Research in Physical Education, Sport and Health
2020, Vol. 9, No. 2, pp.23-29
ISSN(Print):1857-8152; ISSN(Online):1857-8160

PROFESSIONAL EXPOSURE OF THE MUSCULOSKELETAL SYSTEM IN PATIENTS WITH LUMBAR SYNDROME

DOI: https://doi.org/10.46733/PESH209200231
(Original scientific paper)

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Abstract

Anthropological characteristics of the children often have been subject of researching in the kinesiology, but still there is a small number of researches that studied the influence of the residential status among the physical fitness and anthropometrical characteristics, especially in our state. The theoretical and empirical research was conducted on a sample of 2199 participants, drawn from 9 primary schools from the Municipality of Strumica, Republic of Macedonia, from which 5 are situated in rural and 4 in urban environment. The differences in the variables between the participants with various residential statuses are analyzed with multivariate and univariate analysis of variant (MANOVA and ANOVA). The results point to that boys from middle school age who are studying in rural areas have lower average values of the systolic pressure, lower height, lower weight, lower body fat, body mass index and they show better results in endurance in pull-ups, pin running 4x10 meters and three minute step test. Boys from the middle school age who are studying in rural areas show better results in the tests: flamingo, tapping with hand and raising the trunk in 30 seconds. Girls from the middle school age who are studying in rural areas have higher average values of the systolic pressure, lower height, lower body fat and show better results in fitness tests: flamingo, tapping with hand and raising the trunk in 30 seconds. On the basis of the achieved results it could be assumed that the environmental factors in different environments contribute for differences in the anthropological characteristics of the participants.

Key words: *Adolescent, Rural, Urban, Anthropometry, Physical fitness, Measurements*

Introduction

Lumbar pain is one of the most common painful conditions of modern human being and is one of the most common reasons for lost working days (1). People who haven't had no problems with their spine are very rare, both men and women (2,3). Approximately 70% of patients have heavier forms of lumbar disc disease in the most productive working age, i.e. between 30-50 years. 7% to 10% of the patients who have had acute pain in the cross converts to chronic, and these patients spend 80% of their money on health and social funds (2,4). In 70% of all cases of mechanical lumbar pain is due to the degenerative changes in the discuses and facet joints (5,6).

The degenerative changes in the lumbar intervertebral discus are accelerated under the influence of the genetic factors and constitutional weakness in the constitution of the discus, biochemical changes in its structure, the excessive biomechanical, static and dynamic pressures, among which are the excessive pressures related to the job, as well as the individual factors (age, nicotine, excessive body weight, weak bearing of the body, reduced level of fitness etc.) (7,8,9). Any anomaly of posture which acts on the spine can cause an irregular load in a particular segment of the spine, which is prematurely damaged and leading to a temporary illness on the disk. Asymmetric workload causes disruption in metabolism on the loaded side of the disk which is characteristically changing, the ring is damaged early (7). That part suffers the whole burden that otherwise, under normal load, is distributed to the entire disk. The poorer nutrition of the suppressed disc structures and the thrust is the reason for occurrence of less stable tissue, cracking, core migration and herniation (2,7).

The motive of this paper is to show the perception that excessive stato-dynamics occupations related to the type of profession represent an important factor in occurrence changes in the intervertebral spaces, which require timely treatment and prevention, and thus preventing disability due to lumbar pain. The aim of this paper is to determine the differences between the results of disability in patients with lower back pain in relation to the profession, as well as the relationship between the type of profession and the level of changes in the spine.

Materials and methods

The study is observational, descriptive and longitudinal. It has encompassed 200 respondents, patients with low lumbar pain registered in five (doctor's) surgeries for general medicine and three surgeries for physical therapy. The selection of the patients was done randomly, by using method of random sample from different municipalities.

The observational-descriptive part of the study covered collection, processing and assessment of the data of all respondents that participate in the study. Specially prepared survey questionnaire was used for the needs of the study, which was filled in by the examiner. The design and the composition of the questionnaire was based on case-control study anamnestic investigation (epidemiological and demographic characteristics: sex, age, place of residence, profession and social status; functional status: body mass index (BMI), functional status of the spinal column and manual muscular test; type of applied therapy: physical procedures and medication therapy). The respondents were asked to fill in a survey questionnaire so called, Oswestry Index, a special questionnaire for assessment of disability associated with lumbar pain.

Due to statistical processing and analysis of the obtained data, appropriate statistical methods were used. The statistical significance of the differences was established by use of appropriate statistical tests: Pearson's X^2 test; Student's t-test; Pearson's (r) correlation coefficient and Levene's test for equality of variance, Mann-Whitney U-Test of ranks, Wilcoxon test and Kolmogorov-Smirnov test (K-S test) of correspondence, from the group of nonparametric statistical tests, was used as well. Moreover, univariant logistic regression analysis and multivariant logistic regression analyses were used, too. The statistical significance was defined for $p<0.05$. The study was prepared by using statistical program SPSS, version 14.

Results

In the analysis of distribution of frequency used to the respondents by the variable sex, out of a total of 200 respondents, in both examined groups, most patients are female 62%, while 38% are male.

The analysis of the variable BMI in patients treated with physical therapy or medical therapy gives data that the average index of body mass in patients treated with physical therapy is 22.8, with standard deviation 3.938 and standard error 0.394. The average BMI in patients treated with medication therapy is 22.4, with standard deviation 3.060 and standard error 0.306.

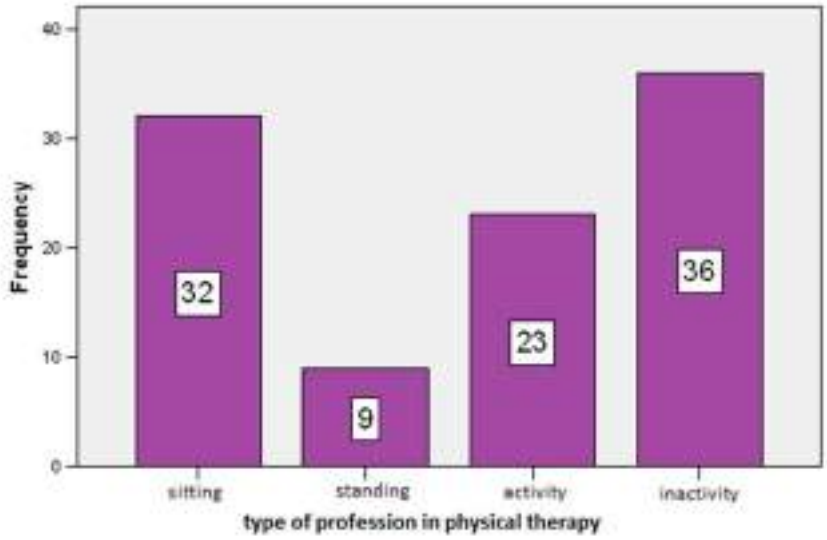
From what has been said above it can be concluded that the average BMI in both groups show that in average the patients are with normal body mass. The examination of statistical significance of the differences between the indexes of body mass in patients treated with physical therapy or medication therapy was carried out with Levene's Test for Equality of Variances. Test statistic (F) has value=5.532 and p-value (significance level) = 0.020, which implies they differ statistically significant. However, the t-test=0.786 with df=0.786 and p=0.433, indicates of absence of statistical significance of the differences.

The respondents treated with physical therapy were with average age of 51.84 years. The lower limit is 49.13 years, whilst the upper limit is 54.55 years. The standard deviation is 13.635, with a standard error of 1.364. The youngest patient is 18 years, while the oldest is 80 years old. The average age of the respondents that underwent medication therapy is 55.86 years. The standard deviation is 13.946, with a standard error of 1.395. The youngest respondent is 21 years, while the oldest is 91 years old. The examined groups are with average age of 53.8 years; t-test showed that there is statistical significance of the differences between the average age of the respondents ($p<0.05$).

The presence of deformities, the study showed that a higher percentage of patients had deformities in both groups. In patients treated with physical therapy, spinal deformities were found to be 84%, while without deformities 16%. In patients treated with medication therapy, with deformities are 60%, while without deformities are 40%. According to X^2 test = 14.286, there is a statistic significance of differences according to the outcome of the applied therapy and the presence or absence of deformities on the spine in the respondents ($p <0.05$) and a contingency coefficient of 0.258.

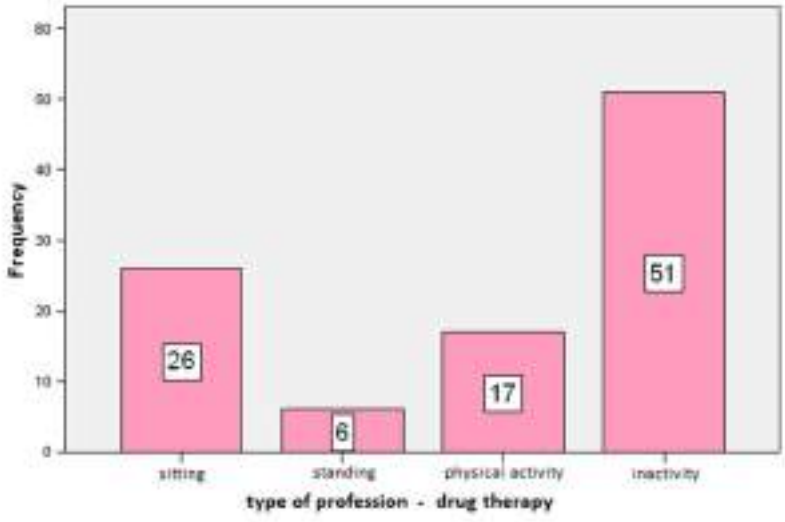
According to the analysis of the distribution of frequencies of the respondents treated with physical therapy according to the variable type of occupation, it was concluded that the highest percentage of patients are patients whose occupations are with physical inactivity 36%, occupations related to sitting 32%, occupations related to physical activity 23%, and 9% are professions related to standing (Graph 1).

Graph 1 Distribution of frequency of the respondents treated with physical therapy according to the variable type of profession



In the respondents treated with medical therapy according to the variable type of profession, 51% were found to be inactivity-related professions, 26% are occupations related to sitting, 17% are activity-related professions, and 6% belong to standing-related professions (Graph 2).

Graph 2. Distribution of frequency of the respondents treated with medical therapy according to the variable type of profession



It was concluded that according to the occupation highest percentage of representation are patients whose work is with physical inactivity (43.5%) and work related to sitting 29%. The Kolmogorov-Smirnov test of consent shows that differences are statistically significant ($p < 0.05$).

The results from the unvariant analysis of the factors deformities in respondents and age in respondents represent predicative values which independently, statistically significantly, are associated with the type of the therapy (physical/medication), at significance level $p<0.05$ (tab.1). It can be concluded that the outcome

does not depend on the patient's sex, whereas there is insignificant negative correlation between the age and the BMI.

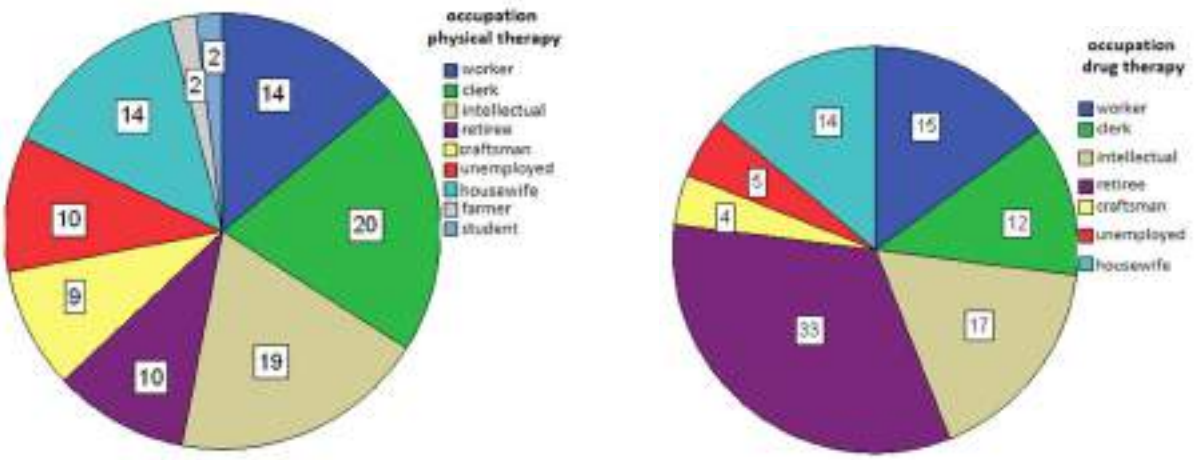
Table 1. Coefficients in multi-variant logistic regression analysis

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B		Correlations		
		B	Std. Error	Beta			Lower Bound	Upper Bound	Zero-order	Partial	Part
1	(Constant)	,574	,190		3,020	,003	,199	,948			
	deformities Yes/No	,353	,076	,317	4,631	,000	,203	,503	,267	,314	,310
	type of profession of the respondents	,043	,027	,108	1,567	,119	-,011	,096	,118	,111	,105
	age of the respondents	,007	,003	,184	2,619	,010	,002	,012	,145	,184	,175

According to the analysis of the frequency distribution of the respondents treated with physical therapy according to a variable occupation, it was concluded that out of a total of 100 respondents 20% are clerks 19% intellectuals, 14% workers, 14% housewives, 10% retirees, 10% unemployed, 9% craftsmen, 2% farmers and 2% students (Graph 3).

The analysis of the distribution of the frequencies of the respondents treated with drug therapy according to the variable occupation, concludes that out of 100 respondents 33% are retirees, 17% intellectuals, 15% workers, 14% housewives, 12% clerks, 5% unemployed and 4% farmers (Graph 3).

Graph 3. Distribution of frequency of the respondents treated with physical / medication therapy according to the variable occupation

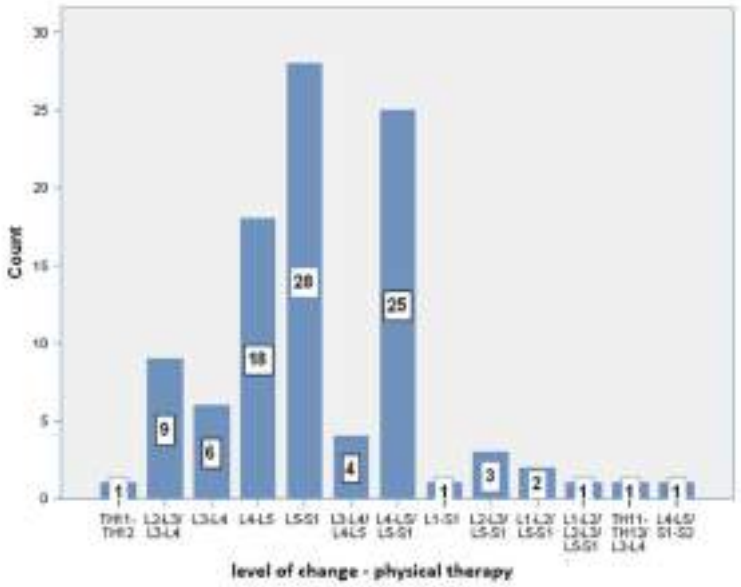


Kolmogorov-Smirnov test shows that the distribution of frequency is normal, the frequencies of the respondents in relation to the variability of occupation (physical therapy (1,852 p = 0,002 / medical therapy 2,058 p = 0.000) are determined as if they do not belong to the homogeneous group, differences were statistically significant (p <0.05).

According to the analysis of the distribution of frequency of the respondents treated with physical therapy according to a variable level of changes in the spine, it was concluded that out of a total of 100 respondents, the largest number (28) had changes on L_5-S_1, 25 respondents had changes on L_4-L_5 and L_5-S_1, 18 respondents had on L_4-L_5, 9 on level L_2-L_3 and L_3-L_4, 6 on level L_3-L_4, 4 on level L_3-L_4 and L_4-L_5,

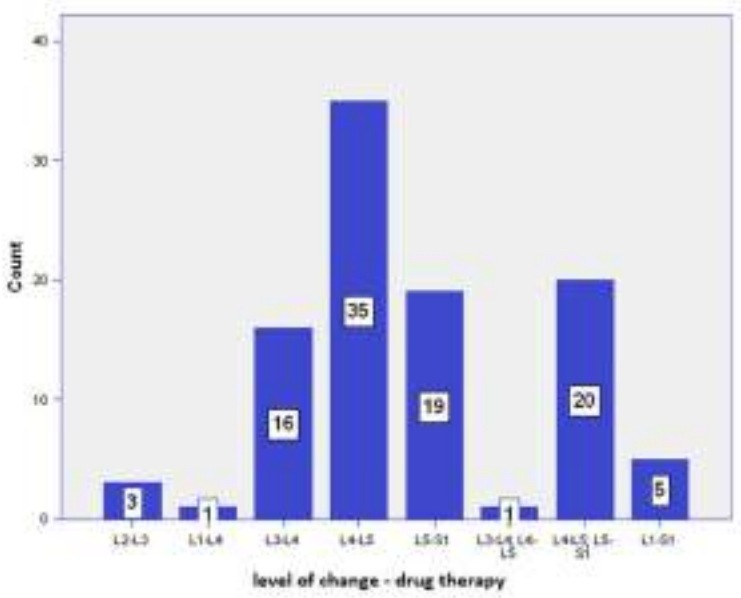
3 at level L2-L3 and L5-S1, 2 at level L1-L2 and L5-S1, while in the rest one by one at other levels. (Graph 4).

Graph 4. Distribution of frequency of the respondents treated with physical therapy according to the variable level of changes in the spine



According to the analysis of the distribution of frequency of the respondents treated with medical therapy according to a variable level of changes in the spine, it was concluded that out of a total of 100 respondents, the largest number 35 had changes on L4-L5, 20 respondents had changes on L4-L5 and L5-S1, 19 respondents had on L5-S1, 16 on level L3-L4, 5 on level L1-S1, 3 on level L2-L3, 1 on level L1-L2, and 1 on level L3-L4 and L4-L5 (Graph 5).

Graph 5. Distribution of frequency of the respondents treated with medical therapy according to the variable level of changes in the spine



Out of a total of 200 respondents, 98 respondents are subject to this part of the analysis. In 58 respondents, the profession is related to sitting, while in 40 respondents, the profession is related to physical activity.

Mann-Whitney U-test of rankings is 1160,000 at $p < 0.05$, which means that there is a statistically significant difference between the type of profession related to sitting, that is, with physical activity and the level of changes in the spine. When testing the statistical significance of differences between the type of occupation associated with sitting, that is between physical activity and the level of changes in the spine: Wilcoxon test=1980,000, shows that the profession related to sitting is associated with changes in L4-L5/L5-S1, and the profession related to physical activity with changes in L2-L3/L3-L4, at $p<0.05$. The Wald-Wolfowitz test=-9,744 shows the same at $p=0.000$.

Discussion

According to the study, most patients are female, but in the studies where the subject of analysis is the lumbar syndrome, they encompass different indicators in terms of the sex, and it can be concluded that there is no evidence of disposition for the health disorder in terms of the sex (2, 3, 4).

According to the analyses of the BMI of patients with lumbar syndrome, most authors establish that the greater part of the patients were with excessive body weight (7).

Analysis of a presence of deformities among the respondents with lumbar syndrome showed that the percentage of patients with lumbar syndrome that suffer deformities is very high and require special attention from a health point of view. Mostly, the deformities proceed were from the adolescences, however the percentage is not smaller related to the occupation type or to poor body and spine posture (8, 9).

Adaptation is needed in the work environment and inventory that suits the type of profession in accordance with the prescribed standards and norms and education of the working population for prevention of bad posture and sitting at the workplace (9).

Patients with lumbar syndrome are usually of an age at which they are the most productive (2, 10). Several authors reported that the development of the degenerative changes of the lumbar spine is closely related to the profession of the patients. Factors as recurrent microtrauma, cumulative effect of flexible and compressive injuries to the spine (4), work associated with frequent bending and rotation of the spine (10), prolonged sitting and standing at work or at home (2, 11), exposure to vibration, (especially for too long car or truck driving) (11, 12), contribute importantly to its development. Pope M.H. in vivo experiments showed that driving of motor vehicles can be a reason for occurrence of hernia of nucleus pulposus. The electromyography studies show presence of notable weakness of m. erector spinae after exposure to vibrations (12).

In the world more and more so-called "cost-effectiveness" analysis is made, during which the relationship between cost (cost of diagnostic procedures, conservative or operative treatment, payment of compensation from illness, financial consequences of lost business days) and the efficiency of some therapeutic treatment is estimated in order to assess what treatment is favorable for application(13, 14). There is evidence that the cost-effective period in overcoming industrial lumbar pain is to prevent chronic disabling lumbar pain by applying confirmed therapeutic methods in the early stages of treatment. Early intervention with adequate patient education in order to avoid weight loss of the organism, improving body mechanics and promoting cardiovascular conditioning, combined with a visit to the workplace by professional health professionals, has been confirmed that it reduces disability by 50%. The meaning is emphasized to avoid surgery and more precisely prediction the outcome of treatment (13, 14, 15).

Ehrmann-Feldmand in the examination of 389 patients who were receiving physical therapy due to spinal cord injury, have shown that the implementation of physical therapy during the first month of injury had a strong protective effect of returning to work within 60 days (14, 16).

The balance between pain, disability, physical harm and job losses are equally significant. If there is a significant discrepancy between the subjective statement to the patient about the degree of pain, disability and inability to work and medical assessment of the injury, diagnosis and physical damage, this could be explained by psychological distress or by personal exaggeration, which may predispose individuals to the development of chronic lumbar pain (11, 17).

Most authors agree that special training programs for spine column are much more effective if applied within the companies. Through education about the body biomechanics, ergonomics and further fitness activities, we can promote proper spine load and strengthen the muscles to prevent spine deformities and degenerative changes of the spine in the workplace. Healthy and strong muscles allow the body to withstand daily efforts (18).

Conclusion

Poor prolonged and forced posture of the body and the spine due to the type of profession as well as non-adherence to ergonomic principles at work, indicates that they are important drivers of development of degenerative changes in the lumbar spine that lead to disability due to lumbar pain. Special care is needed in prevention and their early detection prevention and timely treatment, by introducing a special educational program for the spine in the workplace, ergonomic improvements and organizational interventions. All in order to prevent severe consequences that arise, reducing the number of chronically ill workers as well as extension of working life of workers.

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