight (kg)	64.70±6.71	62.87±7.59	63.84±8.60	1.83±1.18	ns.	0.87±1.20	ns.	–0.97±1.23	ns.	ns.
Body height (cm)	163.65±5.53	164.19±5.39	162.76±5.83	–0.54±0.86	ns.	0.89±0.88	ns.	1.43±0.90	ns.	ns.
Body mass index	24.19±2.63	23.36±3.01	24.18±3.67	0.83±0.48	ns.	–0.01±0.49	ns.	–0.82±0.50	ns.	ns.
LBP disability	21.59±11.04	17.04±10.76	24.54±11.50	4.55±1.70	0.022	–2.95±1.75	ns.	–7.50±1.78	0.000	0.000

LBP – low back pain.
$p < 0.05$.
[1] According to *post hoc* multiple comparisons.
[2] Comparison among 3 approaches (One-Way ANOVA).
ns. – not statistically significant.

Table 2. Correlations (P-Pearson) between the variables in the study groups

Variable	P-Pearson correlation							
	1	2	3	4	5	6	7	8
1. LBP disability	–	–	–	–	–	–	–	–
2. Age (years)	–0.022	–	–	–	–	–	–	–
3. Body weight (kg)	0.187**	0.256**	–	–	–	–	–	–
4. Body height (cm)	0.030	–0.248**	0.163*	–	–	–	–	–
5. Body mass index	0.165**	0.382**	0.849**	–0.379**	–	–	–	–
6. Vigorous MET	0.247**	–0.045	0.010	–0.127*	0.078	–	–	–
7. Moderate MET	–0.034	–0.131*	0.036	–0.070	0.073	0.076	–	–
8. Walking MET	0.098	–0.131*	–0.143*	0.075	–0.172**	0.099	0.015	–
9. Total physical activity MET	0.131*	–0.014	–0.025	–0.101	0.033	0.803**	0.545**	0.427**

LBP – low back pain; MET – metabolic equivalent of task.
** $p < 0.01$; * $p < 0.05$.

DISCUSSION

In general, the results of this study have supported the hypothesis mentioned in the 'Introduction' part. This study shows that both low and high daily physical activity levels are associated with a higher LBP disability score. The study results concerning the relationship between LBP and physical activity level support previous studies and suggest that moderate levels of physical activity are associated with a lower risk of LBP. Similarly to previous studies, the current study shows that the relationship between the level of activity and LBP disability follows a U-shaped curve in young, female desk-job workers [21–24].

The previous studies have demonstrated that vigorous physical activity and workloads are hazardous for the lower back. Vigorous physical activity and strenuous workload are risk factors for LBP [16,21–24]. Bihari et al. [16] and

Kar et al. [25] have shown that women with heavy work loads had more musculoskeletal pain than others. Furthermore, Burdorf et al. [26] have found that sedentary workers who have to work in non-neutral positions are more at risk of LBP. Pataro and Fernandes (2014) state that LBP was associated with longer working hours, flexion and trunk rotation. Dynamic activity such as walking or running served as a protective factor [27]. Moreover, Caban et al. (2014) found that the percentage of workers with ankle and knee pain was significantly higher among workers who join regular moderate and vigorous PA programs than among those who do not attend such programs [28].

Similarly, in this research it was found that there was a significant relationship between the LBP disability score and vigorous MET score ($r = 0.247$, $p < 0.01$). This relationship was higher than the total physical activity MET score ($r = 0.131$, $p < 0.01$). Moreover, in this study, while the moderate physical activity level group's LBP disability score amounted to 17.04±10.76, the LBP disability score in the high physical activity level group was 24.54±11.50. Comparing to the moderate physical activity level group, the LBP disability scores in the low physical activity level group increased to 21.59±11.04.

Han et al. (1997) found that overweight women have a significantly increased likelihood of LBP and no significant interaction between body mass index and low back pain symptoms was found [29]. On the other hand, some studies have shown a statistically significant but weak positive association between body weight and LBP. Increased mechanical demands resulting from a higher body weight have been suspected of causing LBP [24,30–33]. Similarly, this study supports that body weight and BMI should be accepted as weak risk signals for LBP due to lower relations.

There are several limitations of this study. Both the intake data for the physical activity level and LBP disability scores are self-reported. The participants might have been confused by the complex questionnaire using terms which are often unfamiliar for them such as "moderate," "vigorous," etc., and self-report methods generally provide poor estimates of physical activity [34,35]. However, self-reports used in this study have been shown to be valid in the case of assessments of the physical activity level [18,36,37]. The short version of the IPAQ, especially, has been used in numerous international studies [38].

As previously noted, the Oswestry Disability Index is one of the most commonly used and validated scales and this index is simple, quick and inexpensive. Despite the advantages of self-reported methods for LBP disability, this questionnaire is subjective and there is no absolute measure of disability due to pain. Again, the participants may be confused by the double-barrelled questions [20]. The main strength of this study is the large size of the cohort and it is the 1st study to investigate the relationship between daily PA levels and LBP in young, female desk-job workers aged 20 to 40.

CONCLUSIONS

The main finding of this study is that there is a U-shaped relationship between physical activity and LBP disability score in young, female desk-job workers. In the case of young, female desk-job workers a moderate level of daily physical activity, and preventing body weight and fat gain should be recommended for prevention and management of low back pain. Increases in exercise training enhance skeletal muscle mass and decrease musculoskeletal pain [7]. Because of this, young, female desk-job workers should perform the levels of physical activity recommended by the World Health Organization, which is at least 150 min of moderate-intensity aerobic physical activity throughout the week or at least 75 min of vigorous-intensity aerobic physical activity throughout the week, or an equivalent combination of moderate and vigorous-intensity activity [7]. In addition, those women should avoid vigorous physical activity which may cause back muscle strains or ligament strains, such as: lifting heavy objects, twisting or sudden movements [10,21,22,26].

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