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The Structure of the Relationship of Physical Activity and Selected Factors Shaping the Condition and Self-assessment of Health of Patients with the Lumbar Spine Pain Syndrome

Struktura relacji aktywności fizycznej i wybranych czynników kształtujących stan i samoocenę stanu zdrowia pacjentów w zespole bólowym odcinka lędźwiowego kręgosłupa

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Abstract

Introduction. The pain syndrome of the lumbar spine is one of the most common civilization diseases and requires surgery in the case of a significant percentage of patients. It is also associated with a number of other health problems, with gender being an important factor that differentiates patients' health.

Aim. For this reason, our own research was focused on determining the structure of the relationship between physical activity and selected factors shaping the condition and self-assessment of health of patients in the lumbar spine pain syndrome depending on gender.

Material and Methods. The study sample consists of 205 patients hospitalized at the Department of Pediatric Neurosurgery and Neurosurgery of the Independent Public Clinical Hospital No. 4 in Lublin and at the Department of Pediatric Neurosurgery, Neurotraumatology and Neurosurgery, University Hospital No. 1 in Bydgoszcz. The Research used the *Physical Activity Questionnaire IPAQ* in Polish version, *Visual Analogue Scale VAS*, *Questionnaire for Depression Measurement KPD*, a proprietary questionnaire, as well as the results of laboratory tests of glucose concentration in the blood serum. The analysis of multidimensional relations between the variables was performed using the SEM structural equation modeling using the IBM SPSS 25 program with the AMOS extension.

Results. In the subgroups of women and men, models that were structurally similar, although different in the values of selected path coefficients, were developed, which explains the variances of: blood glucose concentration, BMI, intensity of depression symptoms and self-assessment of health condition. The developed structural model shows that physical activity with mediating participation of blood glucose concentration, BMI and depression is associated with self-assessment of health. The indirect dependencies of physical activity and self-assessment of health condition also occur with the mediating participation of the BMI index and blood glucose concentration, as well as the BMI index and depression.

Conclusions. The obtained data indicate that in the absence of health contraindications, an important element of interdisciplinary programs supporting the condition and self-assessment of health of patients with lumbar spine pain syndrome may be regular physical activity, adjusted to the needs and capabilities of the body. The differences between men and women suggest that preventive interventions should be gender-specific. **(JNNN 2021;10(4):153–161)**

Key Words: gender, health condition, pain syndrome of the lumbar spine, physical activity, self-assessment of health

Streszczenie

Wstęp. Zespół bólowy odcinka lędźwiowego kręgosłupa jest jedną z najczęstszych chorób cywilizacyjnych i u znacznego odsetka pacjentów wymaga operacji. Wiąże się to również z szeregiem innych problemów zdrowotnych, przy czym płeć jest ważnym czynnikiem różnicującym stan zdrowia pacjentów.
Cel. Badania własne koncentrowały się na określeniu struktury związku między aktywnością fizyczną a wybranymi czynnikami kształtującymi stan i samoocenę zdrowia pacjentów z zespołem bólowym odcinka lędźwiowego kręgosłupa w zależności od płci.
Materiał i metody. Badaną próbę stanowiło 205 pacjentów hospitalizowanych w Oddziale Neurochirurgii i Neurochirurgii Dziecięcej Samodzielnego Publicznego Szpitala Klinicznego nr 4 w Lublinie oraz w Oddziale Neurochirurgii, Neurotraumatologii i Neurochirurgii Dziecięcej Szpitala Uniwersyteckiego nr 1 w Bydgoszczy. W badaniu wykorzystano *Kwestionariusz Aktywności Fizycznej IPAQ*, *Wizualną Skalę Analogową VAS*, *Kwestionariusz do Pomiaru Depresji KPD*, autorską ankietę, a także wyniki badań laboratoryjnych stężenia glukozy w surowicy krwi. Analizę wielowymiarowych relacji między zmiennymi przeprowadzono za pomocą modelowania równań strukturalnych SEM za pomocą programu IBM SPSS 25 z rozszerzeniem AMOS.
Wyniki. W podgrupach kobiet i mężczyzn opracowano analogiczne pod względem strukturalnym modele, ale różniące się wartościami wybranych współczynników ścieżkowych, które wyjaśniają wariancje: stężenia glukozy we krwi, BMI, nasilenia objawów depresji oraz samooceny stanu zdrowia. Opracowany model strukturalny wskazuje, że aktywność fizyczna przy pośredniczącym udziale stężenia glukozy we krwi, BMI i depresji wiąże się z samooceną stanu zdrowia. Pośrednie zależności aktywności fizycznej i samooceny stanu zdrowia występują również przy mediującym udziale wskaźnika BMI i stężenia glukozy we krwi oraz wskaźnika BMI i depresji.
Wnioski. Uzyskane dane wskazują, że przy braku przeciwwskazań zdrowotnych istotnym elementem interdyscyplinarnych programów wspierających stan i samoocenę stanu zdrowia pacjentów w zespole bólowym odcinka lędźwiowego kręgosłupa może być regularna aktywność fizyczna, dostosowana do potrzeb i możliwości organizmu. Różnice między mężczyznami i kobietami sugerują, że interwencje zapobiegawcze powinny być dostosowane do płci. **(PNN 2021;10(4):153–161)**
Słowa kluczowe: płeć, stan zdrowia, zespół bólowy odcinka lędźwiowego kręgosłupa, aktywność fizyczna, samoocena stanu zdrowia

Introduction

Pain syndrome of the lumbar spine is one of the most common civilization diseases. Estimated data indicate that, regardless of gender, nearly 80.0% of people over 40 have experienced at least one severe pain episode [1–3].

The risk of developing the pain syndrome of the lumbar spine increases with age, with the first episode of pain usually occurring between the ages of 30 and 50. Other risk factors include low levels of physical activity, being overweight or obese, having a genetic predisposition, and performing work that involves bending down and/or lifting heavy objects frequently [4–6]. Back pain may develop in the course of various mental health problems [7,8].

The incidence of low back pain is higher in women (60.9%), and the factors causing it are mainly professional activities, such as lifting weights, standing posture leaning forward, sitting leaning forward and sitting at the computer three or more days per week. In turn, older age, low education, hypertension and smoking are associated with pain in the lumbar spine in men. It has also been shown that, regardless of gender, loneliness is associated with back pain, which is a significant risk factor for the development of reactive mental disorders [9].

Research shows that diabetes mellitus and depressive disorders are among the most common diseases in this group of patients [4–6,10]. A major health problem of the analyzed population is also excess body weight and obesity, in particular abdominal obesity, which is the leading element of the metabolic syndrome, increases the risk of other disease [11–13].

A 5 kg increase in starting weight in women is projected to increase the risk of back pain by 4.0–6.0% over the next 12 years [14]. Available studies show that people with abdominal obesity have jobs associated with a sedentary lifestyle [15]. In addition, one of the important factors that make it difficult for people suffering from ailments from the musculoskeletal system to maintain optimal health is still insufficient health education [16], especially ergonomic education on prevention and work overload [17] and the resulting lack of physical activity, defined as any type of exercise of the body, caused by muscle work, which causes energy expenditure exceeding the level of resting energy, which in turn increases the risk of recurrence of lumbar pain [18,19].

An analysis of the literature shows that gender does not differentiate the frequency of exacerbations in back pain syndromes [18], but there was a tendency for the metabolic syndrome to occur more frequently in women with low back pain [20]. Moreover, gender has been shown to be an important biological determinant of changes taking place in the body under the influence of exercise, which at the same time validates including this

variable in the concept of own research as a moderator of the predicted dependencies [21–25].

Some empirical studies have also found that self-esteem varies depending on gender. Women tend to underestimate their health, which may be related to more frequent reporting of health problems [26–29]. However, other studies have not found gender to influence these types of behaviors [30].

The results of research on the severity of depression symptoms in the group of women and men are also ambiguous. Although most scientific evidence confirms their higher level in women [31,32], there are also indications that in the peri-postoperative period women show a better mental condition than men [33]. Whereas, the latest research suggests that gender does not differentiate the symptoms of depression in patients with pain in the lumbar spine during neurosurgical treatment. However, a relatively small group of patients was covered, hence the reported effects seem to require further empirical verification [34].

European studies show that women are more likely to complain of greater anxiety than poor health (56.0% vs. 25.0%). Estimates show that in countries where the situation of women is unfavorable, women are more likely to report weakened health. It cannot be ruled out that economic gender equality, which often results in greater inclusion of women in the labor market, may adversely affect the self-esteem of health in a situation where they assume greater workload and responsibility while maintaining the tasks of caring for the home and family [35].

Five-year observations have shown that self-assessment of health status is a weaker predictor of mortality in women than in men. It has also been found that in both men and women, negative emotions are associated with worse self-esteem of health, while in men, these experiences are associated with a serious illness (e.g. heart disease, cancer) in conjunction with other negative life events, while in women, they reflect a wider range of factors that are not specific to a life-threatening disease (e.g. joint disease). The observed regularity may explain, therefore, the sexual dimorphism in terms of self-assessment of health, which at the same time seems to be associated with other documented discrepancies in the state of physical and mental health and health-related behaviors [36].

Taking into account the above premises and the ambiguity and insufficient amount of available scientific evidence on the issue in the population of patients diagnosed with lumbar spine pain syndrome, our own research was focused on verifying the moderating role of gender in the relationship of physical activity and selected factors influencing the state and self-assessment of health in this group chronically ill people.

Assuming that regular physical activity is associated with the occurrence of favorable changes in the state of psychophysical health, based on the adopted theoretical frameworks, in a quasi-experimental model, a cross-sectional research was designed to answer the question what is the structure of the relationship between physical activity, blood glucose levels, BMI index, intensity of symptoms characteristic of depressive disorders and self-assessment of health of patients in the lumbar spine pain syndrome depending on gender?

Material and Methods

Subjects

The study sample consists of 205 people hospitalized in the Department of Pediatric Neurosurgery and Neurosurgery of the Independent Public Teaching Hospital No. 4 in Lublin (N=160; 78.0%) and in the Department of Neurosurgery, Neurotraumatology and Pediatric Neurosurgery, University Hospital No. 1 in Bydgoszcz (N=45; 22.0%). Detailed characteristics of the subjects are presented in Table 1. The criteria for including patients in the studies were: 1) pain syndrome

Table 1. Sociodemographic characteristics of the studied patients

Variable	N	%
Place of hospitalization		
Lublin	160	78.0
Bydgoszcz	45	22.0
Gender		
Women	105	50.2
Men	100	49.8
Marital status		
Single	15	7.5
Married	98	47.8
Cohabitation	51	24.5
Widow/widower	26	12.7
Divorced	15	7.5
Education		
Primary	25	12.2
Vocational	61	29.8
Secondary	85	41.5
Higher	34	16.6
	M	SD
Age	39.31	3.25
Number of hospitalization	3.10	2.84
Period of hospitalization	5.06	4.29

of the lumbar spine confirmed by a diagnosis by a doctor from a hospital of the third level of reference, with a neurological or orthopedic or rehabilitation or neurosurgical specialization; 2) duration of the pain syndrome of the lumbar spine — at least 3 months; 3) hospitalization for at least 2 days in the department of neurosurgery; 4) conservative treatment, including pharmacological treatment; 5) severity of pain, specified between 4 and 6 points on the VAS scale; 6) voluntary, informed consent to participate in the study.

The exclusion criteria included: 1) diagnosis of a defective root syndrome, i.e. patients with paresis, asymmetry of reflexes, hypoaesthesia or dysfunction of the sphincters were excluded from the study; 2) failure to meet the inclusion criteria; 3) answering some of the questions in the survey questionnaires; 4) no assessment of blood glucose levels.

The study sample was based on a stratification randomization scheme [37], which was carried out in terms of gender (women, men), age range (early adulthood, middle adulthood, late adulthood, seniors), marital status (single, married, cohabitation, widower, divorced) and the level of education (primary, vocational, secondary, higher) in the layers dividing the population of patients diagnosed with pain syndrome of the lumbar spine. The method used allowed to reproduce the analyzed group of patients, making the analyzed probabilistic sample in the scope of the above-mentioned variables.

Instruments

The research used the Physical Activity Questionnaire IPAQ [38,39], Visual Analogue Scale (VAS) [40], Questionnaire for Measurement of Depression KPD [41] and a self-made questionnaire. The analysis also included the results of standard laboratory tests of blood glucose levels performed in patients after admission to the hospital. Blood glucose concentration tests were performed during the second day of hospitalization of fasting patients in accordance with the procedure for this type of test.

Statistical Analysis

The data obtained during the study in an anonymized form were entered into the IBM SPSS 25 statistical program with the AMOS extension, with the help of which statistical analysis were performed. The description of the researched sample was based on the calculation of the percentage distribution of the qualitative data frequency, the mean values, standard deviation, minimum and maximum of quantitative parameters. The shape of the variables distribution was estimated on the basis of the Kolmogorov–Smirnov test. Correlation matrix analyzes were performed using the Spearman's rho coefficient. Analysis of multidimensional relations between variables was performed by modeling structural equations SEM, in which the Generalized Least Squares (GLS) method was used. In the models presented the values placed next to the arrows indicate the estimates of standardized coefficients for a given path. The paper adopted the limit level of committing the first type of error, consisting in the rejection of the true hypothesis assuming the lack of relationships between the analyzed variables, amounting to 0.05. The predicted relationships were verified at the two-sided significance level.

Ethical Approval

The research was carried out in accordance with the provisions of the Helsinki Declaration of 1995, as amended in 2013. The research protocol was approved by the Ethics Committee of Medical University of Lublin (Project identification code: KE-0254/181/2016). They were voluntary, and each respondent gave written informed consent to participate in them. The respondents were provided with all necessary information and explanations about the conducted research. In addition, individuals were informed about the confidentiality of the data provided and about the possibility of receiving feedback on individual results. In case of doubts, they had the opportunity to obtain additional explanations. The research was carried out on the second day of hospitalization of the patients. The time of the questionnaire research was not limited, in practice it lasted 15 minutes. However, laboratory tests were carried out on the basis of the procedures in force during their performance.

Results

Initial analysis in the population of the studied patients were aimed at verifying whether there was a relationship between physical activity and the severity of pain (Table 2).

Table 2. The values of correlation coefficients between physical activity and the intensity of pain in the studied group of patients

Variable	Physical activity	
	Women	Men
Intensity of pain syndromes	–0.47*	–0.67**

*Correlation significant at the level of 0.05 (two-sided); **Correlation significant at the level of 0.001 (two-sided)

The obtained data indicate that in the group of women studied there is a moderate, inversely proportional relationship between physical activity and the intensity of pain from the lumbar spine, which shows that the more often the patients engage in physical activity, the lower the intensity of pain experienced by them.

In the population of the studied men, it was shown that physical activity is strongly negatively associated with the intensity of pain in the lumbar spine, which indicates that with the increased involvement of patients in physical activity, the intensity of pain in the lumbar spine decreases.

In the next step based on the adopted theoretical assumptions, a model was developed to explain the structure of relationships between selected factors reflecting the health of patients.

The performed analysis of the model fit to the data indicates that it reflects the nature of the relationship between the parameters under consideration. The correction for the complexity of the CMIN/DF model, amounting to 1.68, according to the conservative criterion, does not exceed the critical limit of 2. This means that the constructed model correctly reproduces the variance-covariance matrix from the sample. RMSEA, i.e. the mean square root of the approximation error, is in the range from 0.013 to 0.032 and proves the accuracy of the constructed model. The GFI fit index and its adjusted AGFI counterpart are — 0.97 and 0.96, respectively, while the IFI fit index (0.97) is close to the limit confirming the perfect fit of the model (1.00), thus indicating the correct reflection of the model's character relationships occurring in the population. The significance level of the assumption about the PCLOSE model mismatch is statistically insignificant (0.78) and also confirms the fit of the model.

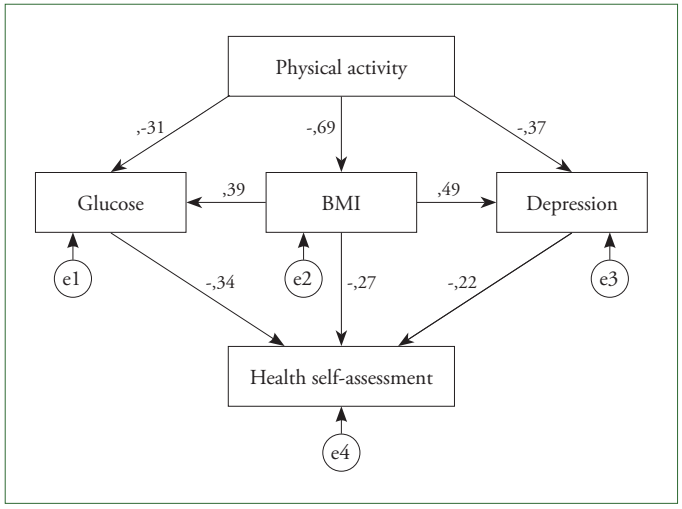

Figure 1. Structural model of the relationship of physical activity and selected factors shaping the condition and self-assessment of the surveyed women (Labels: e1-…–e4 — random factors)

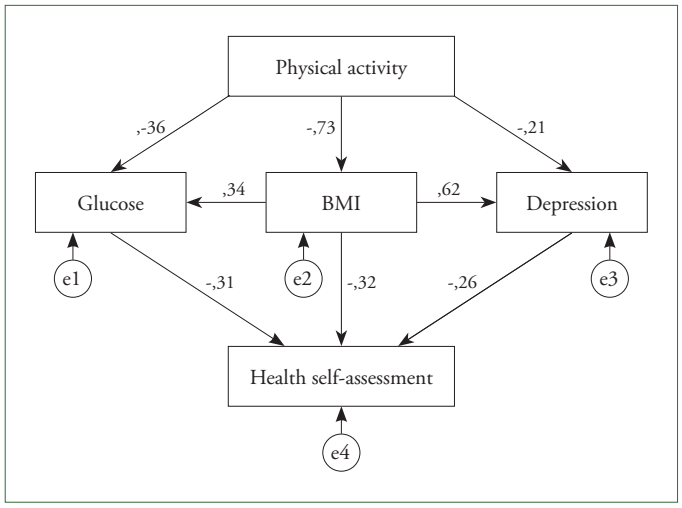

Figure 2. Structural model of the relationship of physical activity and selected factors shaping the condition and self-assessment of the surveyed men (Labels: e1-…–e4 — random factors)

In the group of studied women, the developed model explains 37.0% of the variance in blood glucose levels, 52.0% of the BMI variance, 47.0% of the variance in the severity of depression symptoms and 53.0% of the health self-assessment variance (Figure 1).

In the group of studied men, the developed model explains 41.0% of the variance in the blood glucose level, 54.0% of the BMI variance, 49.0% of the variance in the severity of depression symptoms and 51.0% of the health self-assessment variance (Figure 2).

It has been shown that regardless of gender, the level of physical activity with a mediating contribution of glucose in the blood serum is associated with self-assessment of health. In addition, it was noted that physical activity with the mediating contribution of the BMI index coexists with self-assessment of health status, and is also associated with the analyzed variable explained by the severity of depression symptoms.

The analysis shows that the mechanism explaining the structure of the relationships between physical activity and selected factors shaping the condition and self-assessment of health of the examined patients in the lumbar spine pain syndrome in the case of women and men is similar in terms of structure, but based on the test results comparing two parameters, analyzed on the basis of the values statistics exceeding the range (–2; 2), statistically significant intergroup differences were noted between the values of the two path coefficients. The observed discrepancies concern the relationship between physical activity and the severity of depression symptoms and the relationship between the BMI index and the severity of depression symptoms.

Based on the obtained results, it should be stated that regular physical activity is more important for the severity of depression symptoms in women than for men, and the value of the body mass index is more important for the mood of men than women. However, in the case of other aspects shaping the relationship between the analyzed factors reflecting the health condition of patients in the lumbar spine pain syndrome, no statistically significant differences were found between the path coefficients included in the model.

Discussion

Preliminary analyses show that both in the group of women and men diagnosed with the pain syndrome of the lumbar spine, there is an inversely proportional relationship between physical activity and the severity of pain experienced, which indicates that in the absence of contraindications for health, regular exercise reduces the discomfort experienced by patients.

The obtained results of own research are consistent with the observations of other researchers [23,24]. It has been shown that patients with back pain, accompanied by tension headaches, showed a lower level of physical activity than healthy people. In addition, patients reported a reduced willingness to undertake physical effort due to the symptoms they experienced. It was also observed that a sedentary lifestyle, increasing the pain experienced by the spine, leads to excessive absenteeism from work, and the risk is particularly high in the case of patients qualified for neurosurgical treatment.

In this context, it seems important to conduct research aimed at determining the factors supporting an interdisciplinary approach to the process of treatment and rehabilitation of patients with lumbar spine pain syndrome. With this in mind, the model was constructed explaining the specificity of the relations between physical activity and selected factors shaping the condition and self-assessment of health of patients with the lumbar spine pain syndrome, which turned out to be structurally analogous in the group of women and men. It has been noted that the leading factor shaping the self-assessment of the health condition of the respondents is systematic physical activity, the increase of which, by minimizing the concentration of glucose in the blood serum, the value of the BMI index and the severity of symptoms of depression, is associated with an increase in the self-assessment of health. Moreover, it has been shown that higher involvement in regular physical exercise, by lowering the body mass index and blood glucose concentration, or by reducing the BMI index and the severity of depression symptoms, is associated with an increase in self-assessment of one's health condition.

The obtained results of own research seem to be understandable in the light of contemporary empirical studies confirming that regardless of gender, the level of physical activity is an important predictor of self-assessment of health [42–45]. Kwon's team, conducting research in the population of patients diagnosed with type 1 diabetes, showed that the self-assessment of the health status of the subjects who were not physically active was significantly lower than those of those participating in systematic aerobic training. On the other hand, in a study by Johansson, devoted to verifying the interactions between physical activity and socio-economic factors and self-assessment of health, which was carried out on a sample of 5,326 people, it was found that participants with a high level of physical activity and low education compared to people who rarely train and with higher education displayed higher self-assessment of their health. It was also observed that subjects who were physically active and exhibited a low socio-economic status had a higher chance of maintaining optimal self-assessment of health than people with high socio-economic status, but not trained.

Similar conclusions were also drawn from epidemiological studies conducted in the population of 2,814 people in China. On the basis of the obtained results, it was found that the self-assessment of health status was negatively associated not only with the concentration of glucose in the blood serum, but also with the level of total cholesterol. However, it has not been reported to correlate with being overweight and obesity [45], which, at the same time, is not confirmed by the results of our own research, which showed these types of relationships. The observed discrepancies seem to justify the need for further research in this area [46].

In the predictive model developed by the Stamatakis team, which analyzed the relationship between leading a sedentary lifestyle, BMI value and blood glucose levels in blood (measured in the fasting state), it was shown that sedentary lifestyle and body mass index value were associated with elevated glucose levels in the blood serum, although after including the BMI index in the model, the observed effect was weaker than in the case of the relationship between a sedentary lifestyle and the level of glucose in the blood serum [46,47]. In addition, research on a sample of 1,502 adults from northern Sweden found that the leading risk factors for premature aging include overweight and obesity, low health self-assessment, and insufficient physical activity, which are often associated with features of the metabolic syndrome [47].

These observations are consistent with the results of studies by other authors, which show that people leading a sedentary lifestyle are more prone to depression [48,49], which is also associated with the risk of being overweight or obesity. The Yáñez-Sepúlveda team observed that

people who maintained a normal BMI value spent more time than overweight and obese subjects on moderate and vigorous exercise and spent a smaller part of the day sitting or lying down. It was also noted that the weekly physical activity in the group of people with normal body weight was higher than in the overweight and obese subjects. This allowed the researchers to formulate a conclusion that a higher BMI value is associated with less intense physical effort and its lower level.

On the other hand, other studies have confirmed that regular physical exercise is conducive to achieving the desired effects in terms of mental health — a reduction in the level of perceived anxiety and the intensity of depression symptoms was observed [50,51]. Comparable conclusions have also been drawn from research aimed at verifying the relationship between moderate and vigorous physical activity and the perceived psychophysical health of 10,621 adults. It has been proven that the increase in physical activity is accompanied by a higher self-assessment of health condition and a lower value of the BMI index. On the other hand, in studies carried out in the student population, using structural equation modeling, it was shown that physical activity, eating habits and BMI value explain 26.5% of self-assessment of health, while improper eating habits and being overweight were positively correlated with negative health assessment. Moreover, a positive attitude to physical exercise was positively related to the motivation to perform it.

Gender differences were also observed in the authors' own research, which shows that regular physical exercise is more important for the mood of women than men, while body mass index is less important. It seems, therefore, that promoting physical activity and taking into account the identified socio-demographic differences in the constructed preventive programs may increase the effectiveness of future interventions in the field of public health, which should contribute not only to the self-assessment of health status, but also to the quality of life of patients in pain syndrome of the lumbar spine [52,53].

In summary, it should be emphasized that both the results of our own research and evidence from other empirical studies indicate that an important factor shaping the health of men and women hospitalized in neurosurgery clinics is regular physical exercise, which allows us to conclude that the implementation of initiatives promoting systematic physical activity should contribute to the psychophysical improvement of the health condition of the group of patients in question [54].

Conclusions

The obtained data indicate that in the absence of health contraindications, an important element of interdisciplinary programs supporting the condition and self-assessment of health of patients with lumbar spine pain syndrome may be regular physical activity, adjusted to the needs and capabilities of the body. The differences between men and women suggest that preventive interventions should be gender-specific.

Implications for Nursing Practice

Taking into account the results of the research carried out in the population of patients diagnosed with the pain syndrome of the lumbar spine, it seems important to formulate implicative conclusions that can be used in nursing practice. Considering that:

- both in the population of women and men diagnosed with the pain syndrome of the lumbarspine, physical effort is associated with a reduced intensity of existing pain, ta king into account the lack of contraindications for health, it is worth considering including this form of activity in the preventive intervention recommended to patients;
- physical activity, reducing the concentration of glucose in the blood serum, the value of the BMI index and the severity of symptoms of depression, strengthens the self-assesment of health, it should be noted that an important element of interdisciplinary programs supporting the above-mentioned dimensions of the health condition of patients with lumbag spine pain syndrome can be adapted to the needs and possibilities the body's regular exercise training;
- the mood of women compared to men depends to a greater extent on regular physical exercise, and the value of the BMI index is more important for the well-being of men than women, the developer interdisciplinary preventive interventions should be adjusted to the specifics of individual gender differences.

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