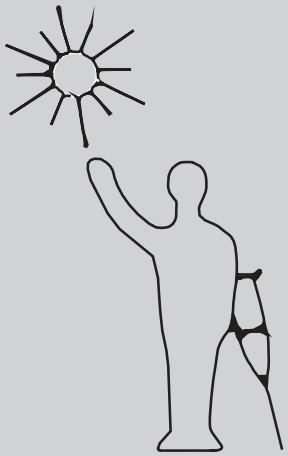

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Effect of Yoga in the Modulation of Heart Rate Variability in Patients with Breast Cancer

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F – editing the final version

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Abstract

Introduction: The aim of this study was to examine the effect of yoga on heart rate variability in patients with breast cancer in an outpatient rehabilitation program.

Material and methods: Eighty-four patients with breast cancer were eligible for this study. After the exclusion of 7 women, 77 participants were randomly allocated to a yoga exercise program (group A, n=33) and Pilates exercise program (group B, n=44). Heart rate variability parameters were evaluated at baseline, after six and twelve months of yoga exercises.

Results: After twelve months of performing yoga exercises, standard deviation of the normal-to-normal intervals (SDNN) improved by 5.53 ms ($p<0.001$), square root of the mean of the squared differences between adjacent normal RR interval (RMSSD) improved by 4.91 ms ($p<0.01$), total power (TP) improved by 279.78 ms2 ($p<0.001$), very low frequency (VLF) improved by 109.76 ms2 ($p<0.01$), low frequency (LF) improved by 88.38 ms2 ($p<0.01$), high frequency (HF) improved by 77.60 ms2 ($p<0.05$), and stress index (Si) improved by 137.24 c.u. ($p<0.01$). Based on the results after 12 months, women in group A showed significantly better results compared to group B in SDNN by 3.28 ms ($p<0.05$), RMSSD by 3.34 ms ($p<0.05$), TP by 170.33 ms2 ($p<0.05$), HF by 64.33 ($p<0.05$), and Si by 56.49 c.u. ($p<0.05$).

Conclusions: Performing the yoga exercise program resulted in an increase of the parasympathetic and baroreflex effects on the cardiovascular system and a decrease in the tonic effects of the sympathetic nervous system. Yoga should be considered as an effective tool in normalizing the functional state of the autonomic nervous system.

Key words: **breast cancer, heart rate, pilates, yoga**

Introduction

There is a growing body of research that emphasizes the important role of heart rate variability (HRV) in reflecting the balance between the sympathetic and parasympathetic nervous system [1-6]. Heart rate variability is a simple and informative indicator of autonomic dysfunction and predictor of cardiovascular pathology [7-10]. Heart rate variability reflects the activity of the cardiovascular system, regulation mechanisms of the whole organism, as well as the individual's

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emotional state. The findings of Lee et al. [11] indicate that HRV analysis could be used as a prognostic factor and survival in patients with breast cancer. The importance of assessing HRV in this population is due to the close association with adverse surgical effects and autonomic dysfunction in breast cancer survivors. Furthermore, assessment HRV has become an efficient test of woman's cancer rehabilitation [3,4].

High rates of cardiovascular diseases in patients with breast cancer are associated with the excessive activity of the sympathetic nervous system. Specific cancer therapies have a great impact on autonomous regulation of cardiac rhythm, which reflects the slightest changes in organism [6,8-10]. Physical activity is increasingly recognized as effective method of reducing cardiovascular risk and improving autonomic modulation for patients who survived cancer.

A growing body of research demonstrates the benefits of yoga exercises for improving mental and physical health in patients with breast cancer. This research suggests that yoga exercises can be an effective tool for relieving fatigue, arm pain, improving sleep disturbance and fitness outcomes in patients with cancer [12-19]. However, the impact of yoga's effects on HRV in breast cancer survivors is not well understood. Most of the current Pilates studies are primarily focused on the impact on fitness, shoulder range of motion, upper extremity circumference, and quality of life in patients with breast cancer [20-22]. Therefore, the question of the effect of Pilates on HRV also requires further investigation.

Consequently, the effects of yoga and Pilates on autonomic dysfunction in patients with breast cancer performed in a rehabilitation setting is relevant.

Material and methods

This research received approval from the Khortytsia National Academy and followed the tenets of the Declaration of Helsinki. Comprehensive sociodemographic characteristics of patients are shown in Table 1. There were no baseline differences between the studied groups. The focus on women aged between 50 and 60 years was used, because of the incidence of breast cancer is highest in this age category.

CONSORT flow diagram is presented at figure 1.

Tab. 1. Sociodemographic and treatment-related characteristics of study participants

Characteristics A (n=30) B (n=40)		Groups		p
		A (n=30)	B (n=40)	
Age, (M±SD)		59.10±1.37	59.40±1.24	>0.05
Race	White, n (%)	29 (97%)	38 (95%)	>0.05
	Black, n (%)	1 (3%)	2 (5%)	>0.05
Married/committed relationship, n (%)		28 (93%)	36 (90%)	>0.05
High school graduate, n (%)		16 (53)	20 (50%)	>0.05
College graduate, n (%)		13 (43%)	18 (45%)	>0.05
Post-graduate, n (%)		1 (3%)	2 (5%)	>0.05
Body mass index, kg/m^2, (M±SD)		24.11±0.38	24.20±0.44	>0.05
Treatment	Radiotherapy, n (%)	27 (90%)	38 (95%)	>0.05
	Chemotherapy, n (%)	3 (10%)	2 (5%)	>0.05
Surgery type (mastectomy by Madden), n (%)		30 (100%)	40 (100%)	>0.05
Time since treatment completion, months (M±SD)		5.13±2.87	5.13±2.79	>0.05
Cancer Stage	Stage 1, n (%)	9 (30%)	14 (35%)	>0.05
	Stage 2, n (%)	21 (70%)	26 (65%)	>0.05

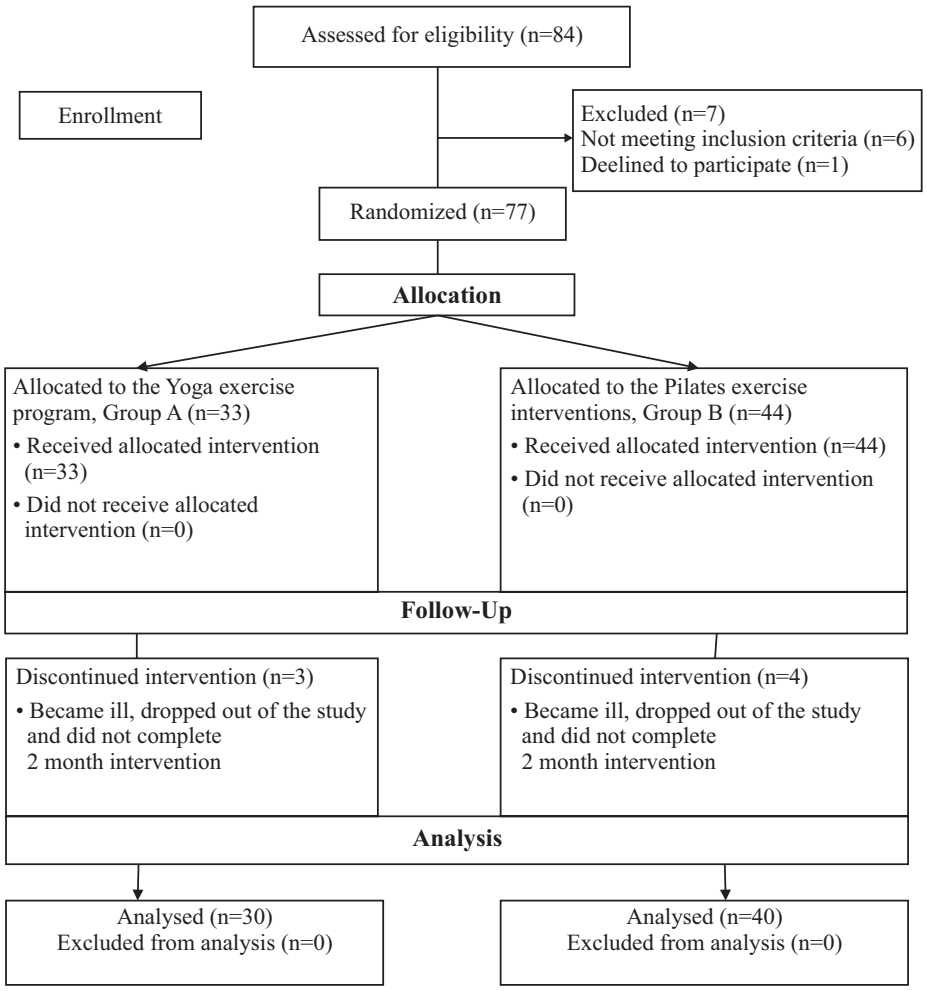

Fig. 1. CONSORT flow diagram

Eighty-four patients with breast cancer were eligible for this study. The inclusion criteria were as follows: 50–60 years of age, recent history of modified radical mastectomy, 6 months after breast cancer surgery, body mass index no more than 25 kg/m^2, consent to participate in the study. Exclusion criteria consisted of women with bilateral mastectomy, chronic obstructive lung disease, metastases, ischemic heart disease, III stage of breast cancer.

After the exclusion of 7 women, 77 participants were randomly allocated to a yoga exercise program (group A, n=33) and Pilates exercise program (group B, n=44). We used Pilates for control group B since there was some research about the effect on HRV in patients with breast cancer. Heart rate variability parameters were evaluated at baseline, after six and twelve months of yoga exercises. 7 women did not complete the interventions and dropped out. Attendance rate of the sessions in group A was 92%, in group B was 90%. Finally, 30 women of group A and 40 women of the group B completed the intervention and were analyzed. There were no baseline differences between the two intervention groups.

Short-term recordings of the *beat*-to-*beat* intervals were used to obtain the following HRV parameters: SDNN (standard deviation of the normal-to-normal intervals), RMSSD (square root of the mean of the squared differences between adjacent normal RR interval), TP (total power), VLF (very low frequency), HF (high frequency), LF/HF ratio, SI (stress index) [23]. HRV indicators were assessed with the electrocardiographic complex KARDIOLAB (Scientific and Technological Centre of Radio Electronic Medical Equipment and Technologies XAI-Medica of the National Aerospace University, Kharkiv, Ukraine, registration certificate number 6037/2007, conformity certificate number UA-MI/2p-2765-2009).

Data recorded (mean, and standard error of the mean) were analyzed using Statistica for Windows (version 8.00). Data was evaluated for normality assumption, homogeneity, and occurrence of extreme scores before concluding analysis. The distribution of the data recorded was tested using the Shapiro-Wilk test. This analysis was performed as preliminary measure before parametric calculations of the analysis of difference. Dependent *T*-tests were used to analyze HRV parameters in one group between baseline and post-intervention. Independent sample t-tests were used to compare post-intervention HRV parameters between two groups of women.

Group A attended three Yoga exercises sessions per week for twelve months. The components of yoga exercise program were based on the patients' individual baseline functional state of the cardiovascular system (FSCS) that was classified as average, lower-than-average and low level by the following form [24]:

FSCS=1,778-0,006×(50+10×(A-58,97)/5,47))-0,012×(50+10×(HR-73,38)/8,98)) + +0,099×(50+10×(MBV-3,35)/0,63))-0,076×(50+10×(LVW-4,09)/ 0,79)),

in which FSCS – functional state of the cardiovascular system;

A – age, years;
HR – heart rate, beats/min;
MBV – minute blood volume, l/min;
LVW – left ventricular work, kgm;
1,778 – absolute term of regression;
0,006; 0,012; 0,099; 0,076 – multiple regression coefficients;
58,97; 5,47; 73,38; 8,98; 3,35; 0,63; 4,09; 0,79 – constant coefficients.

Proposed yoga exercise program for patients with breast cancer also differentiated depending on the duration and intensity of the session, the number of exercise repetitions, as well as their percentage. The breathing exercises performed with an emphasis on a long exhalation and were coordinated with movements. The duration of asana retention, its complexity and number of repetitions was different depending on the level of the functional state of the woman. Exercise intensity was gradually increased from low to moderate. Women constantly concentrated on their own feelings while doing the exercises. Respiratory exercises were performed in stable sedentary poses that allowed to concentrate attention on the act of breathing. The general structure and content of yoga-therapy exercises for women with different levels of functional state of cardiovascular system is given at Figure 2.

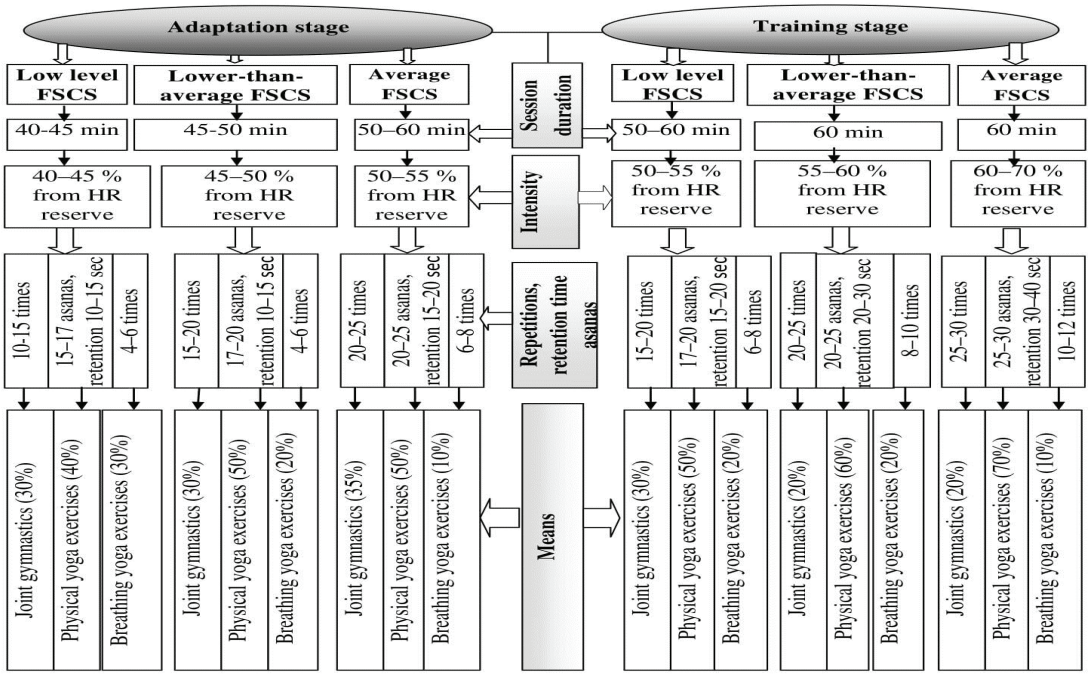

Fig. 2. Structure and content of yoga program for breast cancer patients

Group B participated in Pilates exercises 3 times per week for twelve months. Aggregated time of Pilates also depended on the functional state of the cardiovascular system and lasted from 40-45 minutes at the adaptation rehabilitation stage to 1 hour at training stage. The intensity was varied from 40-45% to 60-70% of reserve heart rate. Heart rate was monitored using Polar in both interventions. The Pilates program included active and passive stretching, exercises for good posture, and resistive exercises, with their intensity related to the cardiovascular functional status. Resistance and flexibility exercises targeted at all major muscle groups. All exercises were performed with musical accompaniment and clearly showed by physiotherapist.

Pilates mat work was the most important part of the session for women at adaptation and training stages. It was necessary for the formation of initial Pilates skills, principles and successful task solution in patients with breast cancer.

Results

The dynamics of HRV parameters in group A is shown in Table 2 during the outpatient rehabilitation. Based on the results of the six-month monitoring, it was found that the yoga intervention resulted in a significant improvement in autonomous modulation.

Tab. 2. Dynamics of HRV indicators in group A during outpatient rehabilitation

Indicator	Baseline data	Duration of rehabilitation	
		six months	twelve months
SDNN (ms)	21.19±1.08	23.60±1.04**	26.72±1.17•••
RMSSD (ms)	18.59±1.50	21.64±1.18	23.50±0.99••
TP (ms^2)	440.91±42.08	541.96±45.82**	720.69±61.93•••
VLF (ms^2)	113.29±18.02	160.32±14.19*	223.05±27.93••
LF (ms^2)	167.92±20.33	179.92±21.61	256.30±27.47••
HF (ms^2)	158.96±22.44	199.29±21.67	236.56±22.57•
LF/HF (c.u.)	1.82±0.33	0.98±0.10**	1.35±0.19
Si (c.u.)	361.80±32.21	265.36±17.22**	224.56±18.66••

Notes: * – p<0,05; ** – p<0,01; compared with the baseline data; • – p<0,05; •• – p<0,01; ••• – p<0,001 compared with the baseline data

Analysis of HRV showed that SDNN intervals significantly improved by 2.41 ms (p<0.01), TP improved by 101.05 ms^2 (p<0.01), VLF improved by 47.03 ms^2 (p<0.05), and Si improved by 96.44 c.u. (p<0.01). Dynamics of spectral indicators in group A showed an increase in TP, but changes for spectral components were different. The structure of HRV was characterized by an increase in overall variability due to preferential growth of VLF component and a slight increase of HF and LF parameters. Sympathicotonia reduction was indicated by a decrease in LF/HF ratio by 0.84 c.u. (p<0.01).

After twelve months of performing yoga, the above mentioned parameters of HRV also changed significantly: SDNN improved by 5.53 ms (p<0.001), RMSSD improved by 4.91 ms (p<0.01), TP improved by 279.78 ms^2 (p<0.001), VLF improved by 109.76 (p<0.01), LF improved by 88.38 ms^2 (p<0.01), HF improved by 77.60 (p<0.05), and Si improved by 137.24 c.u. (p<0.01). Dynamics of overall activity of the autonomic effect on the heart rate was characterized by a significant increase in all spectral components (VLF, LF and HF).

Tab. 3. Dynamics of HRV indicators in group B during outpatient rehabilitation

Indicator	Baseline data	Duration of rehabilitation	
		six months	twelve months
SDNN (ms)	21.30±1.08	23.36±1.07	23.44±1.19
RMSSD (ms)	19.46±1.96	17.77±1.05	20.16±1.08
TP (ms^2)	436.91±41.04	545.71±30.36*	550.36±41.02
VLF (ms^2)	98.74±12.35	211.01±30.54**	150.73±32.46
LF (ms^2)	161.94±14.96	191.61±20.50	227.36±36.43
HF (ms^2)	173.79±32.76	143.09±14.74	172.23±20.65
LF/HF (c.u.)	1.82±0.25	1.69±0.31	1.49±0.22
Si (c.u.)	351.85±25.53	290.72±19.86	281.05±17.69•

Notes: * – p<0,05; ** – p<0.01 compared with the baseline data; • – p<0.05 compared with the baseline data

Women of group B showed a substantial increase TP by 108.80 ms^2 (p<0.05) due to preferential growth of VLF by 112.27 ms^2 (p<0.01) after 6-month performing of Pilates exercises (Table 3). A significant decrease was observed in Si by 70.80 c.u. (p<0.05), which indicated an exertion reduction of regulatory processes after 12 months of Pilates training.

Women of group A showed significantly better results compared to group B in SDNN by 3.28 ms (p<0.05), RMSSD by 3.34 ms (p<0.05), TP by 170.33 ms2 (p<0.05), HF by 64.33 (p<0.05), and Si by 56.49 c.u. (p<0.05) after 12 months (table 4).

In general, the beneficial effect of yoga exercises on autonomic regulation was characterized by an increase of the parasympathetic and baroreflex effects on the cardiovascular system and a decrease in the tonic effects of the sympathetic nervous system.

Tab. 4. Comparison of HRV indicators between the group A and group B during outpatient rehabilitation

Indicator	six months		twelve months	
	group A	**group B**	**group A**	**group B**
SDNN (ms)	23.60±1.04	23.36±1.07	26.72±1.17	23.44±1.19•
RMSSD (ms)	21.64±1.18	17.77±1.05*	23.50±0.99	20.16±1.08•
TP (ms^2)	541.96±45.82	545.71±30.36	720.69±61.93	550.36±41.02•
VLF (ms^2)	160.32±14.19	211.01±30.54	223.05±27.93	150.73±32.46
LF (ms^2)	179.92±21.61	191.61±20.50	256.30±27.47	227.36±36.43
HF (ms^2)	199.29±21.67	143.09±14.74*	236.56±22.57	172.23±20.65•
LF/HF (c.u.)	0.98±0.10	1.69±0.31*	1.35±0.19	1.49±0.22
Si (c.u.)	265.36±17.22	290.72±19.86	224.56±18.66	281.05±17.69•

Notes: * – $p<0.05$ compared data between groups for six months; • – $p<0.05$ compared data between groups for twelve months

Discussion

This study demonstrated the significant impact of yoga exercises can have on improving the functional state of autonomic nervous system in patients with breast cancer.

Based on the results after 12 months of participating, it was found that Yoga exercise intervention was a more valuable and effective tool than Pilates for increasing overall HRV, especially of the parasympathetic nervous system.

The results agreed with recent studies that patients with breast cancer present with dramatically low HRV values [2,6,8,10,11] and that regular physical exercise is considered as effective tool for enhancing autonomic function and balance [3,4].

Previous studies [13,15,25] have been focused on the effects of yoga on reducing fatigue, depression and stress in patients with breast cancer.

A number of studies have investigated different yoga breathing patterns and meditative practice on HRV in healthy volunteers [25-28], but information about effects of yoga on autonomic regulation in patients with breast cancer is almost absent.

Unique to this study, we considered the current level of the functional state of cardiovascular system of our participants in the proposed yoga exercise program. The prescribed yoga program for our participants with breast cancer also varied depending on the duration and intensity of the session, the number of exercise repetitions. The combination of various asanas technique, breathing exercises and relaxation modes had a great impact on the autonomic function and balance in patients with breast cancer. The findings obtained in the current study demonstrated the benefits of long-term yoga practice in reducing stress and increasing overall HRV in patients with breast cancer.

Despite these strengths, the current research also had some important weaknesses. HRV analysis was analyzed only by short-term indicators and differences in emotional condition of women could have an impact on the obtained results. Further studies are needed to investigate the effectiveness of yoga on HRV parameters in heterogeneous population.

Conclusions

Performing the yoga exercise program resulted in an increase of the parasympathetic and baroreflex effects on the cardiovascular system and a decrease in the tonic effects of the sympathetic nervous system. Yoga should be considered as an effective tool in normalizing the functional state of the autonomic nervous system.

References

1. Tyagi A, Cohen M. Yoga and heart rate variability: A comprehensive review of the literature. Int J Yoga. 2016 Jul-Dec; 9(2):97–113.
2. Crosswell AD, Lockwood KG, Ganz PA, Bower JE. Low heart rate variability and cancer-related fatigue in breast cancer survivors. Psychoneuroendocrinology. 2014 Jul;45:58–66.
3. Odynets T, Briskin Y. Impact of personality-oriented programs of physical rehabilitation on the heart rate variability in women with post-mastectomy syndrome. Physiotherapy Quarterly. 2016;24(2):4–8.

4. Prystupa E, Odynets T, Briskin Y, Svistelnyk I. Features of heart rate variability in breast cancer survivors with various types of attitude to the disease. Adv Rehab. 2018;(3):5-9.
5. Cramer H, Lauche R, Klose P, Lange S, Langhorst J, Dobos GJ. Yoga for improving health-related quality of life, mental health and cancer-related symptoms in women diagnosed with breast cancer. Cochrane Database Syst Rev. 2017 Jan 3;1:CD010802.
6. Stachowiak P, Milchert-Leszczyńska M, Falco M, Wojtarowicz A, Kaliszczak R, Safranow K, Kornacewicz-Jach Z. Heart rate variability during and after chemotherapy with anthracycline in patients with breast cancer. Kardiol Pol. 2018;76(5):914–16.
7. Custodis F, Reil JC, Laufs U, Bohm M. Heart rate: A global target for cardiovascular disease and therapy along the cardiovascular disease continuum. J. Cardiol. 2013;62:183–7.
8. Lee DH, Park S, Lim SM, Lee MK, Giovannucci EL, Kim JH, et al. Resting heart rate as a prognostic factor for mortality in patients with breast cancer. Breast Cancer Res Treat. 2016 Sep;159(2):375–84.
9. Aune D, Sen A, o'Hartaigh B, Janszky I, Romundstad PR, Tonstad S, Vatten LJ. Resting heart rate and the risk of cardiovascular disease, total cancer, and all-cause mortality – A systematic review and dose-response meta-analysis of prospective studies. Nutr Metab Cardiovasc Dis. 2017;27:504–17.
10. Giese-Davis J, Wilhelm FH, Tamagawa R, Palesh O, Neri E, Taylor CB, Kraemer HC, et al. Higher vagal activity as related to survival in patients with advanced breast cancer: an analysis of autonomic dysregulation. PsychosomMed. 2015;77(4):346-55.
11. Arab C, Dias DP, Barbosa RT, Carvalho TD, Valenti VE, Crocetta TB, Ferreira M, Abreu LC, Ferreira C. Heart rate variability measure in breast cancer patients and survivors: A systematic review. Psychoneuroendocrinology. 2016 Jun;68:57–68.
12. Eyigor S, Uslu R, Apaydın S, Caramat I, Yesil H. Can yoga have any effect on shoulder and arm pain and quality of life in patients with breast cancer? A randomized, controlled, single-blind trial. Complement Ther Clin Pract. 2018 Aug;32:40–5.
13. Dangi AA, Aurangabadkar SK, Deo MV. Effect of a Structured Yoga Program on Fatigue, Depression, Cardiorespiratory Fitness, and Quality of Life in a Postmenopausal Breast Cancer Survivor. Int J Yoga. 2018 Sep-Dec;11(3):255–57.
14. Daniel C. Hughes, Nydia Darby, Krystle Gonzalez, Terri Boggess, Ruth M. Morris, Amelie G. Ramirez. Effect of a six month yoga exercise intervention on fitness outcomes for breast cancer survivors. Physiother Theory Pract. 2015 Oct; 31(7): 451–60.
15. McCall M. Yoga intervention may improve health-related quality of life (HRQL), fatigue, depression, anxiety and sleep in patients with breast cancer. Evid Based Nurs. 2018 Jan;21(1):9.
16. Tang MF, Chiu HY, Xu X, Kwok JY, Cheung DST, Chen CY, Lin CC. Walking is more effective than yoga at reducing sleep disturbance in cancer patients: A systematic review and meta-analysis of randomized controlled trials. Sleep Med Rev. 2019 May 24;47:1–8.
17. Lin Zuo X, Li Q, Gao F, Yang L, Jie Meng F. Effects of yoga on negative emotions in patients with breast cancer: A meta-analysis of randomized controlled trials. Int J Nurs Sci. 2016;3:299–306.
18. Danhauer SC, Addington EL, Cohen L, Sohl SJ, Van Puymbroeck M, Albinati NK, Culos-Reed SN. Yoga for symptom management in oncology: A review of the evidence base and future directions for research. Cancer. 2019 Jun 15;125(12):1979–89.
19. Cramer H, Lange S, Klose P, Paul A, Dobos G. Yoga for breast cancer patients and survivors: a systematic review and meta-analysis. BMC Cancer. 2012; 12: 412.
20. Pinto-Carral A, Molina AJ, de Pedro Á, Ayán C. Pilates for women with breast cancer: A systematic review and meta-analysis. Complement Ther Med. 2018 Dec;41:130-40.
21. Panchik D, Masco S, Zinnikas P Hillriegel B1, Lauder T, Suttmann E, Chinchilli V, McBeth M, Hermann W. Effect of Exercise on Breast Cancer-Related Lymphedema: What the Lymphatic Surgeon Needs to Know. J Reconstr Microsurg. 2019 Jan;35(1):37-45.
22. Zengin Alpozgen A, Razak Ozdincler A, Karanlik H, Yaman Agaoglu F, Narin AN. Effectiveness of Pilates-based exercises on upper extremity disorders related with breast cancer treatment. Eur J Cancer Care (Engl). 2017 Nov;26(6).
23. Task Force of the European Society of Cardiology and the North American Society of Pacing and Electrophysiology. Heart rate variability. Standards of measurement, physiological interpretation, and clinical use. Eur Heart J. 1996;17(3):354–81.
24. Briskin Y, Odynets T. Prediction algorithm of the functional state of women with postmastectomy syndrome. Slobozhanskyi herald of science and sport. 2016;4(54): 22–25.
25. Vadiraja HS, Rao RM, Nagarathna R, Nagendra HR, Patil S, Diwakar RB, Shashidhara HP, et al. Effects of Yoga in Managing Fatigue in Breast Cancer Patients: A Randomized Controlled Trial. Indian J Palliat Care. 2017 Jul-Sep; 23(3): 247–252. Peng CK, Henry IC, Mietus JE, Hausdorff JM, Khalsa G, Benson H, et al. Heart rate dynamics during three forms of meditation. Int J Cardiol. 2004;95:19–27.
26. Ghiya S, Lee CM. Influence of alternate nostril breathing on heart rate variability in non-practitioners of yogic breathing. Int J Yoga. 2012;5:66–9.
27. Telles S, Singh N, Balkrishna A. Heart rate variability changes during high frequency yoga breathing and breath awareness. Biopsychosoc Med. 2011;5:4.
28. An H, Kulkarni R, Nagarathna R, Nagendra H. Measures of heart rate variability in women following a meditation technique. Int J Yoga. 2010;3:6–9.

The evaluation of foot arch and the distribution of foot-to-ground contact forces in young football players as well as their impact on the occurrence of injuries

A – preparing concepts
B – formulating methods
C – conducting research
D – processing results
E – interpretation and conclusions
F – editing the final version

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Abstract

Introduction: The foot is an important element of the human motor system. It is a single mechanism of propulsion and amortisation. Sports people, football players in particular, are especially prone to limb loading. In this discipline, the first contact with the sport as well as training begin at a very young age. In order to prevent traumas and injuries among young players, it is important to assess their foot arch.

Material and methods: A group of 30 players aged 13-18 who played football at the Progres Sports Academy in Cracow and at the lower- and upper-secondary schools in Cracow under the patronage of Marcin Gortat were tested. The tests involved the podoscopic evaluation of both feet, the test of both feet on a tensometric mat and a survey. To assess the longitudinal foot arch, Clarke's angle was applied in the authors' own tests. The transverse arch was evaluated using the Wejsflog index.

Results: For the overwhelming majority of the persons tested, the most common type of longitudinal arch was flat foot. Only a scant minority had a tendency towards hollow foot. The most common injuries among the examined footballers included muscle pulling and tearing as well as sprains and overloading. Most players suffered injuries of thigh muscles, knee joints, tarsal joints and feet.

Conclusions: It was confirmed that there was a significant correlation between the intensity of training and the frequency of injuries.

Key words: **flat foot, injuries, football, foot diseases**

Introduction

The issue concerning the build and performance of the foot has been debated in numerous scientific publications for many years. Feet are one of the most important elements of the human motor system responsible for amortisation, endurance when maintaining a standing position for a long time and a strong take-off while walking and running [1]. Assessing foot arch is crucial in terms of diagnostics, particularly in the puberty period. Some deviations from proper foot arch are reflected in the pathogenesis of diseases developing in other parts of the body [2].

In contemporary sport, injuries are a common phenomenon and difficult to avoid even in the case of recreational physical activity [3]. Particular attention should be paid to youth, especially football as they are prone to excessive loads of the lower extremity musculoskeletal system. The formation of the foot arch in football players is determined by a wide range of factors such as body mass, type of

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footwear, the surface on which training sessions are held and training loads [4,5].

Undoubtedly, football is the most popular and most widespread team sport in the world. The Polish Football Association (PFA) has 530000 male players and 8000 female players registered [6]. According to the literature, the number of injuries in this sport is estimated to constitute 50-60% of all sports injuries. The research carried out on football players revealed that as many as 97% of players suffered musculoskeletal system injuries at some point in their career [4].

The demands that football players have to face are of particular significance in the case of young footballers. Initial training in Poland starts at the age of 8-9 [7]. The cumulating microinjuries and excessive training loads in a young growing body may lead to post-injury degenerative changes and to the recurrence of the injury [7,8]. The form and intensity of training should be appropriately adapted to the age and physical capabilities of a child. Many players are not aware of the disorders of foot build and functioning and thus, by training regularly and intensively for competitions, they increase the severity of the pathology or are conducive to the occurrence of injury [9]. A complete examination of all the foot dimensions and arches as well as the influence of significant factors on its shape will make it possible to assess the predisposition for injuries [10,2]. Therefore, the aim of this work was to assess foot arch and the distribution of foot-to-ground contact forces in young football players as well as their influence on the frequency and types of injuries.

Material and method

The study included 30 male football players aged 13-18 (mean age 14.5 years). The group consisted of 20 boys from the U-15 category from the Progres Sports Academy in Cracow and 10 players from the lower- and upper-secondary schools in Cracow under the patronage of Marcin Gortat. All the participants (N=30, 100%) had training experience of more than 5 years.

Among the examined players, mean length of the left foot was 25.5 cm and of the right foot – 25.3 cm. Moreover, mean width of the forefoot was measured and it was 9.5 cm in the case of the left foot and 9.6 cm in the case of the right foot. Mean width of the hindfoot was 5.8 cm for both feet.

The study involved a podoscopic assessment of both feet, an examination of both feet on a tensometric mat and a survey.

During the podoscopic test, both feet were assessed simultaneously. Each of the players was standing on a podoscope with bare feet placed parallel to each other. A proper body posture was maintained, upper limbs were held freely along the trunk. The selected parameters were assessed with the use of a 2-D podoscan with built-in sensors and a laptop with special software analysing the image obtained from the scanner. Owing to the construction of this equipment, the obtained result was real (1:1 scale) and the software made it possible to record and store images as well as automatically measure and compare potential asymmetries and angles [2]. In order to assess the longitudinal foot arch, the Clarke's method was applied. The transverse foot arch was evaluated by means of the Wejsflog index.

A computerized platform (tensometric mat) was used to assess the distribution of forces on the plantar side of the foot, which makes it possible to find the location of excessive loads. After the examination on the mat, the following measurements were obtained: centre of gravity location, maximum support point, the plantar side of the right and left foot surface expressed in cm^2, the distribution of weight between the two limbs and the distribution of loads between the left and right leg.

The survey included 26 closed-ended questions and personal information questions regarding such data as gender, age, body mass and body height. The questions referred to the frequency of training sessions, types and location of injuries and treatment applied in young footballers. The players responded to the questions independently after being provided the survey instructions.

Statistical methods

The statistical analysis was performed with the use of the STATISTICA 13.1 PL software. The quantitative analysis included calculations of the number and percentage of players in particular sports classes. In order to find correlations between the variables, chi-square test (χ^2) was applied. In the case of small groups, Yates's correction or Fisher's exact test was applied. The results were significant when their probability value (p) was lower than the significance level $\chi = 0.05$ ($p < 0.05$).

Results

Descriptive statistics:

podoscopic examination

As far as longitudinal foot arch is concerned, the most common type found on the basis of the Clarke's angle was flat foot (for both legs). The norms for the Clarke's angle which were accepted for the players aged 13 ranged between 32 and 57° for the left foot and 32-59° for the right foot. In turn, the norms for the study participants aged 18 ranged from 42° to 54°. While analysing the transverse foot arch on the basis of the Wejsflog index, it was noted that the largest group of the examined players had a proper foot arch both in the left and right foot (table 1).

Tab. 1. Type of longitudinal and transverse foot arch in the examined footballers

			increased	normal	decreased	flat
Longitudinal foot arch	Left foot	N	0	10	0	20
		%	0	33	0	67
	Right foot	N	0	12	0	18
		%	0	40	0	60
Transverse foot arch	Left foot	N	0	26	0	4
		%	0	87	0	13
	Right foot	N	0	22	0	8
		%	0	73	0	27

examination on a tensometric mat

The analysis of the statistical data revealed that several participants (N=8) had their centre of gravity moved forward. A slightly lower number of subjects (N=5) had it moved to the left or forward to the right (N=4). The remaining study participants had their centre of gravity moved backward to the right (N=3), forward to the left (N=3), backward (N=3) and located in the middle of the support polygon (N=3). The lowest number of people (N=1) had it moved backward to the left.

The next variables to be examined were the middle point of the maximum foot load and the symmetry of foot load. In over a half of the study participants (N=16, 54%) had their middle point of the maximum foot load in the right hindfoot. Considerably fewer individuals had it in the left hindfoot (N=7, 23%) and right forefoot (N=6, 20%). It was least common in the left forefoot (N=1, 3%). In turn, in the case of foot load symmetry, the largest number of players loaded their left limb (N=15, 50%). Bearing loads by the right limb was less common (N=10, 33%). The lowest number of the study participants (N=5, 17%) bore loads symmetrically by the right and left limb.

Another factor investigated in this study was the distribution of foot-to-ground contact forces. In some of the study participants (N=12, 40%), larger loads were borne by the left foot, while a smaller group (N=6, 20%) bore larger loads on the right foot. In the remaining participants (N=12, 40%), foot-to-ground contact forces were distributed similarly.

Finally, the percentage distribution of loads between the forefoot and hindfoot was analysed. In the case of the left foot, the largest loads were noted in the hindfoot (N=17, 57%), while slightly fewer participants bore loads on the forefoot (N=7, 23%). In turn, the remaining players demonstrated equal distribution on both sides (N=6, 20%). The percentage distribution between the forefoot and hindfoot of the right limb indicated that the largest group of individuals (N=19, 63%) bore more load on the forefoot, and less load on the hindfoot (N=8, 27%). A proper equal distribution of loads was observed least frequently (N=3, 10%).

survey

The first survey question concerned the frequency of training sessions per week. The majority of the study participants (N=21, 70%) trained 4 times, a smaller group of players (N=7, 23%) trained 5 times, while the lowest number (N=2, 7%) trained 6 times a week. None of the participants selected answers "once", "twice", "3 times" or "7 times".

In the question concerning the duration of one training session, the majority of the respondents (N=22, 73%) selected the answer "90 minutes" and participants (N=8, 27%) choose "more than 90 minutes". None of the players selected the answer "45 minutes" or "60 minutes".

The next question regarded warming up before the training. The vast majority of the respondents (N=29, 97%) always did warm-up exercises, while considerably fewer participants (N=1, 3%) did them only sometimes. None of the respondents selected the answer "rarely" or "never" (table 2).

Another question concerned applying stretching exercises after the training session. Half of the respondents (N=15, 50%) sometimes did stretching exercises, while slightly fewer participants (N=12, 40%) did them after every training. In turn, the lowest number of the study participants (N=3, 10%) rarely did stretching exercises. Nobody selected the answer "never".

Tab. 2. Implementation of warm-up exercises before the training and stretching exercises after the training among the examined players

		N	%
Warm-up before the training	Always	29	97
	Sometimes	1	3
	Rarely	0	0
	Never	0	0
Stretching after the training	Always	12	40
	Sometimes	15	50
	Rarely	3	10
	Never	0	0

The next question referred to injuries. The majority of the study participants (N=26, 87%) had incurred a sports injury, while the remaining ones (N=4, 13%) had never experienced that.

In the following question, the respondents were asked about the location of the injury. The most common answers included the muscles of the thigh (N=15, 58 %) and the knee joint (N=11, 43%). The foot and the ankle joint constituted the same percentage of all the injuries (N=10, 39%). The least common injuries were hip joint injuries (N=7, 27%) calf muscle injuries (N=6, 23%).

The next question regarded the type of the injury that the study participants incurred. The most common type of injury included a pulled muscle (N=12, 46%) and muscle strain (N=11, 42%). Sprains (N=10, 39%), overloads (N=9, 35%), abrasions and local hematomas (N=7, 27%) were slightly less common. Fractures (N=4, 15%) and inflammations (N=4, 15%) constituted a scant minority, while the least common injuries included dislocations (N=3, 12%) and tears (N=2, 8%).

The question concerning the recurrence of the same injury received more answers that were positive (N=16, 53%). The remaining respondents (N=14, 47%) did not incur the same injury again.

Finally, the players were asked about the type of injury that they incurred due to football. The most common answers included ankle joint sprains, Achilles tendon damage and knee joint injury (table 3).

Tab. 3. Type of injury experienced by the examined players

	Achilles tendon injury		Ankle sprain		Knee joint injury
	N	%	N	%	N
Yes	12	46	10	39	11
No	14	54	16	61	15

Statistical analysis-correlations

The correlations between the loads borne by lower limbs and selected factors were examined. The correlation between the loads borne by lower limbs and the frequency of injuries among the examined players was the first correlation to be assessed. No statistically significant correlations between the variables were noted either for the left or for the right limb (table 4).

Tab. 4. Correlation between loads borne by a lower limb and the frequency of injuries

	Chi-square	df	p
Loads borne by the left lower limb and the frequency of injuries	0.099	df=2	P=0.95152
Loads borne by the right lower limb and the frequency of injuries	1.533	df=2	P=0.46454

The second correlation under examination was the correlation between the loads borne by lower limbs and types of foot arch in the study participants. The analysis did not reveal statistically significant correlations between the variables either for the left or for the right foot (table 5).

Tab. 5. Correlations between loads borne by a lower limb and foot arch

	Chi-square	df	p
Loads borne by the left lower limb and left foot arch	3.807	df=2	P= 0.14907
Loads borne by the right lower limb and right foot arch	0.988	df= 2	P=0.60998

The third correlation investigated was the relation between the number of training sessions per week and the frequency of injuries among the study participants. The analysis revealed a statistically significant correlation between the examined variables (table 6).

Tab. 6. Correlation between the frequency of training sessions per week and the frequency of injuries

	Chi-square	df	p
The frequency of training sessions per week and the frequency of injuries	6.923	df=2	P=0.03139

Discussion

Football is the most popular sport in the world. The research conducted by the International Federation of Association Football (FIFA) in 2006

indicated that in that period approximately 265 million people played football in the world [11]. Like in the majority of sports, playing football poses several risks of injuries in players, both during competitions and when played for leisure.

According to Brito et al. [12], the prevalence of injuries among players reaches the level of 1.2 to 4.7 per 1000 hours of exposure during a season. Faude, Robler and Junge [13] indicated that the prevalence of injuries among players aged 13-19 was at the level of 1-5 cases per 1000 hours of training. Leininger, Knox and Comstock [14] reported that the ratio of injuries connected with age was at the level of 0.4% among children aged 2-4, 12.3% among 5-9-year-olds, 49.0% in the age group of 10-14-year-olds and 38.4% among children aged 15 to 18. The study by Żołnikowski et al. [6] revealed that the largest percentage, i.e. 85% of football injuries, were incurred by players below 23 years of age, where under-15-year-olds constituted 45% of them. Our study revealed that injuries related to playing football were common and were incurred by the majority of the examined players.

According to Adamczyk and Luboiński [15], the most common injuries include pulling a muscle (10-47% of the injuries) and ankle joint sprains (28-35%). Similar conclusions were also drawn by Grzybowski and Radzioch [16], who examined 339 cases in the period of 6 years and observed that sprains were the most common injuries (52.6%). Other injuries were muscle and ligament damage (20.7%) and abrasions (17.6%). What is more, injuries usually occurred in the knee joint (35.7%), ankle joint (21.8%) as well as thigh (16.7%) and calf (9.9%). According to other authors, i.e. Hadała et al. [17], the most common types of injuries included abrasions, pulling and sprains, while the least common ones were muscle strains and fractures. The studies also confirmed that the knee joint (33%) and ankle joint (30%) were the most common injury locations. Similar results were obtained in our study. The examined players usually experienced pulling, strains, sprains and overloads. They most often regarded thigh muscles, knee joint, ankle joint and foot.

The lower limb is the most common location of an injury so, undoubtedly, proper foot build is of high significance. Each foot dysfunction can lead to the disorders of the biokinematic chain of the whole body. Therefore, in terms of prevention, getting to know correlations between indicators describing the foot and somatic body features and between foot dysfunctions and motor system disorders and lifestyle diseases is extremely important. Moreover, performance of feet significantly influences gait and run quality and affects the results obtained in numerous sports [18, 2, 19, 20]. Gueen et al. [21] observed that while running, individuals with flat feet had their forefoot and midfoot considerably loaded, due to which they were more prone to injuries.

According to the results obtained by Grabara [22], sports training leads to the lowering of longitudinal and transverse foot arch and toe deformities. Her results are also similar to the results of research by Lautor et al. [23], who observed a frequent occurrence of flat foot and hallux valgus. The correlation between adaptive changes occurring in the foot as a result of training and training experience was also revealed by Farhan et al. [9]. While analysing the longitudinal foot arch with the use of the Clarke's angle, it was found that in the majority of players, both feet were flat. However, although longitudinal flat foot is a common disorder, transverse flat foot has not been noted very often.

Disorders in foot build exert a considerable influence on the frequency of injuries. According to Williams and McClay [24], players with a lower foot arch are more prone to soft tissue damage and knee joint injuries. In our research, no significant correlations were found between the location of foot loads and the frequency of injuries and between loads borne by limbs and foot arches. In turn, an interesting conclusion can be drawn from the statistically significant correlation between the frequency of training sessions and the frequency of injuries.

The presented results and an attempt at their interpretation constitute the material that is useful in assessing feet among young footballers. They may complete further research directed mainly at assessing the effects of improper foot build on the frequency and types of injuries as well as the influence of load distribution in the area of forefoot and hindfoot on the type of foot arch.

Conclusions

1. Flat foot was the most common type of longitudinal foot arch among the examined footballers.

2. Normal foot was the most common type of transverse foot arch among the examined footballers.
3. No correlations were found between foot load location and the type of longitudinal foot arch.
4. No correlations were revealed between foot load location and the frequency of injuries.
5. The frequency of training sessions exerted an influence on the prevalence of injuries in the examined football players.

References

1. Bac A. Budowa morfologiczna stóp dzieci i młodzieży krakowskiej z uwzględnieniem wybranych czynników wpływających na ich kształt. Kraków: Monografie Nr 17; 2013.
2. Mucha D, Ambroży T, Mucha D, Koteja P. Stan wysklepienia i rozkład sił nacisku stron podeszwowych stóp na podłoże u studentek PPWSZ w Nowym Targu. Security, Economy and Law 2015; 4(9):117-33.
3. Kirkendall DT, Junge A, Dvorak J. Prevention of Football Injuries. Asian J Sports Med. 2010:91-2.
4. Gall L, Carting F, Reilly C, et al. Incidence of injuries in elite French youth soccer players: A 10-season study. Am J Sports Med. 2006; 34:928–38.
5. Hin-Chung L, Wearing SC, Grigg NL, et al. The validity of footprint-based measures of arch structure: revisiting the debate of fat versus flat feet in adults. J Foot Ankle Res. 2012;5(3):054.
6. Żołnowski B, Wrona-Żołnowska L, Gębska M. Urazowość młodzieży uprawiającej piłkę nożna w wieku 15-19 lat. Ann Acad Med Stetin. 2013;59(1):120-2.
7. Buryta R. Wstępna ocena intensywnego treningu u młodych piłkarzy nożnych na kształtowanie osi podudzia. Ann UMCS Sect D. 2003.
8. Radzimińska A, Chojnacka D, Bułatowicz I, et al. Profilaktyka urazów sportowych wśród piłkarzy pierwszoligowych. J Health Sci. 2014;4(10):391- 402.
9. Farhan AF, Stephany MJ, Mahammed SK. Prevention of soccer-related ankle injuries in youth amateur players: a randomized controlled trial. Mov, Health Exercise. 2017; 6(1):39-45.
10. Machowski S. Opieka medyczna w szatni i na boisku. Acta Clin. 2002; 2(4):377-82.
11. Kunz M. 265 milion playing football. FIFA Mag 2007.
12. Brito J, Malina RM, Seabra A, et al. Injuries in Portuguese youth soccer players during training and match play. J Athl Train. 2012;47(2):191.
13. Faude O, Robler R, Junge A. Football injuries in children and adolescent players: are there clues for prevention? Polish J Sport Med. 2013;45:819-37.
14. Leininger RE, Knox CL, Comstock RD. Epidemiology of 1.6 million pediatric soccer-related injuries presenting to US emergency departments from 1990 to 2003. The Am J Sports Med. 2007;35(2):288-93.
15. Adamczyk G, Luboiński Ł. Epidemiology of football-related injuries. Acta Clin. 2002;2(3):236-50.
16. Grzybowski A, Radzioch W. Analysis of sports injuries in football based on data from a sport medicine clinic in Czestochowa. Polish J Sport Med. 2000;2:15-20.
17. Hadała M, Bieganowski K, Wierzbowska C. Trauma among football players and working methods of the medical team in selected Polish and Spanish football clubs. Polish J Sport Med. 2006;5(6):272-6.
18. Chen KC, Yeh CJ, Kuo JF, et al. Footprint analysis of flatfoot in preschool aged children. Eur J Pediatrics. 2011;170(5): 611-7.
19. Olsen L, Scanla A, MacKay M, et al. Strategies for prevention of soccer related injuries: a systematic review. Br J Sports Med. 2004;38(1):89-94.
20. Vergare EA, Sanchez RFS, Posada JRC, et al. Prevalence of flatfoot in school between 3 and 10 years. Study of two different populations geographically and socially. Columbia Med. 2012;43(2):142-7.
21. Queen RM, Mall NA, Nunley JA, et al. Differences in plantar loading between flat and normal feet during different athletic tasks. Gait Posture. 2009;29(4):582-6
22. Grabara M. Influence of football training on alignment of the lower limbs and shaping of the feet. Hum Mov. 2008;9(1):46-50.
23. Latour E, Latour M, Nieścieruk-Szafrańska B. Nieurazowe patologie stopy wśród piłkarzy nożnych. Polish J Sport Med. 2008;9(4):85-7.
24. Wiliams DS, Mc Clay IS, Hamill, Buchanan TS. Lower extremity kinematic and kinetic differences in runners with high and low arches. J Appl Biomech. 2001;17 (2):153-63.

An assessment of relationship between urinary incontinence, and quality of life and psychosocial functioning in elderly women from southeastern Poland

A – preparing concepts
B – formulating methods
C – conducting research
D – processing results
E – interpretation and conclusions
F – editing the final version

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Abstract

Introduction: The rapid aging of the human population is an increasing challenge to public health. With aging of population, the number of people functionally and cognitively dependent increases. The incidence of lower urinary tract symptoms and urinary incontinence increases, too.

Material and Methods: The study included 1032 randomly selected women aged 60–80 years living in south-eastern Poland (the Podkarpackie region). For comparative analysis, we divided this population into two subgroups: I - women with a problem recognized by the doctor considering urinary incontinence (UI) and II - clinical control group (women without urinary incontinence, WP). The WHODAS 2.0 questionnaire was used to assess the disability and functioning and WHOQOL-bref to assess the quality of life.

Results: In the studied population of women aged 60-80 years, 14.53% reported urinary incontinence. The global disability level was higher in the UI group in comparison to WP group ($0<0.001$). The intensity of disability was highest in domains of activities of daily life, mobility and social participation. In comparison to women without urinary incontinence, the UI group women experienced larger effect of their dysfunction on all domains of quality of life, in particular the psychical health, psychological health and environment ($p<0.001$).

Conclusions: The study proves that urinary incontinence has a significant effect on lowering the quality of life and psychosocial functioning of elderly women living in south-eastern Poland. The results point to those domains of functioning which require greatest support. These conclusions communicate a significant message for those who develop rehabilitation programmes for elderly patients with urinary incontinence.

Key words: **aged, women, disability evaluation, urinary incontinence, World Health Organization**

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Introduction

Aging of societies is currently one of the most significant demographic processes. Demographically aged countries are these in which the percentage of people older than 65 has exceeded 12%. Poland reached this threshold at the beginning of 1960s [1]. Currently, this percentage in Poland is 13.5%, and by 2050 it will increase to 34.5% [2]. The region of south-eastern Poland has the longest life expectancy of women - 82.5 years - and it is longer than the country's mean (81.5 years) [3].

Aging is the natural process of growing older. Each person experiences age-related changes based on many factors which results in weakening the physiological functions of the body [4]. The degree of fitness of the elderly depends on many factors, among other things: aging changes, development of multiple chronic diseases, lifestyle, as well as social, environmental and psychological factors [5]. Chronic disorders that can be developed in older age lead to increasing functional disability, negatively affect quality of life and social functioning [6]. When societies age, the number of people who are functionally and cognitive dependent increases [7]. The incidence of lower urinary tract symptoms (LUTS) and urinary incontinence (UI) increases, too [8].

According to International Continence Society, UI is "a report of any leakage of urine". It is involuntary urination, regardless of its quantity and reason, that happens once a month or more frequently [9]. The assessment of prevalence of urinary incontinence across the whole society is difficult due to a variety of its definitions [10]. Available studies show that the prevalence of UI in elderly women is between 5% and 69% [11-13]. There has never been a thorough study on this issue in Poland. It is estimated, though, that 5 million Poles suffer from this disorder [14].

Urinary incontinence may lead to lowered self-esteem, increased embarrassment, and social isolation [15]. It generates considerable social and economic costs. Approximately 2% of total health care expenditure, including diagnosis, treatment and hygiene, is spent on elderly patients with urinary incontinence [16]. However, the awareness of elderly people about the treatment and prevention of its occurrence is still low [17]. Falls and UI are the so called Giants of Geriatrics, and together with distortions of cognitive functions and decreased functional ability they constitute key areas for health care regarding the elderly [18]. Coll-Planas et al. [19] found a relationship between decreased functional ability and lowered physical activity and the beginning of UI in elderly subjects. In their study, Foley et al. [20] proved the relationship between falls and urinary incontinence. The feeling of loss of control over one's bladder and problems in simple and complex activities of daily life may result in worsening of quality of life, in developing anxiety and depression [21].

Earlier studies had analysed the impact of UI on quality of life in elderly people who lived on their own [22] and under institutional care [23]. Still, a more comprehensive assessment of level of functioning of elderly women with urinary incontinence has not been available.

Therefore, our study aimed to analyse quality of life and level of functioning of elderly women with urinary incontinence in respect of activity and participation in daily life.

Material and Methods

This cross-sectional study was conducted in south-eastern Poland. According to the data from Central Statistical Office of Poland, life expectancy in this region is the longest in the country [3].

We conducted the study using *Paper and Pencil Personal Interview* (PAPI). Suitably trained pollsters conducted interviews with a questionnaire designed by our research team and with standardized WHODAS 2.0 and WHOQL questionnaires.

In accordance with Declaration of Helsinki, the subjects were provided with information about the aim and the course of the study, and expressed their informed consent to participate. The approval to conduct the study was obtained from the Bioethical Commission of the University of Rzeszów.

The study was conducted on a representative group of women aged 60 to 80 years living in south-eastern Poland (Podkarpackie region). The criteria for inclusion in the study were the following: female sex, age 60 to 80 years, normal cognitive state, informed consent to participate in the study.

For comparative analysis, we divided this population into two subgroups: I - women with a problem recognized by the doctor considering urinary incontinence (UI) and II - clinical control group (women without problem with urinary incontinence, WP).

We assessed subjects' self-perceived health and well-being with the use of WHOQOL-bref. This questionnaire is a general instrument of assessment of QOL and comprises 26 questions. Two of them measure the general health. The remaining 24 questions assess four domains:

1. Physical health;
2. Psychological health,
3. Social relationships;
4. Environment [24].

For each of the elements one can score 1 to 5 points. Total result is presented on a linear scale from 0 to 100, where 0 denotes the least favourable quality of life, while 100 denotes the most favourable quality of life [25].

We conducted the psychosocial functioning assessment with the WHODAS 2.0. This questionnaire is used for assessment of health and disability. It integrates level of functioning in main life domains, and it is directly linked with ICF.

WHODAS 2.0 covers 6 domains of functioning:

1. Cognition - understanding and communicating;
2. Mobility - moving and getting around;
3. Self-care - hygiene, dressing, eating and staying alone;
4. Getting along - interacting with other people;
5. Life activities - domestic responsibilities, leisure, work;
6. Participation - joining in community activities [26].

The points from 0 to 4 are scored within each of the domains. Scores from individual domains are aggregated. The total score may be between 0 and 100 points, where 0 denotes no disability and 100 complete disability [27]. Apart from the general score, WHODAS 2.0 allows for scoring and presenting results for individual domains.

WHODAS 2.0 approaches each distortion to functioning equally. It has high sensitivity, reliability and intercultural usefulness [28].

The study was run on 1032 randomly selected women aged 60–80 years living in south-eastern Poland (Podkarpackie region). The group was isolated for the purpose of this study analysis from a randomly sampled group of 1800 subjects (1032 women and 768 men). We received the study data from the database run by the Ministry of the Interior and Administration of Poland. We sampled a total of 31 029 subjects (name, surname, address and the PESEL number) - 6 029 subjects aged 60-70 and 25 000 subjects aged 71-80. The reserve sample was 5029 and 24 200 subjects, respectively. We used the SPSS programme to sample the base group without replacement. This kind of sampling allowed for maintaining high methodology standards and made the study representative for south-eastern Poland (Podkarpackie region). The assumed confidence level was 95% (0.95) with estimation error (maximal error) of 3%. The representative results we obtained provided us with information on a large population of people.

Statistical methods

We analyzed the collected data with the use of StatSoft, Inc. (2011) programme STATISTICA (data analysis software system), version 10. Preliminary analysis used the measurements of descriptive statistics. To assess whether there was a relationship between non-measurable variables, we used the chi-square test of independence. For measurable variables, due to lack of normal distribution of the assessed characteristics in individual subgroups, we used the non-parametric Mann-Whitney U test. In order to assess the impact of individual diseases on urinary incontinence, we used logistic regression. Statistical significance was set at $p<0.05$.

Results

In the studied population of women aged 60 to 80 years, 14.53% of subjects reported urinary incontinence. The mean age of the UI group was 72.29 years (SD = 6.06), while the mean age of WP group was 69.26 years (SD = 5.95).

Urinary incontinence increased significantly with age. The UI and WP groups were comparable in terms of place of residence, marital status, education, and income. As the mean age was slightly higher in the study population, there were slight differences between the groups, for example, there were more widows or women with poorer education (table 1).

We found the highest odds ratio for urinary incontinence in women after cerebrovascular accident (CVA). Elderly women with these diseases are almost four times as likely to have urinary incontinence as those without them. We also found very high risk of urinary incontinence in women with degenerative disease of peripheral joints, degenerative diseases of the spine, gastric and duodenal ulcerative disease and neoplastic disease. In women with these diseases, the odds ratio for urinary incontinence is over three times as high as in women without them (table 2).

Tab. 1. Socio-demographic characteristics of the study population

Demographic characteristics	Group UI (N = 150)		Group WP (N = 882)		Significance level
	Number (N)	Percentage (%)	Number (N)	Percentage (%)	
Age					
60 - 70	55	36.67	507	57.48	p < 0.001
71 - 80	95	63.33	375	42.52	
Place of residence					
City	66	44.00	417	47.28	p = 0.457
Countryside	84	56.00	465	52.72	
Marital status					
Single	5	3.33	41	4.65	p = 0.333
Married	73	48.67	496	56.24	
Separated / divorced / divorcee	5	3.33	20	2.27	
Widow / widower	66	44.00	318	36.05	
In partnership	1	0.67	7	0.79	
Education					
Primary	67	44.67	318	36.05	p = 0.041
Vocational	29	19.33	214	24.26	
Secondary	21	14.00	82	9.30	
Vocational secondary	22	14.67	167	18.93	
Higher	11	7.33	101	11.45	
Income per person per month					
Up to 1000 PLN	14	9.33	115	13.04	p = 0.249
1001 PLN – 2000 PLN	55	36.37	364	41.27	
2001 PLN – 3000 PLN	21	14.00	103	11.68	
3001 PLN – 4000 PLN	8	5.33	40	4.54	
4001 PLN and more	2	1.33	28	3.17	
No data	50	33.33	232	26.30	

*PLN - (Polish zloty) - the official name of the Polish currency

Tab. 2. Urinary incontinence with other diseases

Chronic disease		**Prevalence (%)**	**Adjusted risk ratio**	**95% CL**	***P***
Coronary diseases (ischaemic heart disease) or angina pectoris	Yes No	21.87 10.89	2.291	1.613 – 3.254	<0.001
Heart attack and chronic consequences of a heart attack	Yes No	26.32 13.34	2.320	1.416 – 3.802	<0.001
Hypertension	Yes No	16.90 10.59	1.716	1.169 – 2.519	0.006
Atherosclerosis	Yes No	23.62 12.36	2.191	1.489 – 3.226	<0.001
CVA (stroke, embolism) and chronic consequences of a CVA	Yes No	35.94 13.12	3.715	2.157 – 6.378	<0.001
Diabetes	Yes No	19.90 13.32	1.617	1.076 – 2.429	0.021
Osteoporosis	Yes No	26.42 11.80	2.685	1.831 – 3.936	<0.001
Degenerative disease of peripheral joints	Yes No	22.09 7.73	3.381	2.311 – 4.947	<0.001
Degenerative diseases of the spine	Yes No	21.50 7.81	3.233	2.205 – 4.741	<0.001
Lumbar spine pain syndromes	Yes No	20.40 9.98	2.311	1.620 – 3.296	<0.001
Thoracis spine pain syndromes	Yes No	23.10 11.19	2.385	1.671 – 3.405	<0.001
Cervical spine pain syndromes	Yes No	21.10 10.94	2.176	1.533 – 3.086	<0.001
Rheumatism	Yes No	21.01 11.11	2.128	1.499 – 3.019	<0.001
Allergy	Yes No	24.49 12.20	2.334	1.587 – 3.433	<0.001

Neoplastic disease	Yes No	32.43 13.15	3.170	1.881 – 5.339	<0.001
Asthma	Yes No	26.56 13.74	2.271	1.266 – 4.073	<0.001
Chronic respiratory diseases	Yes No	27.03 13.57	2.359	1.367 – 4.070	0.002
Gastric and duodenal ulcerative disease	Yes No	32.09 13.08	3.259	1.949 – 5.449	<0.001
Migraine	Yes No	19.50 13.63	1.535	0.991 – 2.376	0.055

We found highly significant differences in disability levels between the UI and the WP groups, both in general disability and in individual domains. The UI group had women of greater disability than the WP group (table 3).

Tab. 3. Level of disability in women from the study population and clinical control group

Level of disability			Group UI (N = 150)	Group WP (N = 882)	Significance level
Overall	No	N (%)	7 (4.67%)	225 (25.51%)	p < 0.001
	Mild	N (%)	44 (29.33%)	333 (37.76%)	
	Moderate	N (%)	57 (38.00%)	243 (27.55%)	
	Severe or extreme	N (%)	42 (28.00%)	81 (9.18%)	
Domain 1	No	N (%)	24 (16.00%)	379 (42.97%)	p < 0.001
	Mild	N (%)	52 (34.67%)	215 (24.38%)	
	Moderate	N (%)	42 (28.00%)	210 (23.81%)	
	Severe or extreme	N (%)	32 (21.33%)	78 (8.84%)	
Domain 2	No	N (%)	12 (8.00%)	288 (32.65%)	p < 0.001
	Mild	N (%)	29 (19.33%)	230 (26.08%)	
	Moderate	N (%)	39 (26.00%)	185 (20.98%)	
	Severe or extreme	N (%)	70 (46.67%)	179 (20.29%)	
Domain 3	No	N (%)	64 (42.67%)	612 (69.39%)	p < 0.001
	Mild	N (%)	30 (20.00%)	142 (16.10%)	
	Moderate	N (%)	32 (21.33%)	80 (9.07%)	
	Severe or extreme	N (%)	24 (16.00%)	48 (5.44%)	
Domain 4	No	N (%)	28 (18.67%)	328 (37.19%)	p < 0.001
	Mild	N (%)	44 (29.33%)	224 (25.40%)	
	Moderate	N (%)	37 (24.67%)	150 (17.01%)	
	Severe or extreme	N (%)	41 (27.33%)	180 (20.40%)	
Domain 5.1	No	N (%)	22 (14.67%)	351 (39.80%)	p < 0.001
	Mild	N (%)	13 (8.67%)	133 (15.08%)	
	Moderate	N (%)	34 (22.67%)	164 (18.59%)	
	Severe or extreme	N (%)	81 (54.00%)	234 (26.53%)	
Domain 6	No	N (%)	4 (2.67%)	180 (20.41%)	p < 0.001
	Mild	N (%)	30 (20.00%)	257 (29.14%)	
	Moderate	N (%)	55 (36.67%)	300 (34.01%)	
	Severe or extreme	N (%)	61 (40.69%)	145 (16.44%)	

[a] Domain 1, cognition; Domain 2, mobility; Domain 3, self-care; Domain 4, getting along; Domain 5.1, life activities/domestic responsibilities; and Domain 6, participation in social life (Üstün et al. 2010).

We found highly significant differences in quality of life between the UI and WP groups in the physical health, psychological health, and environment. With the significance level set at $p < 0.001$ there was no significant difference in social relationships, yet it was clear that in this area quality of life is lower in UP group than in WP group, too (table 4).

Tab. 4. Quality of life in studied groups

Quality of life	Group UI (N = 150) Mean	Group WP (N = 882) Mean	Significance level
Physical	21.43	23.59	p < 0.001
Psychological	19.69	20.59	p = 0.001
Social Relationship	10.49	11.07	p = 0.004
Environment	25.96	28.26	p < 0.001

Discussion

According to our best knowledge, our study is the first one to assess disability and quality of life in women with urinary incontinence from the biopsychosocial perspective on disability.Our results have shown that total level of disability was higher in the group of women with urinary incontinence in comparison to the WP group. The level of disability was the highest in the domains that concern activities of daily life, mobility and social participation. In comparison to women without urinary incontinence, elderly women with urinary incontinence experienced greater effect of the dysfunction on areas of quality of life, and in particular in the physical health, psychological health, and environment. It seems, therefore, that urinary incontinence in older women is an important determiner affecting the level of disability and the quality of life.

Our study found that 14.53% of women aged 60 to 80 years reported urinary incontinence. Urinary incontinence is common in elderly people, yet it is difficult to ascertain its exact prevalence due to an accompanying feeling of embarrassment or shame in respondents [29]. An observational study by Women's Health Initiative found that urinary incontinence affects 29.3% women aged 65 years and over [30]. According to a study by URINO project, the prevalence of urinary incontinence was higher and amounted to 31% [31]. In our study, we found a lower rate of urinary incontinence, yet it may have been due to the embarrassment the elderly respondents felt when answering the questions of the pollster, as well as a lower prevalence of diseases that are risk factors for developing UI (e.g. diabetes or stroke) in the study population [32].

Numerous studies have found that urinary incontinence is related to increased prevalence of disability in elderly women. Gilmour et al. [33] confirmed the relationship between urinary incontinence and disability in simple and complex activities of daily life. According to Omli et al. [34], UI results in losing autonomy and lowering functional abilities. Yet, they found that even though UI is a significant factor that results in lowering abilities to perform simple activities of daily life, it is not related to lowering abilities of complex activities, such as: going shopping, going for a walk or preparing meals.

The factor of urinary incontinence affected all the domains of functioning of the studied women. The effect was the strongest in activities of daily life and participation. Rodríguez-Blázquez et al. [35] analyzed the relationship between chronic diseases, body functions and limitations to activity and to participation in elderly subjects. They found that genitourinary functions may be strongly related to limitations to activity and participation. In their study on elderly urban citizens, Donez et al. [36]. found that most often disability affects activities related to household tasks and daily life participation.

We found a strong relationship between UI and lowered quality of life among elderly women. Numerous studies point out the relationship between urinary incontinence and lowered quality of life [22,23,37]. Frick et al. [38] found no differences in lowered quality of life depending on the kind of urinary incontinence. Barentsen et al. [39] and Grimby et al. [40] confirmed these findings. French, German, British and American studies on groups of women with urinary incontinence found a general tendency for lowered quality of life depending on the intensity of UI symptoms. The strongest correlations were found in domains of family and social life [41].

Strengths and limitations

A strength of our study was its study population, which included women with urinary incontinence and without urinary incontinence. We were able to compare the functioning and the quality of life of both groups. Also, this is the first study conducted in Poland that used a tool for assessment of functioning and disability based on ICF - the WHODAS 2.0. Using a standardised questionnaire for measuring decrease in functioning enables a comparison of obtained results with other studies worldwide.

The study was based on data reported directly by elderly subjects, which may be a limitation. We did not conduct analysis of the impact of the kind and gravity of urinary incontinence on the psychosocial functioning of elderly women.

Conclusions

The study proves that urinary incontinence has significant effect on lowering of quality of life and psychosocial functioning of elderly women living in south-eastern Poland. The results point

to those domains of functioning which require greatest support. These conclusions communicate a significant message for those who develop rehabilitation programmes for elderly patients with urinary incontinence.

References

1. Kulik T, Janiszewska M, Piróg E, Pacian A, Stefanowicz A, Żołnierczuk-Kieliszek D, Pacian A. Sytuacja zdrowotna osób starszych w Polsce i innych krajach europejskich. Medycyna Ogólna i Nauka o Zdrowiu. 2011:17(2):90-5.
2. Główny Urząd Statystyczny.Prognoza ludności na lata 2014-2015. Studia i analizy statystyczne. Warszawa. 2014.[cited 2018 Feb 17] Available from: http://stat.gov.pl/obszary-tematyczne/ludnosc/prognoza-ludnosci/prognoza-ludnosci-na-lata-2014-2050-opracowana-2014-r-,1,5.html.
3. Główny Urząd Statystyczny. Trwanie życia w 2015r. Warszawa. 2016. [cited 2018 Feb 18]. Available from: http://stat.gov.pl/obszary-tematyczne/ludnosc/trwanie-zycia/trwanie-zycia-w-2015-r-,2,10.html.
4. Fraga MF, Esteller M. Epigenetics and aging: the targets and the marks. Trends Genet. 2007;23:413–8.
5. Roehrig B, Hoeffken K, Pientka L, Wedding U. How many and which items of activities of daily living (ADL) and instrumental activities of daily living (IADL) are necessary for screening. Crit Rev Oncol Hemat. 2007; 62:164–71.
6. Wolff JL, Starfield B, Anderson G. Prevalence, expenditures, and complications of multiple chronic conditions in the elderly. Arch Intern Med. 2002;162(20):2269-76.
7. Vermeulen J, Neyens JC, van Rossum E, Spreeuwenberg MD, de Witte LP. Predicting ADL disability in community-dwelling elderly people using physical frailty indicators: a systematic review. BMC Geriatr. 2011;11:33.
8. Wagg A, Gibson W, Ostaszkiewicz J, Johnson T, Markland A, Palmer MH, et al. Urinary incontinence in frail elderly persons: Report from the 5th International Consultation on Incontinence. Neurourol Urodyn. 2015;34(5):398-406.
9. Abrams P, Cardozo L, Fall M, Griffiths D, Rosier P, Ulmsten U, et al. The standardisation of terminology of lower urinary tract function: report from the Standardisation Sub-committee of the International Continence Society. Neurourol Urodyn. 2002;21(2):167-78.
10. Fultz NH, Herzog AR.Prevalence of urinary incontinence in middle-aged and older women: a survey-based methodological experiment. J Aging Health. 2000;12(4):459-69.
11. Klausner AP, Vapnek JM.Urinary incontinence in the geriatric population. Mt Sinai J Med. 2003; 70: 54-61.
12. Cerruto MA, D'Elia C, Aloisi A, Fabrello M, Artibani W. Prevalence, incidence and obstetric factors' impact on female urinary incontinence in Europe: a systematic review. Urol Int. 2013;90(1):1-9.
13. Melville JL, Katon W, Delaney K, Newton K. Urinary incontinence in US women: a population-based study. Arch Intern Med. 2005;165(5):537-42.
14. Radziszewski P, Baranowski W, Nowak-Markwitz E, Rechbeger T, Suzin J, Witek A. Wytyczne Zespołu Ekspertów odnośnie postępowania diagnostyczno-terapeutycznegou kobiet z nietrzymaniem moczu i pęcherzem nadreaktywnym. Ginekol Pol. 2010;81:789-93.
15. Aslan E, Beji NK, Erkan HA, Yalcin O, Gungor F. Urinary incontinence (UI) and quality of life (QoL) of the elderly residing in residential homes in Turkey. Arch Gerontol Geriatr. 2009;49(2):304-10.
16. Incontinence. Causes, management and provision of services. A Working Party of the Royal College of Physicians. J R Coll Physicians Lond. 1995;29(4):272-4.
17. Cygańska A, Sobieska D, Truszczyńska A, Tomaszewski P, Krzysztoszek K. Świadomość kobiet dotycząca metod fizjoterapeutycznych w leczeniu nietrzymania moczu. Adv Rehab. 2018;4:21-27.
18. Wenger NS, Roth CP, Shekelle PG, Young RT, Solomon DH, Kamberg CJ, et al. A practice-based intervention to improve primary care for falls, urinary incontinence, and dementia. J Am Geriatr Soc. 2009;57(3):547-55.
19. Coll-Planas L, Denkinger MD, Nikolaus T. Relationship of urinary incontinence and late-life disability: implications for clinical work and research in geriatrics. Z Gerontol Geriatr. 2008;41(4):283-90.
20. Foley AL, Loharuka S, Barrett JA, Mathews R, Williams K, McGrother CW, et al. Association between the Geriatric Giants of urinary incontinence and falls in older people using data from the Leicestershire MRC Incontinence Study. Age Ageing. 2012;41(1):35-40.
21. Loh KY, Sivalingam N.Urinary incontinence in the elderly population. Med J Malaysia. 2006;61(4):506-10.
22. Aguilar-Navarro S, Navarrete-Reyes AP, Grados-Chavarría BH, García-Lara JM, Amieva H, Avila-Funes JA.The severity of urinary incontinence decreases health-related quality of life among community-dwelling elderly. J Gerontol A Biol Sci Med Sci. 2012;67(11):1266-71.
23. Jerez-Roig J, Santos MM, Souza DL, Amaral FL, Lima KC. Prevalence of urinary incontinence and associated factors in nursing home residents. Neurourol Urodyn. 2016;35(1):102-7.

24. World health Organization. WHO Quality of Life-BREF (WHOQOL-BREF). [cited 2018 May9]. Available from:http://www.who.int/substance_abuse/research_tools/whoqolbref/en/.
25. The WHOQOL Group. Development of the World Health Organization WHOQOL-BRIEF quality of life assessment. Psychol Med. 1998; 28(3), 551–8.
26. Üstün B, Chatterji S, Kostanjsek N, Rehm J, Kennedy C, Epping-Jordan J, et al. Developing the World Health Organization Disability Assessment Schedule 2.0. Bull World Health Organ. 2010;88(11): 815–23.
27. World health Organization. WHO Disability Assessment Schedule 2.0 (WHODAS 2.0). [cited 2018 May 10]. Available from: http://www.who.int/classifications/icf/more_whodas/en/.
28. Üstün TB, Chatterji S, Villanueva M, Bendib L, Celik C, Sadana R.WHO Multi-country Survey Study on Health and Responsiveness 2000-2001. In: Murray CJL, Evans DB, eds. Health systems performance assessment: debates, methods and empiricism Geneva: World Health Organization; 2003; 761-96.
29. Hunskaar S, Burgio K, Diokno AC, Herzog AR, Hjalmas K,Lapitan MC. Epidemiology and natural history of urinary incontinence (UI). In: Abrams P, Cardozo L, Khoury S. editor(s).Incontinence nd Edition. Health Publicationltd. 2002.
30. Rosso AL, Eaton CB, Wallace R, Gold R, Stefanick ML, Ockene JK, et al. Geriatric syndromes and incident disability in older women: results from the women's health initiative observational study. J Am Geriatr Soc. 2013;61(3):371–9. .
31. Barentsen JA, Visser E, Hofstetter H, Maris AM, Dekker JH, de Bock GH. Severity, not type, is the main predictor of decreased quality of life in elderly women with urinary incontinence: a population-based study as part of a randomized controlled trial in primary care. Health Qual Life Outcomes. 2012 ;10:153.
32. Quander CR, Morris MC, Melson J, Bienias JL, Evans DA. Prevalence of and factors associated with fecal incontinence in a large community study of older individuals. Am J Gastroenterol. 2005;100(4):905-9.
33. Gilmour H, Park J. Dependency, chronic conditions and pain in seniors. Statistics Canada, Supplement to Health Reports. 2006;16:21-31.
34. Omli R, Hunskaar S, Mykletun A, Romild U, Kuhry E. Urinary incontinence and risk of functional decline in older women: data from the Norwegian HUNT-study. BMC Geriatr. 2013;13:47.
35. Rodríguez-Blázquez C, Damián J, Andrés-Prado MJ, Almazán-Isla J, Alcalde-Cabero E, Forjaz MJ, et al. Associations between chronic conditions, body functions, activity limitations and participation restrictions: a cross-sectional approach in Spanish non-clinical populations. BMJ Open. 2016;6(6):e010446.
36. Donmez L, Gokkoca Z, Dedeoglu N. Disability and its effects on quality of life among older people living in Antalya city center, Turkey. Arch Gerontol Geriatr. 2005;40(2):213-23.
37. Schimpf MO, Patel M O'Sullivan DM Tulikangas PK. Difference in quality of life in women with urge urinary incontinence compared to women with stress urinary incontinence. Int Urogynecol J Pelvic Floor Dysfunct. 2009; 20(7): 781-6.
38. Frick AC, Huang AJ, Van den Eeden SK, Knight SK, Creasman JM, Yang J, et al. Mixed urinary incontinence: greater impact on quality of life. J Urol 2009;182(2):596–600.
39. Barentsen JA, Visser E, Hofstetter H, Maris AM, Dekker JH, de Bock GH. Severity, not type, is the main predictor of decreased quality of life in elderly women with urinary incontinence: a population-based study as part of a randomized controlled trial in primary care. Health Qual Life Outcomes. 2012;10:153.
40. Coyne KS, Zhou Z, Thompson C, Versi E. The impact on health-related quality of life of stress, urge and mixed urinary incontinence. BJU Int. 2003, 92(7):731–5.
41. Abrams P, Smith AP, Cotterill N. The impact of urinary incontinence on health-related quality of life (HRQoL) in a real-world population of women aged 45-60 years: results from a survey in France, Germany, the UK and the USA. BJU Int. 2015;115(1):143-52.

The weakened memory function in young overweight people

A – preparing concepts
B – formulating methods
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Abstract

Introduction: Several lines of evidence indicate that being overweight or obese is associated with adverse effects observed at the level of the central nervous system. It was demonstrated that overweight or obese people exhibit lower level of cognitive functions, including the ones dependent on the hippocampus (learning and memory). The majority of studies in this area are concerned with the impact of body mass on the cognitive function in elderly people.

Material and methods: We examined the relationship between body mass index and cognitive performance in two groups of young volunteers: overweight (18 males; aged 17 ± 0.18; BMI 26.12 ±0.91) and normal body weight group (27 males; aged 17.12 ± 0.14; BMI 21.55 ± 1.12). To evaluate the cognitive performance in our subjects we used face/name association test.

Results: The mean results in the face name/association test in overweight group were 66.05 ± 6.7%. In normal weight group were was 73.53 ± 6.19% ($p<0.005$). Moreover, we observed correlation between BMI and face/name association test results ($p<0.005$).

Conclusions: Our data suggest a link between body mass and the level of cognitive performance. We demonstrate that the increased body weight may have a negative effect on some cognitive function even in young people. The potential mechanism for this association remains unclear.

Key words: **adolescence, memory, BMI, Hippocampus, face/name association**

Introduction

The excessive weight, defined as accumulation of excess adipose tissue, has been linked to cognitive impairment. The anthropometric tool used to determine normal body weight - Body Mass Index (BMI) is in the range of 18.5 to 25 kg/m^2 for normal-weight individuals. Individuals considered to be overweight have the value BMI above 25 kg/m^2. The BMI value larger than 30 kg/m^2 indicates obesity [1]. Several lines of evidence indicate that increased body weight (above 25 kg/m^2) may be associated with decreased cognitive performance levels in learning, memory and executive functions [2-4]. Obesity is also described as one of the factors predisposing to development of dementia and neurodegenerative diseases (e.g. Alzheimer's disease) [5,6]. The majority of research in humans focuses on the groups of elderly subjects. Cognition impairment in older adults has a variety of possible causes associated prominently with structural and functional changes in the brain (neuronal loss, synaptic degeneration) [7]. The level of cognitive functions decreases as a result of normal ageing process. At the same time, however, there is a negative correlation between BMI and cognitive performance levels observed [8-12]. Relatively limited number of studies addresses the problem of body weight and cognitive function in young people. Previously published data indicate

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that increases in body weight may be associated with reduced cognitive performance also in young people. For example, it was demonstrated that obese adolescents had slower cognitive processing speeds (compared with normal weight peers) for functions depending on the frontal lobe [13]. Other studies reported that overweight and obese adolescents performed poorly on tests for inhibition, flexibility and decision-making - functions depending on the prefrontal cortex and the anterior cingulate [14]. At the same time, there is very limited research focusing on the impact of body weight on the cognitive performance related to the function of hippocampus in adolescents. The hippocampus is of particular interest because this is a part of the brain where the process of neurogenesis takes place throughout the individual lifetime, but the rate of the process decreases with age. Also, the proliferation and incorporation of local hippocampal stem cells was experimentally related to hippocamp-dependent cognitive functions [15]. In young mammals (including humans) proliferation of precursors and survival of new neuronal cell is maintained at a relatively high level [16]. Therefore, it is of interest to determine whether the excessive body weight in young people is (as in older individuals) associated with the weakened cognitive efficiency, or the possible weight-related cognitive decline is masked by robustness of neurogenesis in cognition-related structures.

The potential mechanism for the effect of increased body mass on the central nervous system is unclear but a growing body of research suggests that being overweight or obese is related to atrophy of certain areas of the brain. Structures of the brain that are particularly sensitive to increases in body weight include temporal and frontal lobes, parietal cortex, hippocampus, cerebellum and midbrain. In obese people, reduction in grey matter volume was observed in these areas [17-19]. Mechanism of obesity-related cognitive dysfunction may be also related to reduced synaptic plasticity in the hippocampus and cerebral cortex [20] or increased neuronal apoptosis in the hippocampus and hypothalamus [21]. Currently, it is accepted that higher levels of adipose tissue lead to increased circulating levels of proinflammatory cytokines such as tumour necrosis factor, C-reactive protein, interleukin 1β, and interleukin-6. These factors may contribute to chronic systematic inflammation and - as a result - accelerate the cognitive decline [22].

Material and Methods

The study was conducted in accordance with the Declaration of Helsinki for Human Studies. The study protocol was approved by a local Ethics Committee.

Volunteers (45 males) were recruited from the local high school in Bydgoszcz. The volunteers were divided into two groups, differentiated by body mass index (BMI): overweight (18 males; aged 17 ± 0.18; BMI 26.12 ±0.91), and normal body weight group (27 male; aged 17.12 ± 0.14; BMI 21.55 ± 1.12). Based on surveys, the selected males who lead sedentary lifestyle and did not participate in any sporting activities except physical education lessons. In order to limit the influence of hormonal factors, only boys were qualified for this study. In order to limit the influence of differences in the level of education and socioeconomic background, all volunteers were students from the same school. The selected volunteers were healthy and did not suffer from any chronic conditions.

Body weight status was assessed based on BMI calculated according to the standard formula (weight in kilograms divided by height in square meters). BMI was categorized according to the National Institutes of Health obesity standard: BMI 18.5-24.9 normal weight, BMI 25-29.9 overweigh, BMI 30-34.9 class I obesity [1].

Evaluation of cognitive skills was based on scores from face/name association test. The detailed experimental protocols for these tests were described previously [23]. Shortly, in the acquisition phase of the face/name association test, subjects were exposed to 100 faces -each associated with a single name on a computer screen. Each face/name pair was presented for 2 seconds. After 10 min from the end of acquisition phase the retrieval phase began. During this phase test subjects were presented with the same faces as in acquisition phase but each face was associated with two names, one of which was the same name as in acquisition phase. The task of the subject was to indicate the name associated with the face during acquisition phase. No time limits for retrieval phase were imposed. The percent of correctly associated names, and the duration of the retrieval phase were recorded for each subject.

Statistical significance of the differences between the two groups was assessed using two-tailed T-Test. The results are presented as means with standard deviation. $p<0.05$ was considered statistically significant.

Results

In the normal body mass group, the average score of face/name association test was 73.53 ± 6.19%. In the overweight group the average score was 66.05 ± 6.7% (Fig. 1A). The difference in the scores between overweight and the normal weight subject was statistically significant, with $p<0.005$. No statistically significant difference ($p<0.5$) was observed between the two groups in the duration of the retrieval phase of the test. In the normal weight group, mean retrieval duration equalled 259.82 ± 75.58 seconds and in the overweight group the retrieval duration was 261.87 ± 77.7 (Fig. 1B). We observed a negative relationship between BMI and the scores of face/name association test ($p<0.005$) (Fig. 2A, 2A).

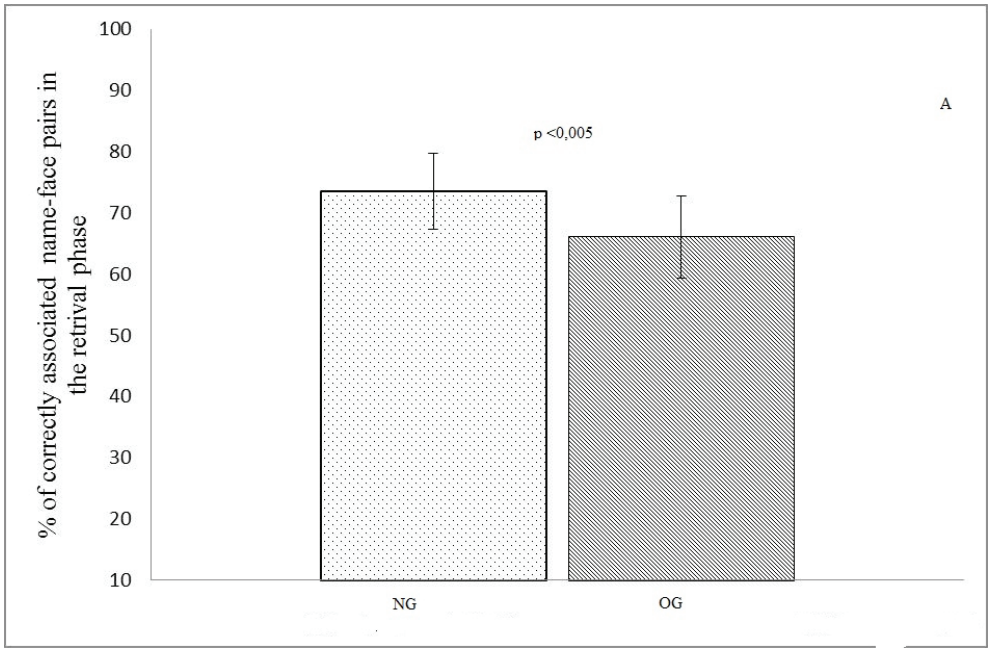

Fig. 1A. Face/name association test scores in normal weight (NG) and overweight groups (OG). The average percent of correctly associated name-face pairs (± SD), in the retrieval phase

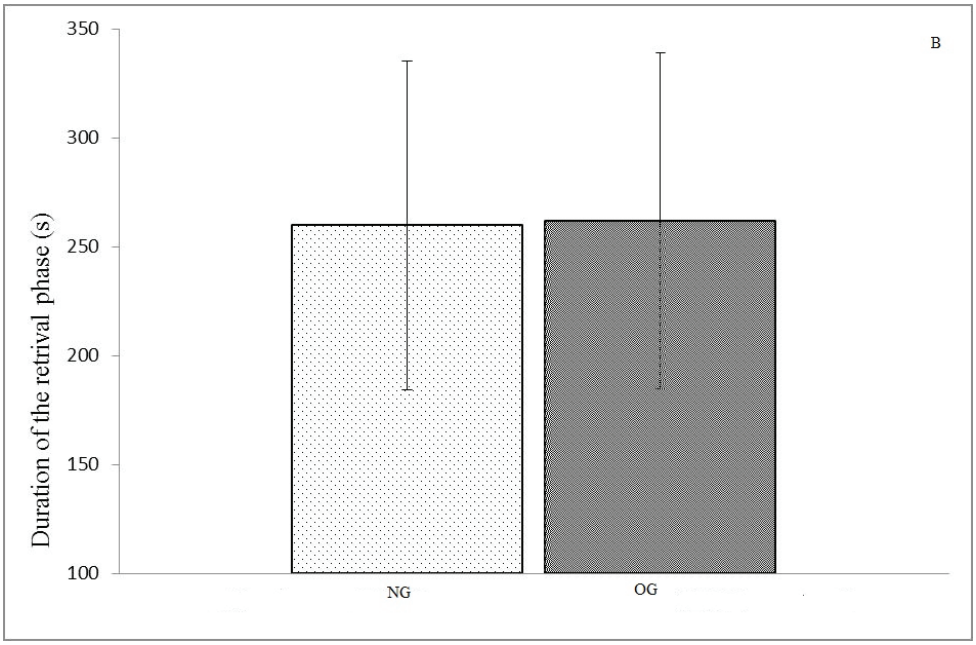

Fig. 1B. Face/name association test scores in normal weight (NG) and overweight groups (OG). The average duration of the retrieval phase (± SD)

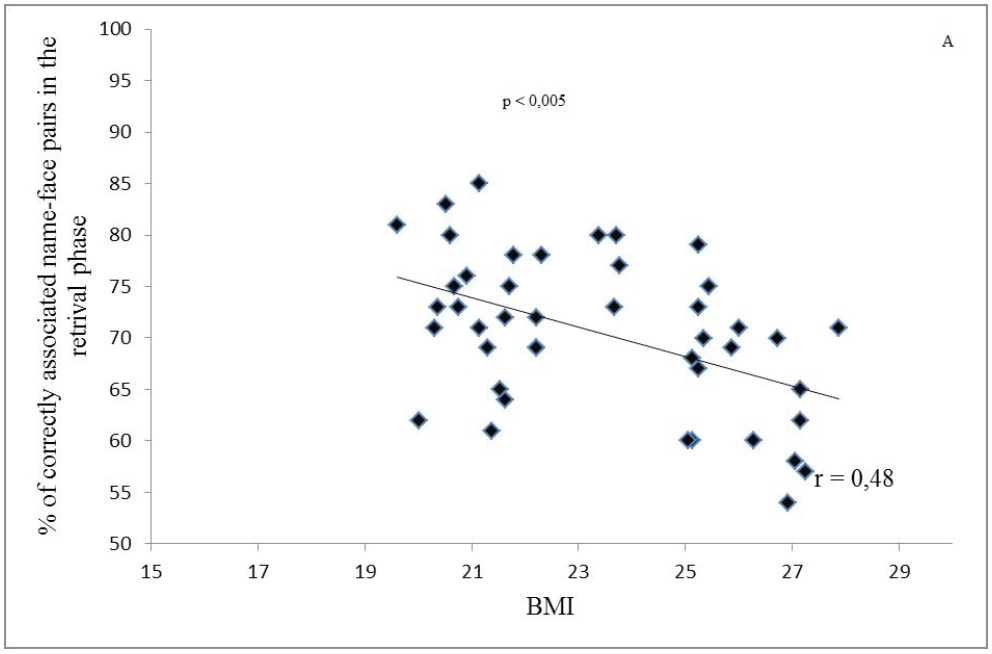

Fig. 2A. Correlation between BMI and the face/name association test results in normal weight (NG) and overweight group (OG). The % of correctly associated name-face pairs in the retrieval phase

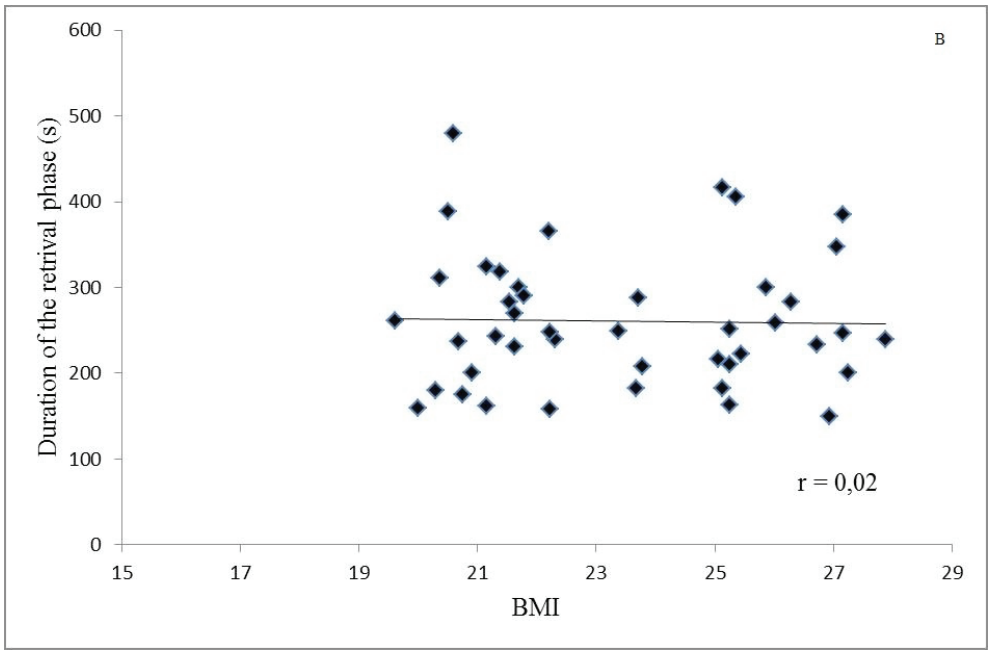

Fig. 2B. Correlation between BMI and the face/name association test results in normal weight (NG) and overweight group (OG). The duration of the retrieval phase are plotted against individual BMI values

Discussion

The data presented in this report indicate that there is a dependence between body weight and the efficiency of declarative memory. Our study revealed that people with normal body weight scored higher in the face/name test compared with the overweight subject ($p < 0.005$). The increased body mass impacted negatively the percent of names correctly associated with faces ($r = 0.48$; $p < 0.005$) but did not result in prolongation of the retrieval phase of the test. The subjects in the experimental group were overweight but not obese. Previous studies have shown only a minor progression of

cognitive impairment between overweight and obese subjects (9). These observations suggest that the association between body mass and cognitive performance may be a threshold phenomenon. Even the low levels of excessive body weight may result in significant cognitive decline without significant additional decline associated with further increase in body weight. The distribution of data points in figure 2A seem to support such a notion but more data is needed in order to reach a conclusive opinion in that matter.

Currently, the relationship between body weight and cognitive function is not fully understood. An increased BMI is associated with many pathophysiological changes with the potential to negatively impact cognitive functioning. For example, in obese people vascular changes, impaired insulin regulation, chronic systemic inflammation are observed [24,25,26]. Furthermore, effect of body weight on cognitive skills may be associated with other factors such as gender, hormone levels, topological distribution of body fat, lifestyle and diet [27]. Participants of this study were young and healthy and therefore we can exclude impact of co-existing illnesses such as hypertension or diabetes on cognitive function [28]. The physical activity of all volunteers was limited to participation in physical education classes at school. Therefore, overweight among some of the participants of the research was not the result of the lack of physical activity. Also, better results in face/name test in the normal weight group could not result just from a positive impact of physical activity on the central nervous system. The observed differences in short-term memory test performance between normal-weight and overweight groups indicated the potential impact of increased body mass on the hippocampus. The main functions of hippocampus are related to the processes controlling learning and memory. Importantly, the MRI studies have demonstrated that the hippocampus is the structure with increased activity during the face-name association test [33,34]. Moreover, hippocampus is indicated as a regulatory part for food motivation, intake and weight regulation [29]. Several lines of evidence indicate that hippocampus is strongly influenced by the level of adiposity. Brain scanning techniques showed that a greater BMI is related to reduced hippocampal in obese male subject [30]. Furthermore, hippocampus is sensitive to adipose-tissue-derived inflammatory cytokines. These cytokines were found to impair synaptic plasticity in the dentate gyrus and CA regions of the hippocampus [31,32].

Our results may be limited in several ways. Firstly, we determined overweight status only by using body mass index measurement. We did not have any background knowledge about fat content and muscle mass, and information regarding obesity duration. Our findings are consistent with the results from other studies which demonstrated lower levels of cognitive performance in overweight and obese young people. The findings are also consistent with limited studies indicating that obesity is associated with memory impairments in young people [12,35,36,37,38]. Similarly, negative hippocampal effects were observed as a result of so-called western diet (high saturated fat foods). It was demonstrated that sustained western diet could lead to alterations in hippocampal functioning. High fat diet may lead to neuroinflammation, reduced neurogenesis and synaptic function impairment in the hippocampus. It also contributes to memory loss and cognitive impairment [39].

Conclusion

Our data demonstrate that the link between increased BMI and the decrease of cognitive performance is prominent even in young individuals. Excessive body mass may be an important factor in the early stages of cognitive dysfunction development. However, more research is needed to elucidate the underlying mechanism for such a relationship.

References:

1. Keys A, Fidanza F, Karvonen MJ, Kimura N, Taylor HL. Indices of relative weight and obesity. J Chron Diseases. 1972; 25(6): 329–43.
2. Boeka AG, Lokken KL. Neuropsychological performance of a clinic sample of extremely obese inviduals. Arch Clin Neuropsychol. 2008;23(4):467-74.
3. Gunstad J, Paul RH,Cohen RA et al. Elevated body mass index is associated with executive dysfunction in otherwise healthy adults. Compr Psychiatry. 2007;48(1):57-61.

4. Cournot M, Marquie JC, Ansiau D et al. Relation between body mass index and cognitive function in healthy middle-aged men and women. Neurology. 2006;67(7):1208-14.
5. Whitmer RA, Gunderson EP, Barrett-Connor E. Obesity in middle age and future risk of dementia. A 27 year longitudinal population based study. BMJ. 2005;330:1360-5.
6. Gustafson D, Rothenberg E, Blennow K et al. An 18-year follow-up of body mass index and risk for Alzhaimer's disease. Arch Intern Med. 2003;163(13):1524-8.
7. Barnes CA. Normal aging: regionally specific changes in hippocampal synaptic transmission. Trends Neurosci. 1994;17(1):13-8.
8. Joeng SK, Nam HS, Son MH, Son EJ, Cho KH. Interactive effect of obesity index on cognition. Dement Geriatr Cogn Disord. 2005;19(2-3):91-6.
9. Dwojaczny B, Zegarski T, Sikorski W, Złomańczyk P, Tafil-Klawe M. The increased body mass index effect on memory. Med Biol Sci. 2016;30(2):13-8.
10. Smith E, Hay P, Campbell L, Trollor JN. A review of the association between obesity and cognitive functions across the life-span: implications for novel approaches to prevention and treatment. Obesity Prevent. 2011;12(9):740-55.
11. Lokken KL, BoekaAG, Austin HM, Gunstand J, Harmon CM. Evidence of executive dysfunction in extremely obese adolescents: a pilot study. Surgery for obesity and related diseases. 2009;5(5):547-52.
12. Li Y, Dai Q, Jackson JC, Zhang J. Overweight is associated with decreased cognitive functioning among school-age children and adolescents. Obesity. 2008;16(8):1809-15.
13. Sweat V, Yates KF, Migliaccio R, Convit A. Obese adolescents show reduced cognitive processing speed compared with health weight peers. Childhood Obesity. 2017;13(3):190-5.
14. Verdejo-Garcia A, Perez –Exposito M, Schmidt-Rio-Valle J, Fernandez –Serrano MJ, Cruz F, Perez –Garcia M et al. Selective alterations within executive functions in adolescence. Obesity. 2010;18(8):1572-8.
15. van Praag H, Shubert T, Zhao C, Gage FH. Exercise enhances learning and hippocampal neurogenesis in aged mice. J Neurosci. 2005; 25: 8680-5.
16. Kuhn HG, Dickinson-Anson H, Gage FH. Neurogenesis in the denate gyrus of the adult rat: age-related decrease of neuronal progenitor proliferation. J Neurosci. 1996;16: 2027-33.
17. Ward MA, Carlsson CM, Trivedi MA et al. The effect of body mass index on global brain volume in middle-aged adults. A cross sectional study. BMC Neurol. 2005;5(23):1-7.
18. Taki Y, Kinomura S, Sato K et al. Relationship between body mass index and gray metter volume in 1,428 health inviduals. Obesity. 2008;16:119-24.
19. Gustafson D, Lissner L, Bengtsson C et al. A 24-year follow-up of body mass index and cerebral atrophy. Neurology. 2004;63(10):1876-81.
20. Molteni R, Barnard RJ, Ying Z et al. A high-fat refined sugar diet reduces hippocampal brain-derived neurotrophic factor, neuronal plasticity and learning. Neuroscience. 2002;112(4):803-4.
21. Moraes JC, Coope A, Morari J et al. High-fat diet induces apoptosis of hypothalamic neurons. PloS One. 2009;4(4):5045-56.
22. Gorelick PB. Role of inflammation in cognitive impairment: result of observational epidemiological studies and clinical trials. Ann NY Acad Sci. 2010;1207:155-62.
23. Złomańczuk P, Milczarek B, Dmitruk K et al. Improvement in the face/name association performance after three months of physical training in elderly women. J Physiol Pharmacol. 2006;57(4):417-24.
24. Convit A, Wolf O, Tarshish C, de Leon M. Reduced glucose-tolerance is associated with poor memory performance and hippocampal atrophy among normal elderly. Proc Natl Acad Sci USA. 2003;100(4):2019-22.
25. den Heijer T, Vermeer SE, Van Dijk EJ, Prins ND, Koudstal PJ,Hofman A et all. Type 2 diabets and atrophy of medial temporal lobe structures on brain MRI. Diabetologia. 2003;46(12):1604-10.
26. Rahmouni K, Correia M, Haynes W, Mark A. Obesity-associated hypertension: new insight into mechanism. Hypertension. 2005;45(1): 9-14.
27. Goodman-Gruen D, Barrett-Connor E. Sex differences in body fat and body fat distribution in the elderly. Am J Epidemiol. 1996;143(9):898-906.
28. Elias MF, Elias PK, Sullivan LM et al. Obesity, diabetes and cognitive deficit: the Framingham Heart Study. Neurobiol. 2005;26:11-6.
29. Davidson TL, Kanoski SE, Schier LA, Clegg DJ, Benoit SC. A potential role for the hippocampus in energy intake and body weight regulation. Curr Opin Pharmacol. 2007; 7(6):613-6.
30. Taki Y, Kinomura S, Sato K et al. Relationship between body mass index and gray metter volume in 1,428 health inviduals. Obesity. 2008;16(1):119-24.
31. Bellinger FP, Madamba S, Siggins GR. Interleukin 1 beta inhibits synaptic strength and long-term potentiation in the rat CA1 hippocampus. Brain Res. 1993;628(1-2):227-34.
32. Pickering M, O'Connor JJ. Pro-inflamatory cytokines and their effects in the dentate gyrus. Prog Brain Res. 2007;163:339-54.

33. Sperling RA, Bates JF, Cocchiarella AJ, Schacter DL, Rosen BR, Albert MS. Encoding novel face-name association; a functional MRI study. Hum Brain Mapp. 2001;14: 129-39.
34. Naveh-Benjamin M, Guez J. The associative memory deficit of older adults: further support using face-name association. Psychol Aging. 2004; 19: 541-6.
35. Mond JM, Stich H, Hay PJ, Kraemer A, Baune BT. Associations between obesity and developmental functioning in pre-school children: a population–based study. Int J Obes. 2007;31(7):1068-73.
36. Cserje'si R, Molnar D, Luminet O, Lenard L. Is there any relationship between obesity and mental flexibility in children? Appetite. 2007;49:675-8.
37. Gunstad J, Paul RH, Cohen RA, Tate DF,Gordon E. Obesity is associated with memory deficits in young and middle-aged adults. Eating Weight Disord. 2006;11: 15-9.
38. Park HR, Park M, Choi J, Park KY, Chung HJ, Lee J. A high –fat diet impairs neurogenesis: involvement of lipid peroxidation and brain-derived neurotrophic factor. Neuroscience Letters. 2010; 482(3): 235-9.

A – preparing concepts
B – formulating methods
C – conducting research
D – processing results
E – interpretation and conclusions
F – editing the final version

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Benign hypermobility joint syndrome impact on the injuries in jazz dancers

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Abstract

Introduction: Hypermobility is diagnosed by detecting asymptomatic and increased mobility of the joints over accepted standards. It might be inborn or practiced. The second one is a result of regular exercising e.g. dance career which generates loads in excess of tissues' capacity of repairing which is leading to many chronic injuries. Main purpose of the research was to detect a correlation between the joint hypermobility presence and the injury occurrence in jazz dancers group.

Material and methods: The research have been conducted among 30 jazz dancers and 30 non-dancers. There has been used a survey with the following questions related with the physical activity, treatment of the occurred injuries, type of the stabilizing exercises, pain's frequency and intensity (VAS Pain). In order to examine a hypermobility Beighton Score was used.

Results: In 27 dancers the joint hypermobility was detected and 23 of them suffered an injury in their life. The most common type of injury was a biceps femoris muscle strain (12 people). An average number of points from Beighton Score was 5.53. In the control group the hypermobility was detected in 9 people. An average number of points was 2.13. Mostly dancers were complaining about the pain in the knee joint (15 people, avg. 2.07 VAS points). In the control group the pain was related with the lumbar spine column (12 people, avg. 1.33 VAS points). The points from Beighton Score reached by the dancers was correlated with the injuries occurrence. The time of doing stabilizing exercises had no impact on the prevalent contusions but there was a correlation between the time and the frequency and intensity of the pain.

Conclusions: Benign hypermobility joint syndrome was more common among the dancers than non-dancers and was related with pain occurrence.

Key words: **benign hypermobility joint syndrome, dance, pain, injury**

Introduction

Benign hypermobility joint syndrome is characterised by the laxity of joint capsules and ligaments, increased range of joint mobility as well as improper functioning and operation of organs and systems containing connective tissue. With regard to biomechanics, in this disorder, a safe physiological barrier shifts towards increasing joint mobility up to the anatomical barrier, at times even crossing it and showing abnormal symptoms [1-3]. Joint capsule laxity, ligament elongation, increased range of motion in peripheral and spinal joints are both the effect and cause of benign hypermobility syndrome [4].

Aside from increased joint mobility, clinical symptoms of BHJS include: joint subluxation or luxation, back pain, mild tissue damage, thin skin and joint pain [5]. Pain is often accompanied by edema, which appears mostly during increased physical activity [6].

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Modified Beighton Scale is the basic scale for the assessment of BHJS [7]. Each maneuver is assessed with points on a 0-1 scale for both right and left side of a body. Diagnosis is based on the following maneuvres: passive dorsiflexion of the fifth MCP (metacarpophalangeal) joint ≥ 90°, apposition of the thumb to the forearm, hyperextension of the elbow joint ≥ 10°, hyperextension of the knee joint ≥ 10°, laying hands flat on the floor during forward flexion of the trunk while maintaining extension of knee joints. BHJS diagnosis for girls requires at least 5 points, while diagnosis for boys requires at least 4 points [8].

Increased joint mobility might be congenital as well as acquired. The latter is a result of systematic performance of exercises, such as dancing exercises [9]. Isolation movements, maintaining low center of gravity, high dance dynamics as well as leaning the trunk forward and putting the bodyweight from hindfoot to forefoot ('collabs')]10] form the basis of the jazz dance technique. This technique also requires increased range of motion in certain joints, stretching of certain muscle groups and strengthening of the whole muscular system.

The purpose of this paper was the analysis of the relationship between BHJS and the occurrence of injuries among people practicing jazz dance.

Material and methods

On obtaining permission from Science Commission SKE 01-18/2018, trials began with 60 participants: 30 dancers (26 women and 4 men) constituting the study group and 30 people (24 women and 6 men) constituting the control group of people not engaged in professional sport or dancing. The two groups did not differ in terms of age, height, body mass and BMI (tab. 1).

Tab. 1. Description of study and control group

	Age	Height	Body mass	BMI
Study group	avg. 24.9 yrs sd. 2.1	avg. 1.7 m sd. 0.1	avg. 60.1 kg sd. 7.7	avg. 20.5 sd. 1.4
Control group	avg. 25 yrs sd. 3.5	avg. 1.7 m sd. 0.1	avg. 58.5 kg sd. 10.3	avg. 20.2 sd. 1.8
Test statistic	-0.1	0.6	0.7	0.7
p-value	0.2	0.4	0.1	0.4

The average span of dancing experience was 14.6±4.5 years.

In both groups, subjects engaged in supplementary physical activity. The aforementioned supplementary physical activities most often included running, swimming, gym exercises and fitness. The average time spent every week by the dancers from study group on supplementary physical activities was 4.1±2.8h, while for the control group this amounted to 2±1.4h. 20 subjects (67%) from study group worked in a sedentary job for 35.1±2.54h weekly on average. 18 subjects (60%) from control group were also employed in a sedentary job but their average weekly working hours amounted to 37.5±1.5h.

The study was conducted using a survey designed by the author. The common part of the survey for both groups consisted of basic personal details of the subjects, physical activity they engaged in, past injuries and treatment thereof, performed stabilization exercises as well as joint pain, its frequency and intensity on the VAS scale. Second part of the survey was given only to dancers (study group) and consisted of three additional questions about the span of dancing experience, technique and character. Beighton scale was used to assess benign hypermobility joint syndrome.

Statistical analysis

Pearson correlation coefficient was calculated for all the compared variables. A weak or strong positive relationship between the studied variables was determined, depending on the value of correlation coefficient. Statistical hypothesis H0: $r = 0$ was tested along with alternative hypothesis H1: $r \neq 0$ in order to generalise results to the population. The average values for study group ($\bar{x}$) and control group ($\bar{y}$) were calculated for some variables. In order to verify, whether the differences between average values are statistically significant, hypothesis $H_0: \bar{x} = \bar{y}$ was tested along with alternative hypothesis H1: $\bar{x} \neq \bar{y}$ [11].

Results

Among the 30 subjects who were professional jazz dancers, 27 subjects (90%) was diagnosed with BHJS, while in control group only 9 subjects (30%) were diagnosed with BHJS.

23 dancers (77%) suffered injuries during their career and 21 of them (91%) were diagnosed with BHJS. In control group, 10 subjects (33%) suffered injuries, while only 3 of them were diagnosed with

BHJS. The most frequent injury in study group was biceps femoris strain suffered by 12 dancers, and comprising 26% of all injuries. Fractures were the most frequent injury in control group, comprising 64% of all injuries. Types and location of the injuries are shown in tables 2 and 3.

Tab. 2. Types of injuries suffered by study and control group subjects

Type of injury	Study group				Control group			
	HS diagnosed		HS not diagnosed		HS diagnosed		HS not diagnosed	
	No. of subjects	%	No. of subjects	%	No. of subjects	%	No. of subjects	%
Fractures	3	8%	0	0%	2	67%	4	57%
Joint injuries	10	26%	0	0%	1	33%	1	14%
Muscle injuries	21	53%	1	100%	0	0%	2	29%
Other	5	13%	0	0%	0	0%	0	0%
Total	39	100%	1	100%	3	100%	7	100%

Tab. 3. Body parts affected by the injuries suffered by study and control group subjects

Location of injury	Study group		Control group	
	No. of subjects	%	No. of subjects	%
Lower extremity injuries	40	89%	6	55%
Shoulder joint injuries	3	7%	1	9%
Other	2	4%	4	36%
Total	45	100%	11	100%

Correlation between benign hypermobility joint syndrome and the number of injuries suffered by dancers was deemed statistically significant (tab. 4).

Tab. 4. Correlation between the injuries of dancers and BHJS

	Study group	Control group
Pearson linear correlation coefficient	0.45	-0.10
Student's t-test value	2.63	-0.54
p-value	0.02	0.34

The survey also contained questions about stabilization exercises. The majority of the subjects – 23 dancers (77%) and 20 control group subjects (67%) performed those exercises. However, the time spent on performing the exercises was different for each of the groups. On average, study group subjects performed the exercises twice weekly for a total of 34.3±28.3 minutes, while control group subjects performed them once per week for ca. 13±27 minutes.

Stabilization exercises which the subjects performed most frequently, include exercises 1, 2 and 4 (figure 1). Figure 2 shows a detailed percentage distribution of performed exercises in both groups.

A relation between the average time spent weekly on stabilization exercises and the average weekly frequency of pain occurrence was also measured for the dancers. It was determined that the more time the subjects spent on exercising, the rarer was the occurrence of pain (tab. 5). Trendline in the chart no. 2 depicts the studied correlation.

Tab. 5. Relation between the average time spent weekly on the exercises and the frequency of pain occurrence in study group

Pearson linear correlation coefficient	-0.38
Student's t-test value	-2.16
p-value	0.04

Another relationship related to the exercises performed by subjects concerned the time spent on stabilization training and number of injuries suffered within the period during which the subjects performed the exercises (figure 3). The exercising group was defined as comprising of subjects who spent at least 30 minutes on training every week. It was demonstrated that the training time did not have an effect on the number of injuries. There were no noticeable differences between the numbers of average number of injuries in control and study group. Figure 4 shows the relationship studied in the sample.

An important component of the performed study was for the subjects to determine, whether they experience any pain and what joint did the pain occur in. Moreover, the respondents assessed

A. *Stabilization exercise 1*

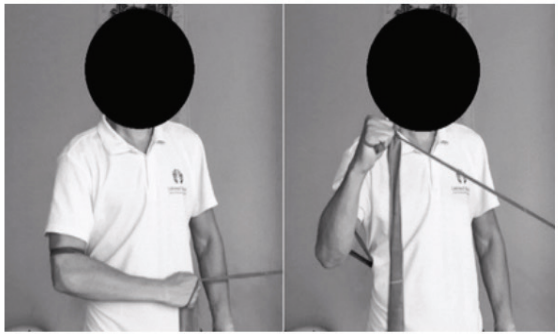
B. *Stabilization exercise 2*

C. *Stabilization exercise 3*

D. *Stabilization exercise 4*

E. *Stabilization exercise 5*

F. *Stabilization exercise 6*



G. *Stabilization exercise 7*

Fig. 1. List of stabilization exercises

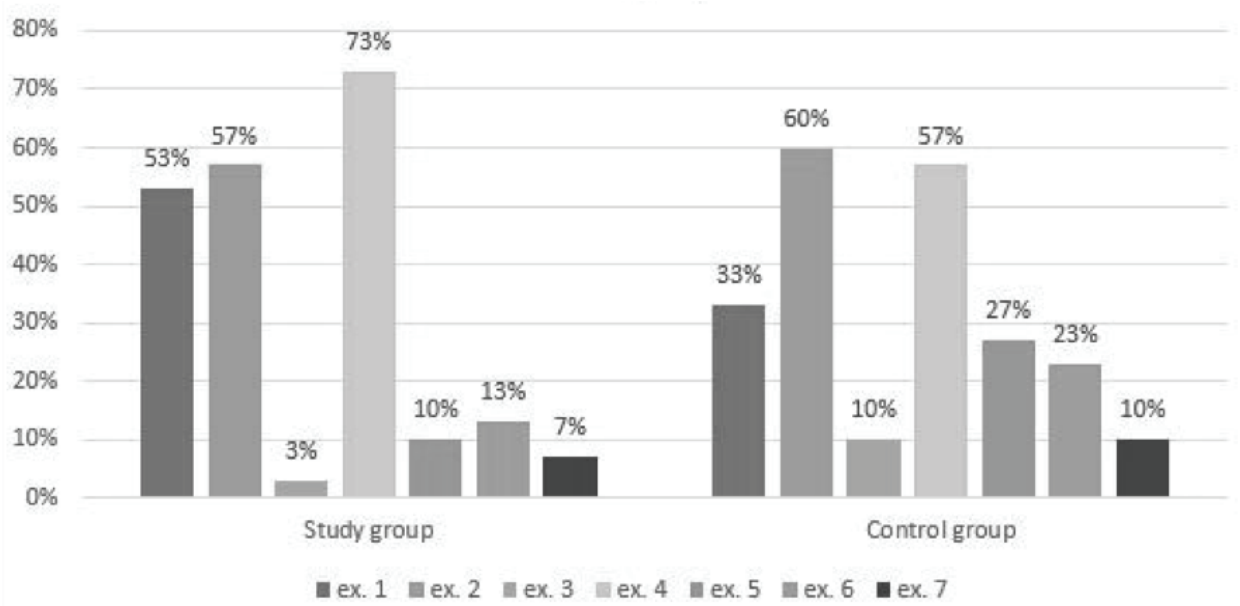


Fig. 2. Percentage distribution of performed stabilization exercises in study and control group

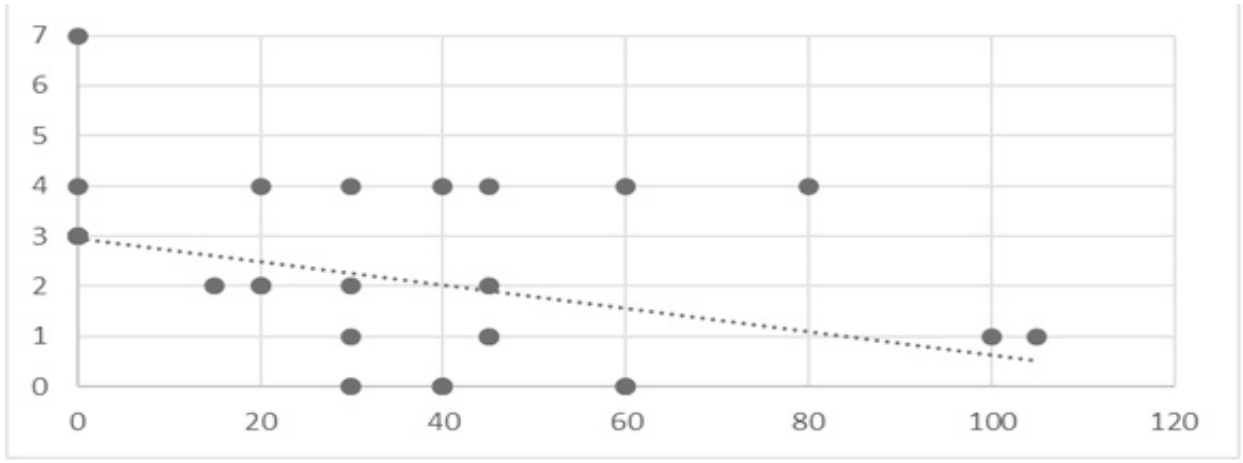


Fig. 3. Relationship between the number of suffered injuries and the average time spent weekly on performing stabilization exercises in study group

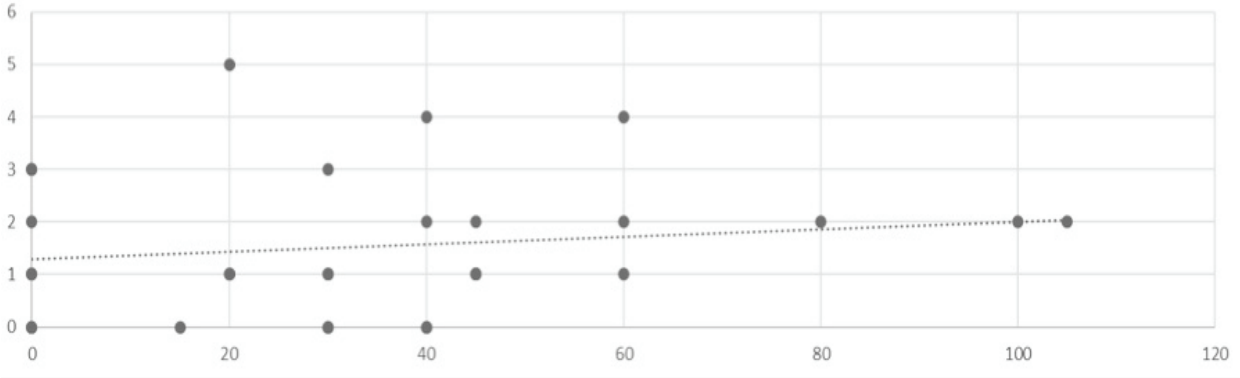


Fig. 4. Relationship between the average time spent weekly on stabilization exercises and average weekly frequency of pain occurrence in study group

pain intensity on the VAS scale as well as pain occurrence frequency. The most frequent area where study group dancers reported pain was knee joint – 15 subjects, with the avg. VAS-scale intensity of 2.1±2.4. It was also the most reported joint, in terms of pain occurrence frequency – avg. 1.1±1.4 days per week. In terms of both pain intensity and occurrence frequency, the second most reported area in study group was lumbar spine – 11 subjects, with the avg. VAS-scale intensity of 1.8±2.7 and average pain occurrence of 1±1.5 times per week. The same component was assessed in control group. The most reported area of pain occurrence was lumbar spine – 12 subjects (40%). The average VAS-scale intensity amounted to 1.3±1.8, while the pain occurred 1±1.84 times per week, on average.

Discussion

Dancing exercises generate strain which exceeds the ability of tissue to repair itself, which leads to chronic damage, inflammation and regressive changes. There are two kinds of factors which facilitate the overload of motor organs – acceleration and the results of lifestyle factors [12].

The longer a person has practiced dancing, the higher the risk and frequency of injury among dancers is. This risk, however, is still lower than in other sport disciplines [13]. The most common injuries among dancers include: meniscus tears in knee joint, chronic recurring bursitis, injuries of collateral and cruciate ligaments, avascular necrosis of tibial tuberosity, patellofemoral arthritis, overuse of peroneus muscles, fallen foot arch, hallux valgus, mallet toes and Achilles tendon enthesopathy (an area often compressed by straps of ballet or pointe shoes) [12,14]. Reynolds et al. have demonstrated that jazz dancers much more commonly suffer from injuries in distal joints and in lower extremities [15]. The authors' own study results have confirmed this. Most of the injuries suffered by dancers were located in lower extremities.

Most dancers and gymnasts have lumbar lordosis which deviates from the norm to a moderate or significant degree. Extreme range of motion, which is necessary for dancing and gymnastics, may contribute to excessive lordosis among dancers, which might later cause severe abnormalities of the spine [16]. Dancers from the analysed group did not report any problems in lumbar spine area, presumably because of their young age.

Schleper et al. have shown that psychological aspect of benign hypermobility joint syndrome. People suffering from BHJS have also been reported to have decreased physical fitness as well as increased fatigue and depression, as compared to control group [17]. This aspect, albeit important, was not analysed in the authors' study.

One of the indicated preventive measures in terms of injuries and overload is the incorporation of stabilization exercises to one's training routine, which helps strengthen weakened structures and increase neuromuscular coordination [1]. Preventive measures also include: the use of joint braces and Kinesio tape as well as proprioception training [18]. In order to prevent injuries and overload dancers are advised to perform stabilization exercises, which are also beneficial in pain reduction.

Importance of the study. This is one of the first studies in the available literature which analyses the relationship between BHJS and injury proneness among jazz dancers.

Limitations of the study. The analysis of injuries was conducted with the use of a survey created by the authors. Financial constrictions prevented any other form of study.

Conclusions

1. Benign hypermobility joint syndrome occurred more frequently among jazz dancers than people who do not practice dance or other sport disciplines professionally.
2. Injury proneness of jazz dance was linked to BHJS.
3. Stabilisation exercises appear to be beneficial in pain reduction.

References

1. Huxel KC, Anderson BE. Core Stability Training for Injury Prevention. Sports Health. 2013;5(6):514-22.
2. Yazgan P, Geyikli I, Zeyrek D, Baktiroglu L, Kurcer MA. Is joint hypermobility important in prepubertal children? Rheumatol Int. 2008;28(5):445-51.
3. Seçkin U, Tur BS, Yilmaz O, Yağci I, Bodur H, Arasil T. The prevalence of joint hypermobility among high school students. Rheumatol Int. 2005;25(4):260-3.

4. Dziak A. Dysfunkcje stawów kończyn. Acta Clinica. 2002;2(2):129-36.
5. Elliott EJ, Munns C, Tofts LJ, et.al. The differential diagnosis of children with joint hypermobility: a review of the literature. Pediatr Rheumatol. 2009;7(1):1–10.
6. Simpson MR. Benign joint hypermobility syndrome: evaluation, diagnosis, and management. J Am Osteopath Assoc. 2006;106(9):531-6.
7. Lawrence A. Benign hypermobility syndrome. J Indian Rheumatol Assoc. 2005;13:150-5.
8. Beighton P, Grahame R, Bird H. The Brighton Criteria for Hypermobility Syndrome. In: Beighton P, Grahame R, Bird H, editors. Hypermobility of joints. 4th ed. London: Springer; 2012:14-15.
9. Wiesler ER, Hunter DM, Martin DF, Curl WW, Hoen H. Ankle flexibility and injury patterns in dancers. Am J Sports Med. 1996;24(6):754-7.
10. Seguin ET. Histoire de la danse jazz. CHIRON; 2003.
11. James G, Witten D, Hastie T, Tibshirani R. An Introduction to Statistical Learning with Applications in R. Springer. 2017;103:15-57.
12. Michalczak M, Bojarczuk K, Smoleń A. Stosowanie zabiegów fizjoterapeutycznych u osób uprawiających balet po urazie sportowym oraz przeciążeniach narządu ruchu. Journal of Education, Health and Sport. 2016;6(7):640-51.
13. Ekegren CL, Quested R, Brodrick A. Injuries in preprofessional ballet dancers: incidence, characteristics and consequences. J Sci Med Sport. 2014;17(3):271-5.
14. Muniz de Araújo LG, Monteiro HL, Marcel C. Musculoskeletal disorders (MSDs) in dancers and former dancers participating in the largest dance festival in the world. Sci Sports. 2013;28(3):146-54.
15. Reynolds M, Kerchief B, Boyce D. A Descriptive Study on Injury Prevalence Among Female Ballet, Jazz and Modern Dancers. J Women's Health Phys Ther. 2013;37(2):83-9.
16. Ambegaonkar JP, Caswell AM, Kenworthy KL, Cortes N, Caswell SV. Lumbar lordosis in female collegiate dancers and gymnasts. Med Probl Perform Art. 2014;29(4):189-92.
17. Scheper MC, de Vries JE, de Vos R, Verbunt J, Nollet F, Engelbert RH. Generalized joint hypermobility in professional dancers: a sign of talent or vulnerability?. Rheumatology (Oxford). 2013;52(4):651-8.
18. Henn ED. A study of injury and its prevention in first-year university dance students. Temple University. 2016;138.
19. Sachse J, Janda V, Hinzmann J, Lewit K, Ruhm B. Assessment of Normal Mobility in Young Adults. J Orthopaedic Med. 2004;26(3):87-97.
20. Arcelus J, Witcomb GL, Mitchell A. Prevalence of eating disorders amongst dancers: a systematic review and meta-analysis. Eur Eat Disord Rev. 2014;22(2):92-101.
21. Kurpel DMA, Ribas GG, Skare T. Frequency of pain and eating disorders among professional and amateur dancers. Sao Paulo Med. J. 2016;134(6).
22. Nonn-Wasztan S, Wójcik M. Zastosowanie stretchingu i jego form u tancerzy. In: Majchrzycki M, Łańczak-Trzakowska M, Gajewska E, editors. Diagnostyka i usprawnianie pacjentów z dysfunkcjami narządów ruchu. Poznań: Uniwersytet Medyczny im. Karola Marcinkowskiego w Poznaniu; 2013:49–61.

Assessment of the quality of life and the relationship between its level and sociodemographic factors and physical activity in the group of patients with Parkinson's disease

A – preparing concepts
B – formulating methods
C – conducting research
D – processing results
E – interpretation and conclusions
F – editing the final version

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Abstract

Introduction: Parkinson's disease is a chronic condition that has a significant impact on one's quality of life (QOL). There is a growing interest in the QOL of people with chronic illnesses. An individuals' QOL is an important element of the overall assessment of health status and the effectiveness of treatment regimens.

Material and method: The study group consisted of 44 people with diagnosed Parkinson's disease from the Krakow Association of People Affected by Parkinson's Disease and the Association of People Affected by Parkinson's Disease Ostoja in Krakow. The WHOQOL-Bref Questionnaire was used to assess QOL, while the IPAQ Questionnaire was used to evaluate the level of physical activity. Sociodemographic data were collected by means of a questionnaire.

Results: The lowest domain of QOL observed in the study group was psychological area (44.6 points), and the highest in the environmental area (60.5 points). The physical domain score was significantly related to age, marital status and duration of disease, whereas the psychological domain score was correlated with hypertension. The social domain score was associated with the level of education and their place of residence. The environmental domain score was associated with their material status and level of education. Greater levels of physical activity correlated with better QOL in the physical ($p=0.005$), psychological ($p=0.001$) and social domains ($p=0.0001$).

Conclusions: The study demonstrates the relationship between the QOL and various sociodemographic factors (age, education, marital status, place of residence, material status, duration of the disease and coexistence of hypertension) and the level of physical activity in individuals with Parkinson's disease.

Key words: **Parkinson's disease, quality of life, physical activity**

Introduction

Parkinson's disease is a nervous system disorder that significantly affects quality of life (QOL) [1]. It is the second most common neurodegenerative disorder in the world [2-4]. This disease results in the progressive loss of dopamine [5]: a neurotransmitter whose deficiency causes symptoms of the disease [6]. Every year, worldwide, 4.5 to 19 people per 100.000 are diagnosed with this disease [5], and

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the number of cases increases with age [1]. For people over 55 years of age it affects 1.4% of the population, while in people over 75 years of age it affects 3.4%. It is estimated that in Poland, about 80,000 people are affected and the forecasts predict that by 2020 this number may increase to 110,000 [1]. Parkinson's typically starts in the fifth or sixth decade of life [5] and is more common among men [7,8].

The cause of Parkinson's disease is not fully understood. The neurodegeneration process may occur due to genetic or environmental factors, and nerve cells may die due to chronic inflammatory processes, toxic factors, accelerated aging, oxidative stress or protein metabolism disorders [1,9].

Parkinson's disease is characterized by motor and non-motor symptoms associated with decrease availability of dopamine and non-dopamine neurons [10,11]. Typical motor symptoms include: bradycardia, muscle stiffness, resting tremor, impairment of postural reflexes and motor coordination [2,3,10,12,13], which lead to a decrease in muscle strength, imbalance, gait and functional efficiency [2]. The disease is also often accompanied by emotional symptoms, autonomic disorders or sleep disorders [3,14]. Moreover, cognitive disorders, memory problems, depressive symptoms, anxiety, pain or faster fatigue may also occur [10,15]. As the disease progresses, its symptoms intensify and disability increases [3].

The interest in the QOL of people with chronic disease has been growing [16]. It is an important element of evaluate of health status and effectiveness of treatment. QOL is related to sociodemographic factors, such as age, gender or education, social and living conditions, and the level and availability of medical services [17]. An important element related to a greater level of QOL of patients is maintaining physical activity at an appropriate level [10,18,19,20]. Physical activity prolongs the period of physical independence, positively influences sleep, mood, memory and QOL of people with chronic diseases [21]. It has been demonstrated that people who do not participate in regular physical activity appear to have greater levels of disability [22]. Moreover, people with a decreased level of physical activity show a lesser degree of participation in social life [23], which results in a decreased QOL [24].

The aim of the study was to evaluate the QOL of patients with Parkinson's disease and to determine the relationship between QOL's level and sociodemographic factors and physical activity.

Material and method

The study group consisted of 44 persons (15 women and 29 men) with Parkinson's disease from the Krakow Association of People Affected by Parkinson's disease and the Association of People Affected by Parkinson's disease Ostoja in Krakow. The mean age of the participants was 67.5 years and the mean time from the diagnosis of Parkinson's disease was 9.6 years.

The criteria for inclusion in the study were: Parkinson's disease diagnosis, aged 30 to 85, diagnosis >3 years, no serious systemic diseases, and consent to participate in the study.

The Bioethics Committee of the University of Rzeszów approved the research project.

The following questionnaires were used for the study:

- WHOQOL-Bref- is an abbreviated version of the questionnaire, which aims to assess the QOL in four areas: physical, psychological, social and environmental. Respondents answer questions in a 5-point scale, which determines the nature of the aspect of a given QOL domain. The questionnaire also includes two questions, which are analyzed separately and focus on the individual assessment of the QOL by respondents and their general health. In accordance with the WHO recommendation, the conversion of raw points was used to obtain a scoring scale. The obtained results range from 0 to 100 points, where 0 is associated with low QOL and 100 with high QOL [24,25].

- International Physical Activity Questionnaire (IPAQ) - serves to assess the level of physical activity. The short version of the questionnaire, containing 7 questions, was used in the study. The questions refer to time spent on physical activity, ranging from sedentary to vigorous. On the basis of the study, the intensity coefficient was determined and the examined person was qualified to one of the three levels of activity:

- high, where the respondents obtain a result in excess of 1500 METs/week

- sufficient, where the respondents obtain a result in the range of 600-1500 METs/week

- insufficient, where the respondents score a result lower than 600 METs/week [26].

The following data were collected using a questionnaire: age, gender, education, marital status, place of residence, material status, duration of Parkinson's disease, occurrence of other chronic diseases (hypertension, degenerative disease, others) and sporting activity in the past.

A statistical study was carried out using Statistica software version 13.1. Arithmetic means, standard deviations, medians, minimum and maximum values were calculated to describe the distribution of numerical values of features. In the study, the Pearson correlation coefficient was used.

The Mann-Whitney test was also used in the analysis of the results to compare two independent groups.

The level of statistical significance was set at $p<0.05$.

Results

The study group consisted of 44 people with Parkinson's disease, including 15 women (34%) and 29 men (66%). The mean age was 67.5 years [±7.5]. The characteristics of the respondents are presented in Table 1.

The lowest domain of QOL observed in the study group was psychological area (44.6 points), and the highest was environmental area (60.5 points). Figures characterizing the QOL are presented in Table 2.

A correlation between the QOL and various sociodemographic factors and physical activity of people with Parkinson's disease was observed (Table 3).

Tab. 1. Characteristics of the study group

Variable	Study group
Age in years [±SD]	67.5 [±7.5]
Sex, n (%)	
Women	15 (34%)
Men	29 (66%)
Place of residence, n (%)	
Village	17 (39%)
Town	27 (61%)
Education, n (%)	
Primary and secondary	10 (23%)
Higher	34 (77%)
Marital status, n (%)	
Single	19 (43%)
In relationship	25 (57%)
Material status, n (%)	
Poor/average	17 (39%)
Good/very good	27 (61%)
Diagnosis of Parkinson's disease, n (%) [years]	
<50	4 (9%)
51-50	27 (61%)
61-70	12 (27%)
>71	1 (2%)
Duration of Parkinson's disease [±SD]	9.6 [±4.8]
Additional ailments, n (%)	
Arterial hypertension	28 (64%)
Joint degenerative disease	26 (59%)
Other	8 (18%)
Sport in youth, n (%)	
No	31 (71%)
Yes	13 (29%)
IPAQ, n (%)	
High	13 (29%)
Sufficient	5 (11%)
Insufficient	26 (59%)

Tab. 2. Characteristics of QOL of patients with Parkinson's disease

Variable	Mean	Standard deviation	Median	Min	Max
Subjective assessment of QOL	2.95	0.75	3	2	4
Subjective assessment of health status	2.45	0.7	2	1	4
Physical domain	48.1	9.3	44	38	75
Psychological domain	44.6	9.8	44	31	81
Social domain	54.2	12.2	56	31	81
Environmental domain	60.5	9.2	59.5	44	81

Tab. 3. Analysis of the relationship between QOL and sociodemographic factors and physical activity of the surveyed persons

Variable	Subjective assessment of QOL Mean [±SD]	Subjective assessment of health status Mean [±SD]	Physical domain Mean [±SD]	Psychological domain Mean [±SD]	Social domain Mean [±SD]	Environmental domain Mean [±SD]
Age						
p	0.005	0.071	0.003	0.723	0.101	0.191
Sex						
Women	3.2 [±0.6]	2.4 [±0.8]	49.3 [±9.3]	47.2 [±12.6]	56.6 [±13.6]	60.6 [±10.2]
Men	2.8 [±0.8]	2.5 [±0.6]	47.4 [±9.4]	43.2 [±7.9]	53 [±11.5]	60.4 [±8.8]
p	0.11	0.6	0.42	0.37	0.34	0.99
Education						
Primary and secondary	2.9 [±0.9]	2.4 [±0.5]	45.8 [±8]	40 [±8.1]	45.1 [±6.4]	55 [±8.3]
Higher	3 [±0.7]	2.5 [±0.8]	48.7 [±9.7]	45.9 [±10]	56.9 [±12.3]	62.1 [±9]
p	0.79	0.96	0.43	0.16	0.002	0.04
Marital status						
Single	2.8 [±0.8]	2.4 [±0.8]	52.7 [±10.2]	47.5 [±11.8]	54.9 [±13.5]	57.6 [±7.5]
In relationship	3.1 [±0.7]	2.5 [±0.6]	44.5 [±6.8]	42.4 [7.5]	53.7 [±11.5]	62.6 [±9.9]
p	0.2	0.26	0.005	0.17	0.67	0.08
Place of residence						
Village	3.1 [±0.8]	2.6 [±0.7]	50.5 [±9.4]	43.3 [±7]	59.1 [±9.9]	61.1 [±9.3]
Town	2.9 [±0.8]	2.4 [±0.7]	46.5 [±9]	45.4 [±11.3]	51.2 [±12.7]	60 [±9.3]
p	0.47	0.32	0.13	0.41	0.02	0.78
Material status						
Poor/average	2.7 [±0.8]	2.5 [±0.7]	47.6 [±8.4]	42.8 [±8.5]	50.4 [±9.5]	54.7 [±6.1]
Good/very good	3.1 [±0.7]	2.4 [±0.7]	48.4 [±10]	45.7 [±10.6]	56.6 [±13.3]	64.1 [±9.7]
p	0.08	0.64	1	0.48	0.07	0.001
Duration of Parkinson's disease						
p	0.006	0.009	0.011	0.568	0.620	0.074
Additional ailments						
Hypertension						
No	3.1 [±0.7]	2.4 [±0.8]	49.8 [±9.7]	49.7 [±11.6]	58.1 [±14.6]	61 [±10.1]
Yes	2.9 [±0.8]	2.5 [±0.6]	47.1 [±9.1]	41.7 [±7.4]	52 [±10.3]	60.1 [±8.8]
p	0.46	0.85	0.3	0.01	0.06	0.89
Degenerative joint disease						
No	2.9 [±0.7]	2.5 [±0.6]	49.1 [±10.6]	42.5 [±8.8]	49.2 [±12.2]	58.8 [±9.2]
Yes	3 [±0.8]	2.4 [±0.8]	47.4 [±8.4]	46 [±10.4]	57.7 [±11.2]	61.6 [±9.2]
p	0.96	0.59	0.69	0.24	0.06	0.34
Sport in youth						
No	2.8 [±0.7]	2.4 [±0.8]	47.4 [±8.9]	44.5 [±9.8]	56.2 [±10.2]	60.1 [±8.6]
Yes	3.3 [±0.9]	2.5 [±0.5]	49.6 [±10.4]	44.8 [±10.2]	49.5 [±15.6]	61.2 [±10.9]
p	0.05	0.35	0.48	0.75	0.08	0.75
IPAQ (Total MET)						
p	0.19	0.86	0.005	0.001	0.0001	0.08

It was found that age affects the subjective evaluation of QOL and QOL in the physical domain. People with greater level of education were characterized by better QOL in the social domain (p=0.002) and in the environmental domain (p=0.04). It was also noted that single people had better QOL in the physical domain than those in a relationship (p=0.005). Persons living in rural areas were characterized by better QOL in the social domain (p=0.02). The occurrence of hypertension significantly affected the QOL in the psychological domain (p=0.01). The respondents with good or very good material status showed a better QOL in the environmental field (p=0.001). The duration of the disease decreased the QOL in the physical domain (p=0.011) as well as subjective assessment of QOL (p=0.006) and subjective assessment of health status (p=0.009). The level of physical activity affected the physical domain (p=0.005), psychological domain (p=0.001) and social domain (p=0.0001), where its decrease was significantly associated with a decrease in the QOL in these areas.

Discussion

Simpson et al. [27] noted that psychological interventions with their potential to improve the QOL in the emotional area become important in the therapy of Parkinson's disease. In our own research it was observed that the lowest domain of QOL was found in the psychological area, which seems to demonstrate Simpson et al.'s thesis about the essence of psychological care in the life of people with Parkinson's disease.

There are many factors affecting QOL, both modifiable and unmodifiable. These factors may determine the QOL of patients to a different degree [28].

Gender is one of the factors determining the QOL. The literature reports that Parkinson's disease is more frequently diagnosed in men than in women [5]. However, Tu et al. did not show any relationship between gender and QOL, just like Schraag et al. Similar results were obtained by Augustyniuk et al [16]. Also, in our own research, no correlation between the QOL in the group of women and men was found.

Another study attempted to determine the relationship between the QOL and the age of the respondents. It was found that the disease progresses faster with age and the reaction to pharmacological treatment (levodopa) decreases. Gait and posture disorders, cognitive impairment and dementia development progress [31], which affects the QOL of patients. Augustyniuk et al. [16] observed a correlation between age and QOL. The authors found the best QOL for people between 50 and 60 years of age, while the worst in those over 70 years of age. The dependence in this regard was also demonstrated by Tu et al. Moreira et al. [32] who proved that with increasing age, the QOL in some areas of life deteriorates, i.e. by the decrease of independence in activity of daily living and cognitive functions. Our own research demonstrated the occurrence of dependence as QOL decreased. With the increase in age, the QOL in the physical domain and subjective evaluation of the QOL were reduced.

This study also explored the relationship between the QOL and the level of education. Education plays an important role in individual's personal and social development and supports and enriches the understanding of oneself and the world [33]. He et al. [34] noted that higher levels of education were associated with improved QOL. This study supports these findings with greater levels of education being associated with higher reported QOL in both the social and environmental domains.

Marital status is another factor that could influence the QOL of individuals with Parkinson's disease. Moreira et al. [32] reported worse QOL in the social domain in married patients. This dependence seems to be surprising, since persons in a relationship are usually considered to have greater support and acceptance. On the other hand, this correlation can be explained by the fact that chronic disease, resulting in growing dependence on the partner, may be a source of conflict and thus weaken family and social ties [35]. Our own research also found that single people had a significantly greater level of QOL in the physical domain, in contrast to persons in relationships. This result may be related to the fact, that the average duration of the disease was 8.6 years for single persons and 10.3 years for persons in a relationship, which, given the progressive nature of the disease, could explain the occurrence of this dependence.

Studies have also examined the relationship between the QOL and the place of residence of individuals with Parkinson's disease. Rural areas are typically characterized by informal interactions with

strong social links and urban areas are more formal and thus weaker ties between inhabitants are formed [36]. Augustyniuk et al. [16] found a significant difference between the inhabitants of smaller towns and cities, with higher levels of QOL being reported by people from smaller towns and cities. In our own research it was also found that people living in rural areas reported greater levels of QOL in the social domain, in contrast to city dwellers. Our respondents from the rural environment reported greater levels of personal relationships with other people and were more satisfied with the support they received from their friends.

This study also identified a link between the QOL and the duration of the illness. Parkinson's disease is a progressive disorder with increasing motor and non-motor symptoms over time [37]. The duration of the disease has a negative impact on the QOL of patients due to the deterioration of physical and emotional condition [38]. Tu et al. observed that a longer duration of the disease led to a deterioration in the QOL of patients [30]. Moreira et al. [32] also observed a decrease in the QOL in various domains of the disease (daily activities, emotional domain) in patients with longer duration of the disease. Augustyniuk et al. [16] noted a worse QOL in patients with disease duration exceeding 15 years, slightly better in patients whose disease duration was 5 years. In our study we found that longer duration of Parkinson's disease caused poorer QOL in the physical domain. Respondents were also less satisfied with the overall quality of their lives and the status of their health. Further evaluation of QOL's changes related to the progression of the disease is very important, as it may lead to more effective targeting of interventions [37].

This study also identified the relationship between the level of physical activity and the QOL of patients with Parkinson's disease. Research by Van Uem et al. [39] confirmed that greater levels of physical activity are associated with greater level of QOL. Our own research also demonstrated this relationship, referring to three domains: physical, psychological and social. Patients who undertook greater physical effort were characterized by greater level of QOL in the above-mentioned domains. Physical activity is a modifiable lifestyle factor that may influence the course of Parkinson's disease [40]. For this reason, it is important to combine traditional therapeutic procedures with an appropriate physical activity strategy in order to reduce motor disorders, postural instability and improve the QOL of people struggling with this disease [41].

Finally, this study examined the relationship between the QOL and material status and hypertension. Previous studies report that the occurrence of hypertension decreases the QOL of patients with this disease [42,43]. In our study, coexistence of hypertension led to deterioration of QOL in the psychological domain. On the other hand, the decreased QOL in the environmental area was associated with poor or average material status. These dependencies have not been studied in a group of patients with Parkinson's disease previously. Therefore, it is not possible to compare one's own results with those of other authors.

A limitation to this study was the small sample size. Given the findings of this study it is clear that more work needs to be done to better understand the effects that Parkinson's disease has on QOL. Therefore, it is important to continue this work in a larger group of patients and to extend this work by exploring a broader range of factors that may affect QOL in this population.

Conclusions

The study demonstrates the relationship between the QOL and various sociodemographic factors (age, education, marital status, place of residence, material status, duration of the disease and coexistence of hypertension) and the level of physical activity in individuals with Parkinson's disease.

References

1. Cholewa J, Gorzkowska A, Nawrocka A, Cholewa J. Jakość życia osób z chorobą Parkinsona w kontekście pracy zawodowej i rehabilitacji ruchowej. Med Pr. 2017;68(6):725-34.
2. Pinto C, Salazar AP, Marchese RR, Stein C, Pagnussat AS. Is hydrotherapy effective to improve balance, functional mobility, motor status, and quality of life in subjects with Parkinson's disease? A systematic review and meta-analysis. PM R. 2018; pii:S1934-1482(18)30931-6.

3. Balzer-Geldsetzer M, Klotsche J, LANDSCAPE Consortium, Dodel R, Riedel O. Quality of life in a German cohort of Parkinson's patients assessed with three different measures. J Neurol. 2018; doi: 10.1007/s00415-018-9047-9.
4. Poewe W, Seppi K, Tanner CM, Halliday GM, Brundin P, Volkmann J, et al. Parkinson disease. Nat Rev Dis Primers. 2017;3:17013.
5. World Health Organization [Internet] Neurological disorders associated with malnutrition [updated 2006]. Available from: https://www.who.int/mental_health/neurology/chapter_3_b_neuro_disorders_public_h_challenges.pdf?ua=1.
6. Szefler-Delera J, Suszyński K, Doroniewicz I, Kowalczyk A, Opala G, Kwiek SJ. Nordic Walking w rehabilitacji choroby Parkinsona. An Acad Med Siles. 2014;68 (5):361–7.
7. Kozak-Putowska D, Iłżecka J, Piskorz J, Wójcik G, Nalepa D. Kinezyterapia w chorobie Parkinsona. Medycyna Ogólna i Nauki o Zdrowiu. 2015;21(1):19-23.
8. Gaweł M, Potulska-Chromik A. Choroby neurodegeneracyjne: choroba Alzheimera i Parkinsona. Post Nauk Med. 2015; XXVIII(7):468-76.
9. Wickremaratchi MM, Perera D, O'Loghlen C. Prevalence and age of onset of Parkinson's disease in Cardiff: a community based cross sectional study and meta-analysis. J Neurol Neurosurg Psychiatry. 2009;80(7):805-7.
10. Fayyaz M, Jaffery SS, Anwer F, Zil-E-Ali A, Anjum I. The Effect of Physical Activity in Parkinson's Disease: A Mini-Review. Cureus. 2018;10(7):e2995. doi: 10.7759/cureus.2995.
11. DeMaagd G, Philip A. Parkinson's Disease and Its Management: Part 1: Disease Entity, Risk Factors, Pathophysiology, Clinical Presentation, and Diagnosis. P T. 2015;40(8):504-32.
12. Huang X, Ng SY-E, Chia NS-Y, Setiawan F, Tay K-Y, Au W-L, et al. Non-motor symptoms in early Parkinson's disease with different motor subtypes and their associations with quality of life. Eur J Neurol. 2019;26(3):400-6.
13. Adewusi JK, Hadjivassiliou M, Vinagre-Aragón A, O'Connor KR, Khan A, Grünewald RA, et al. Peripheral neuropathic pain in idiopathic Parkinson's disease: Prevalence and impact on quality of life; a case controlled study. J Neurol Sci. 2018;392:3-7.
14. Bollu C, Sahota. Sleep and Parkinson Disease. Mo Med. 2017;114(5):381-6.
15. Ophey A, Eggers C, Dano R, Timmermann L, Kalbe E. Health-Related Quality of Life Subdomains in Patients with Parkinson's Disease: The Role of Gender. Parkinsons Dis. 2018; 2018: 6532320.
16. Augustyniuk K, Knapik J, Starczewska M, Schneider-Matyka D, Jurczak A, Szkup M. Ocena jakości życia pacjentów z chorobą Parkinsona. Med Health Sci Rev. 2016;2(1):7-12.
17. Sobczyk W, Gugała M, Rola R. Rozwój badań nad jakością życia w chorobach przewlekłych. Post Psychiatr Neurol. 2008;17(4):353-6.
18. Coe S, Franssen M, Collett J, Boyle D, Meaney A, Chantry R, et al. Physical Activity, Fatigue, and Sleep in People with Parkinson's Disease: A Secondary per Protocol Analysis from an Intervention Trial. Parkinsons Dis. 2018; 2018: 1517807.
19. Wu P-L, Lee M, Huang T-T. Effectiveness of physical activity on patients with depression and Parkinson's disease: A systematic review. PLoS One. 2017;12(7): e0181515.
20. Rafferty MR, Schmidt PN, Luo ST, Li K, Marras C, Davis TL, et al. Regular Exercise, Quality of Life, and Mobility in Parkinson's Disease: A Longitudinal Analysis of National Parkinson Foundation Quality Improvement Initiative Data. J Parkinsons Dis. 2017;7(1):193-202.
21. Ramaswamy B, Jones J, Carroll C. Exercise for people with Parkinson's: a practical approach. Pract Neurol. 2018;18(5):399-406.
22. Ćwirlej-Sozańska A, Wilmowska-Pietruszńska A, Wiśniowska-Szurlej A, Sozański B. Analysis of health, functioning and disability of rural inhabitants aged 60–80 living in south-eastern Poland – a cross sectional study. Ann Agric Environ Med. 2017;25(3):388-94.
23. McAuley E, Blissmer B, Marquez DX, Jerome GJ, Kramer AF, Katula J. Social relations, physical activity, and well-being in older adults. Prev Med. 2000;31(5):608-17.
24. Ćwirlej-Sozańska AB, Sozański B, Wiśniowska-Szurlej A, Wilmowska-Pietruszyńska A. Quality of life and related factors among older people living in rural areas in south-eastern Poland. Ann Agric Environ Med. 2018;25(3):539-45.
25. Kowalska M, Skrzypek M, Danso F, Humeniuk M. Ocena wiarygodności kwestionariusza WHOQOL-BREF w badaniu jakości życia dorosłych, aktywnych zawodowo mieszkańców aglomeracji górnośląskiej. Prz Epidemiol. 2012;66:531-7.
26. Biernat E, Stupnicki R, Gajewski AK. Międzynarodowy Kwestionariusz Aktywności Fizycznej (IPAQ) – wersja polska. Wych Fiz Sport. 2007;51(1):47-54.
27. Simpson J, Lekwuwa G, Crawford T. Predictors of quality of life in people with Parkinson's disease: evidence for both domain specific and general relationships. Disabil Rehabil. 2014;36(23):1964-70.
28. Gozdek L, Laskowska I, Michałak M, EJ Gorzelańczyk. Ocena jakości życia osób z chorobą Parkinsona. Pol Forum Psychol. 2007;12(1):51-62.
29. Schrag A, Jahanshahi M, Quinn N. What contributes to quality of life in patients with Parkinson's disease? J Neurol Neurosurg Psychiatry. 2000;69(3):308-12.
30. Tu XJ, Hwang WJ, Ma HI, Chang LH, Hsu SP. Determinants of generic and specific health-related quality of life in patients with Parkinson's disease. PLoS One. 2017;12(6): e0178896. doi: 10.1371/journal.pone.0178896.

31. Levy G. The Relationship of Parkinson Disease With Aging. Arch Neurol. 2007;64(9):1242-6.
32. Moreira RC, Zonta MB, Araújo APS, Israel VL, Teive HAG. Quality of life in Parkinson's disease patients: progression markers of mild to moderate stages. Arq Neuropsiquiatr. 2017;75(8):497-502.
33. Javed S, Javed S, Khan A. Effect of Education on Quality of Life and Well Being. Int J Indian Psychol. 2016;3(3 58):1-10.
34. He L, Lee EY, Sterling NW, Kong L, Lewis MM, Du G, et al. The Key Determinants to Quality of Life in Parkinson's Disease Patients: Results from the Parkinson's Disease Biomarker Program (PDBP). J Parkinsons Dis. 2016;6(3):523-32.
35. Navarro-Peternella FM, Marcon SS. Living with Parkinson's disease from the perspective of parkinsonians and their relatives. Rev Gaúcha Enferm. 2010;31(3):415-22.
36. Carta MG, Aguglia E, Caraci F. Quality of Life and Urban / Rural Living: Preliminary Results of a Community Survey in Italy. Clin Pract Epidemiol Ment Health. 2012;8:169–74.
37. Benge JF, Kekecs Z, Encarnacion E, Ainslie M, Herff C, Elkins G, et al. Duration of disease does not equally influence all aspects of quality of life in Parkinson's disease. J Clin Neurosci. 2016;28:102-6.
38. Soh SE, McGinley JL, Watts JJ. Determinants of health-related quality of life in people with Parkinson's disease: a path analysis. Qual Life Res. 2013;22(7):1543-53.
39. van Uem JMT, Cerff B, Kampmeyer M, Prinzen J, Zuidema M, Hobert MA, et al. The association between objectively measured physical activity, depression, cognition, and health-related quality of life in Parkinson's disease. Parkinsonism Relat Disord. 2018;48:74-81.
40. Mantri S, Fullard ME, John E. Duda JE, Morley JF. Physical Activity in Early Parkinson Disease. J Parkinsons Dis. 2018;8(1):107–11.
41. Borrione P, Tranchita E, Sansone P, Parisi A. Effects of physical activity in Parkinson's disease: A new tool for rehabilitation. World J Methodol. 2014;4(3):133–43.
42. Carvalho MV, Siqueira LB, Sousa AL, Jardim PC. The influence of hypertension on quality of life. Arq Bras Cardiol. 2013;100(2):164-74.
43. Trevisol DJ, Moreira LB, Kerkhoff A, Fuchs SC, Fuchs FD. Health-related quality of life and hypertension: a systematic review and meta-analysis of observational studies. J Hypertens. 2011;29(2):179-88.

Educational component in rehabilitation programs for persons with chronic obstructive pulmonary disease: a systematic review

A – preparing concepts
B – formulating methods
C – conducting research
D – processing results
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Abstract

Introduction: Chronic obstructive pulmonary disease is a chronic disorder that involves high-priced treatment and management, 45–75% of which may be associated with exacerbation. Treatment, rehabilitation, adherence to a healthy lifestyle, and following recommendations for self-management require a patient's high motivation and self -organization. Analysis and the search for effective strategies that could be implemented to enhance the effectiveness of an educational component in rehabilitation for people with COPD have become the purpose of the study.

Material and methods: The search was conducted on a resource of the National Center for Biotechnology Information. From the initial database searches, 2487 unique papers were identified, 895 were retrieved for full-text evaluation, 39 of those were included for further data extraction.

Results: Publications selected for analysis based on the main content were grouped into 5 categories; most articles were focused on the self-management strategy.

Conclusions: The current practice of conducting and recommending education for COPD patients, as well as modern technologies, will make it possible to properly implement this component in pulmonary rehabilitation programs, achieve the objectives and positive impacts. Effective educational strategies ensure long-term benefits for the patients, fewer exacerbations, better physical performance, and quality of life. The correct inhaler technique is the fundamental practical skill to be learned by COPD patients during training sessions. A set of recommendations has been developed, and they should be considered when elaborating on the curriculum within the pulmonary rehabilitation for COPD patients.

Key words: **physical therapy, COPD, pulmonary rehabilitation, self-management.**

Introduction

Chronic obstructive pulmonary disease (COPD) is a common, preventable and treatable disorder, which is characterized by persistent respiratory symptoms and airflow limitations due to airway and/or alveolar abnormalities usually caused by significant exposure to noxious particles or gases [1]. Dyspnea and cough are the initial common symptoms that reduce physical activity, load-carrying ability, and quality of life.

COPD is a chronic disease that involves high-priced treatment and management [2], 45–75% of which may be associated with exacerbation [3].

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Modern COPD therapy is aimed at the reduction of the severity of symptoms, prevention of the development of relapses of exacerbation, maintenance of the optimal functioning of the respiratory system, and improving the quality of life [1].

One of the most critical deterrents to successful COPD treatment is a patient's low adherence to therapy, which is primarily due to the low subjective evaluation of medical care outcomes and, as a result, false conclusions on the efficiency of treatment. Other reasons for low motivation to adhere to the prescribed treatment are low patient's awareness of disease patterns, the lack of understanding of the need for long, often lifelong, therapy, the lack of knowledge on the prognosis in case of failure to receive treatment, the mechanisms of action of the prescribed medicine, the differences between the background and symptomatic therapy, as well as the fear of the occurrence of side effects, dependence on medications, high cost of treatment, patient's unwillingness to materially change his/her lifestyle (for example, quit smoking) [4]. In other words, treatment, rehabilitation, living a healthy lifestyle, and following recommendations for self-management require a patient's high motivation and self-organization.

It has been demonstrated that strategies for comprehensive pulmonary rehabilitation are beneficial in solving the abovementioned issues.

The following definition of pulmonary rehabilitation was defined in a joint official statement by the American Thoracic Society (ATS) and the European Respiratory Society (ERS) for the year 2013: "… a comprehensive intervention based on a thorough patient assessment followed by subject-tailored therapies that include, but are not limited to, exercise training, education, and behavior change, designed to improve the physical and psychological condition of people with chronic respiratory disease and to promote the long-term adherence to health-enhancing behaviors" [5].

The advantages of pulmonary rehabilitation of individuals with COPD has been clearly demonstrated in the literature and need no further confirmation [6]. However, the search for optimal educational programs, ways of implementation and evaluation of their effectiveness, the introduction of strategies for the formation of knowledge, skills, and competencies, as well as the development of patient's self-management are still critical and relevant.

The purpose of our study is to analyze and find effective strategies that could be implemented to enhance the effectiveness of the educational component in the rehabilitation of patients with COPD.

Material and Methods

The search has been conducted on a resource of the National Center for Biotechnology Information, in the USA (PubMed). To identify all the descriptors needed for a comprehensive search, we consulted Medical Subject Headings (MeSH). The keyword combination was "COPD," "Chronic obstructive pulmonary disease," "Pulmonary Disease Chronic Obstructive," "Organization and administration," "Prevention and control," "Rehabilitation," "Therapy," "Education," "Educational," "Knowledge," "Informatisation" with selective Boolean operators "AND" and "OR."

The following are the criteria for publication selection: studies pertaining solely to patients with COPD (1), papers published within the past five years (April 2014 – April 2019) (2), availability of the full text in English (3), the studies related to the level of awareness and familiarity among patients with the primary disease (COPD) (4), publications concerned with the importance, specific content of educational programs, their ways of implementation, and effectiveness (5), papers were related to self-management of patients with COPD.

Exclusionary criteria: protocols with incomplete clinical studies (a comment, an editorial, case report, clinical trial, a letter, a protocol) (1), papers related to the training of the staff involved in treatment/rehabilitation of patients with COPD and further evaluation of their level of awareness (2) or to other respiratory system diseases or if a patient was simultaneously diagnosed with COPD and other illness (3), publications on planning and implementation of activities related to medical treatment (4).

In order to ensure the accuracy of the review, both authors have independently developed a summary of the included studies. The exactness of these studies has been checked using a checklist with five questions: is this a detailed description of the participants? (1); is this an accurate description of educational programs, their ways of implementation? (2); is this a proper summary of the educational program? (3); is this a detailed

description of outcomes? (4); is this a logical summary of the research methodology? (5).

Co-authors analyzed the articles by the checklist, edited the summary, and improved its accuracy. The results have been discussed, agreed, and used for the creation of tables.

All the search results are relevant as of April 2019.

Results

Figure 1 illustrates the 3-phase screening approach and the number of articles included at each stage. From the initial database searches, 2487 unique papers were identified, 895 were retrieved for full-text evaluation, 39 of those were included for further data extraction. Publications selected for analysis based on the main content have been grouped into five categories; most articles have been focused on the self-management strategy. Among them, there are influence of the level of awareness on various aspects of health and life – 6 publications (1), education on specific issues related to COPD – 5 publications (2), provision of educational services and assessing their effectiveness – 3 publications (3), content and implementation of the educational component within the integrated pulmonary rehabilitation – 7 publications (4), self-management strategies – 18 publications (5).

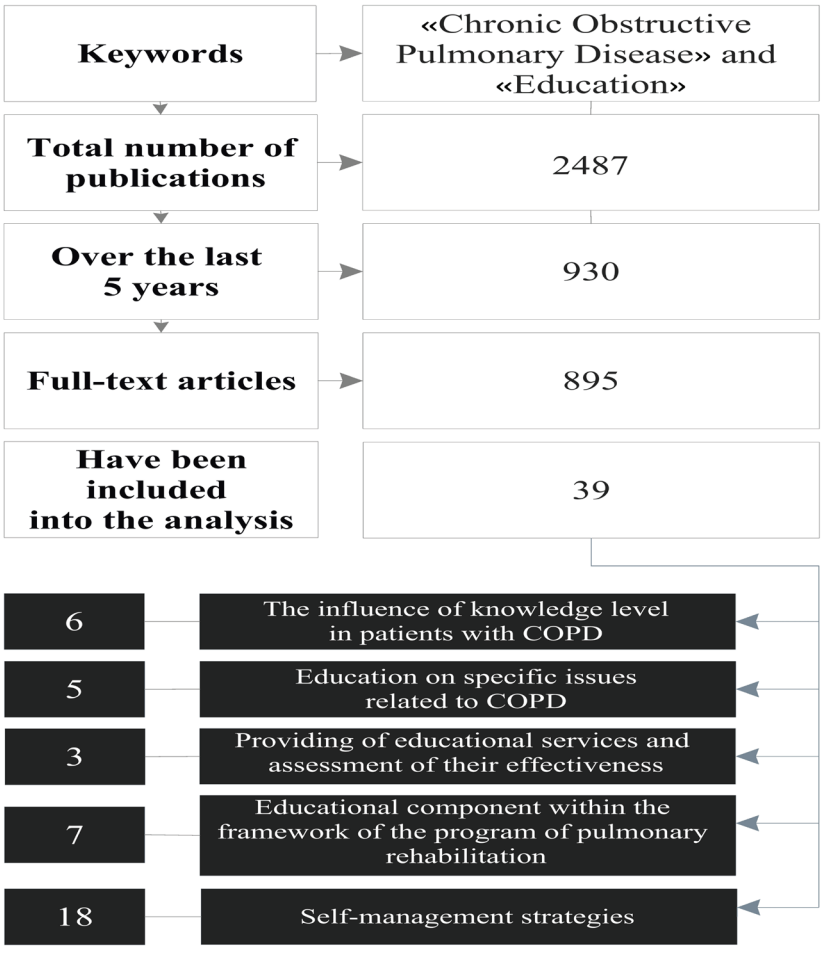

Fig. 1. The phases of screening approach and the number of articles included at each stage

The division of articles into separate groups was, in some cases, conditional since the study could have been conducted in two or more areas. In this case, the publication has been attributed to the selected group considering the main objective of the study.

1. Influence of the level of awareness on various aspects of health and life

For the successful treatment and improvement of the quality of life of patients with COPD it is essential to have a high level of specialized

knowledge about this disease, especially about the way disease affects the well-being and various aspects of life (Table 1). The ability of patients with COPD to independently influence the course of the disease, while maintaining their well-being at a relatively stable level depends on the level of disease awareness. The level of awareness of patients with COPD of the nature, course, and effects of the disease affects various aspects of life. In particular, there is a strong positive correlation between the level of awareness of patients with COPD and the level of their self-management [7].

Tab. 1. Analysis of articles devoted to the impact of knowledge level on various aspects of health and life

No.	Authors, year, country	Type of research / goal of research	Number of participants and sex; age (years old)	Research methods	The content of the educational program or research results
1	Hua Yang et al., 2019, China [7]	Observation/ Determination of the relationship between the knowledge level on the disease and the level of self-management	246♂ + 100♀; 44–86	COPD-Q and CSMS questionnaires	It was found that the knowledge level on COPD correlates with the level of self-management behavior. Educational activities to enhance the knowledge level on COPD may be necessary to improve self-management.
2	Abdulsalim S. et al., 2018, India [9]	Randomized controlled clinical study / Evaluating the effectiveness of the pharmacist's clinical intervention on the patient's commitment to treatment	194♂ + 12♀; 61.1 (8.4)*–60.6 (7.9)	MAQ questionnaire	Consultation sessions (15–20 min) and information leaflets on the following essential indications: adhere to medical therapy, measure out in doses and take medication on time, need to quit smoking, do exercises, use inhalers properly and detect illness rapidly
3	Collinsworth A.W. et al., 2018, USA [8]	Prospective randomized pilot study/ Evaluate the feasibility of the developed educational program	128♂ + 180♀; 44–86; 70.9 (12.5)–70.0 (11.9)	Patient Activation Measure and CAT questionnaires	An educational program is aimed at obtaining basic knowledge about COPD and participation in the planning of self-management activities (15–30 min) and planned telephone conversations. Participation in planning in collaboration with patients provided a common choice of patient's most significant on their opinion strategies for preserving health and preventing exacerbations.
4	Schüz N. et al., 2015, Australia [11]	Randomized controlled study/ Studying the effect of anxiety and depression in patients on the effectiveness of a rehabilitation program	182; ND, >45	Questionnaires by HADS, Partners in Health Scale; axonometry	16 conversations over the phone for 12 months. The topics of conversations concerned 5 components of self-management.
5	Zhang Q. et al., 2014, China [10]	Cross-sectional study/ Study the knowledge of COPD as a risk factor for anxiety and/or depression in patients with COPD, links between levels of knowledge, functionality, and quality of life	327♂ + 32♀; 65.64 (7.60)	Dyspnea scale mMRC; HADS, CAT, BCKQ; 6MWD questionnaires	A higher score has been correlated by HADS with a lower COPD level. Critical issues of COPD that are a risk factor for anxiety and/or depression in patients with COPD are epidemiology, and infection
6	Nakken N. et al., 2017, Netherlands [12]	Cross-sectional study / Comparing the knowledge level of illness in patients and their guardians	194** 102♂ + 92♀; 66.0 (8.7)	The questionnaire with 34 statements, formulated by a multidisciplinary group of pulmonary rehabilitation	Patients and their guardians have limited knowledge of COPD and overall health status. Patients should be educated with their guardians, which will be useful in terms of improving management strategies, strengthening relationships, and organizing behavioral changes.

Notes: COPD-Q – Chronic Obstructive Pulmonary Disease knowledge Questionnaire, CSMS – COPD Self-Management Scale, MAQ – Morisky, Green and Levine Medication Adherence Questionnaire, HADS – Hospital Anxiety and Depression Scale, mMRC – Modified Medical Research Council, CAT – COPD Assessment Test, BCKQ – Bristol COPD Knowledge Questionnaire, 6MWD – six-minute walk distance.
ND – sex was not determined in the study.
* – M (SD).
** – the study involves patients and their guardians; the age and gender is given for patients with COPD.

One of the goals of educational programs in the field of rehabilitation is to improve the person's adherence to therapy. Patients with COPD chose to develop such skills that will contribute to the formation and development of self-management, as well as the correction of a lifestyle (leaving off smoking) [8]. These and other educational topics have been provided within the educational program, which had been planned for each patient. Thanks to the abovementioned approach and educational program the duration from the beginning of the program until the first exacerbation was longer and had a positive impact on the health condition of the subjects, however, in general, it did not decrease the total number of hospitalizations.

Better adherence to medication therapy can be achieved by involving pharmacists in providing consultations for patients with COPD [9]. Such an approach reduces the number of intents of improper consumption of pharmaceuticals.

The level of awareness of the disease is a risk factor for the development of anxiety and depression in patients with COPD , a decrease in the quality of life, and an increase of dyspnea [10]. The level of a patient's anxiety and depression before the educational program significantly determines its effectiveness. In particular, there has been found the positive effect of educational program on self-management on the level of awareness and the change in physical activity of patients with a low level of anxiety and depression [11]. At the same time, a higher level of anxiety and depression was associated with a lower level of physical activity after completing the educational program.

To overcome/stabilize the disease both patients with COPD and their guardians shall have the appropriate level of awareness. [12]. In general, the researchers have not found any significant differences between the level of awareness of the patients and their representatives. Moreover, the responses of patients who had previously participated in the program of pulmonary rehabilitation, persons with better cognitive function, younger patients, and patients with a higher level of education, as well as patients with previously diagnosed COPD appeared to be more accurate.

2. Education on specific issues related to COPD

The syllabus for COPD patients includes a wide range of topics. Some of them are theoretical, while others are combined with practical skills. Among the selected publications there are studies devoted to the significance and peculiarities of studying particular educational topics, mainly the use of inhalation devices, the correct use of which is an essential basis for the effective treatment of COPD patients (Table 2). The studies confirmed a high rate of inappropriate use of inhalers among COPD patients (40–100%) [13-15], even after specialized training or long-term (on average 9 years) usage of the device.

Among the methods of the proposed work with patients, specialists have suggested as follows: specially developed handout material [14], which considers the level of awareness of a patient (including a very low one) of the disease, video lectures, demonstration of the use of inhaler techniques, direct instructions given by pharmacists, etc. [16]. Individual methods of work appeared to be the most successful ones (practical training sessions with medical specialists, and individual instructions), but video demonstration has also appeared to be effective. Even one training session with a pharmacist can significantly improve the quality of use of inhalation devices and save the result of training for 4–6 weeks [16]. However, evaluating the number of training sessions required to minimize mistakes in the use of inhalations, Takaku Y. et al. found that many specialists (pharmacists) misplaced steps and failed to demonstrate to their patients appropriate techniques of using the inhaler [17]. In order to achieve the maximum positive effect and to develop the skills of using one model of the inhaler, a patient needs at least three sessions of instructions. However, some patients may continue wrong inhalations even after repeated instructions that sometimes depend on physical constraints and the inability to use the device properly [17]. In such cases, it is recommended that the device is changed to an easier one.

Tab. 2. The results of selected educational issues related to COPD

No.	Authors, year, country	Type of research/ aim of research	Number of participants and sex; age (years old)	Research methods	Description of educational methodology
1	Windisch W. et al., 2018, Germany [13]	Randomized controlled trial/ Compare the effectiveness of learning with the use of web video with individual instructions for the correct inhalation technique	74♂ + 78♀; 66.6 (7.7)*–68.2 (9.1)	Checklists of the correct inhalation technique (https://www.atemwegsliga.de)	Individual instructions provided by the doctor. Web videos provided by Deutsche Atemwegsliga demonstrating proper inhalation techniques
2	Purohit A.N. et al., 2017, India [15]	Prospective, continuous, interventional, comparative study/ Evaluate the impact of such training activities as a demonstration of a researcher's technique and information sheets on the use of a metered-dose inhalers (MDI)	65, ND; 49.47 (1.95)–44.70 (2.19)	WHO Guidebook Checklist	Demonstration of the technique of using the inhaler, cards with a graphic representation of the correct technique of using an inhalation device
3	Beatty C.R. et al., 2017, USA [14]	Prospective experimental study/ To investigate the influence of the level of medical literacy on inhalation technique	120, ND; 18–89	Medical literacy questionnaire – REALM-SF. Checklist for a correct use of an inhaler	Specially designed handout material that takes into account the specific types of inhalers and the level of medical literacy, a standard handout that is used in hospitals
4	Takaku Y. et al., 2017, Japan [17]	Prospective study/ Evaluate the number of instructions needed to minimize mistakes when using inhalers of different types	74♂ + 7♀; 72 (7)	Checklists for assessing the correct use of the inhaler	Repetitive testing of practical skills, evaluation of the effectiveness of the acquired knowledge (2-5 times with intervals from 2 weeks up to 1 month until the maximum possible positive result is achieved), instructions
5	Bouwmeester C. et al., 2015, USA [16]	Observation/ Assess the patient's ability to demonstrate and maintain appropriate methods of administering inhaled medication after training provided by a pharmacist	36, ND; 81 (10.05)	Hickey's Pharmacies Inhaler Technique assessment	Training session with a pharmacist on the use of an inhaler, evaluation of its performance

Notes: MDI – Metered Dose Inhaler, REALM-SF – Short Form of Rapid Assessment of Adult Literacy in Medicine.
* – M (SD).
ND – sex was not determined in the study.

3. Providing educational services and assessing their effectiveness (Table 3)

A face-to-face meeting at least once a week for 6–8 weeks and simultaneous provision of printed educational materials are the classical approach towards the implementation of the educational component [18]. It requires territorial accessibility of institutions that provide such services for patients, relevant professionals, the patient's ability to attend training sessions and financial support. Accordingly, in order for patients with COPD to get more specialized education and to reduce the economic burden, alternative educational ways are being sought. An intensive, one-sessional training within a one-day training camp, which has a statistically proven efficiency, may be an economically sound resolution. [19].

Educational services may also be provided both in the form of lectures and using digital media (in particular, DVDs) [20]. A comparison of these two forms of training showed no significant differences in the awareness of patients who used these techniques. An increase in viewing online medical information among adults with chronic diseases, as well as the possibility of usage of information and communications technologies, increases patient's access to learning. YouTube™ (www.youtube.com), one of the most popular social websites, is often used to exchange some educational materials for patients with chronic diseases. Assessing the content and quality of 223 video tutorials on YouTube, it has been revealed that about half of the videos cover the topic of "Drug Management" (50.7%), while "Leaving off Smoking" has been highlighted in 17.9% of the analyzed videos, "Physical activity" – 17.5%, "Everyday affairs" – 16.6%, "Infection control" – 11.7%, "Respiratory training" only 9.8%, "Nutrition" and "Stress management/energy saving" – less than 5% of the videos [21]. The promotion of educational materials on YouTube has great potential; however, the quality and the content of analyzed and available videos were quite low, and their total number is small if compared with the amount of video material related to other chronic diseases.

Tab. 3. Provision and effectiveness of educational services for people with COPD

No	Authors, year	Type of research / goal of research	Number of participants and sex; age (years old)/ subject of study	Research methods	Organization of educational services or research findings
1	Ward S., Sewell L., Singh S., 2018, UK [20]	Comparative follow-up study/ Evaluate the quality of providing educational services in the form of a DVD presentation	64♂ + 59♀; 68.00 (10.04)*–71.26 (10.19)	BCKQ questionnaire	Conducted by: members of a multidisciplinary team (pulmonologist, occupational therapist, nurse of respiratory medicine, physical therapist, psychologist, dietician, and pharmacist). Themes: information on the disease, healthy eating, medicines, prevention of exacerbations and exacerbations' features, physical activity and training, energy conservation, rest, and thorax treatment
2	Bhattacharyya P. et al., 2018, India [19]	Clinical study/ Evaluate the effectiveness of self-study and intensive one-session training under the guidance of specialists based on a simple training program for patients	62♂ + 28♀; 62 (9)–71.26 (10.19)	CAT	As part of one-day training camp. Themes: information on COPD and the importance of smoking cessation, pharmaceutical information, the correct use of inhaled medicines, the importance of treatment for COPD-related diseases, proper and appropriate food and hygienic interventions (including bronchial hygiene), general exercises and exercises with particular emphasis on walking and breathing
3.	Stellefson M. et al., 2014 [21]	Heuristic evaluation/ Analyze the content of video materials related to COPD and located on YouTube	223 video materials	3 experts who have experience in web design and health technology have estimated the functionality of the prototype of the COPDFlix Social Resource Center	The following main recommendations were given for eliminating barriers in using the website: use a simpler language for potential website users, include website map and highlight active hyperlinked items

Notes: BCKQ – Bristol COPD Knowledge Questionnaire; CAT – COPD Assessment Test.
* – M (SD).

4. Content and implementation of the educational component within the integrated pulmonary rehabilitation

Education is one of the compulsory components of pulmonary rehabilitation programs [22-23], and most of them have training sessions for patients with COPD . Researches strive to find the most relevant topics, duration, number of sessions, and ways of providing educational material (Table 4).

The positive effect of pulmonary rehabilitation programs decreases in the course of time, making it important to find out ways for maintaining the achieved results. One of such approaches has been studied by Wilson A. M. et al. [24], who proposed a support program for patients with COPD , who had already completed pulmonary rehabilitation. Unfortunately, this program has appeared to be ineffective for maintaining or improving the quality of life and ability to withstand the physical load, reducing the level of anxiety and depression, as well as positive effects on dyspnea and daily physical activity achieved after the completion of the pulmonary rehabilitation program. Half of the time of the support program has been devoted to the educational component. Three-hour training sessions (in the 3d, 6th, and 9th month) were devoted to the following topics:

1. Healthy eating, the importance of physical training, prevention of exacerbations, and action plan in case of any of them, leaving off smoking.
2. Overcoming dyspnea, consideration of different workout strategies, breaking barriers on the way to physical activity.
3. Psychological issues that arise during the development of chronic disease, their possible solutions, mastering of relaxation techniques, and assistance for those who care for patients with COPD .

On the basis of a systematic review of publication from January 1996 to February 2016, Gardener A. C. et al. identified 13 areas that are important for patients with COPD and in which they require additional support [25].

Tab. 4. Publications devoted to the educational component within the framework of a pulmonary rehabilitation program

No.	Authors, year, country*	Type of research/ goal of research	Number of participants and sex; age (years old)/ subjects for study	Number of participants / Research methods	Content and organization of the educational component or research findings
1	Gardener A. C. et al., 2018 [25]	A systematic review of literature/ Determine the full range of needs for the support of patients with COPD	31 articles	The review was conducted in accordance with the PRISMA recommendations, publications from January 1996 to February 2016 were considered	a complex set of areas of necessary support for patients with COPD has been identified according to the patients' views
2	Chaplin E. et al., 2017, UK [29]	Randomized controlled trial/ Evaluate whether web-based pulmonary rehabilitation programs can be an alternative to conventional programs	103 participants: 71♂ + 32♀; 66.1 (8.1)**–66.4 (10.1)	Physical performance has been assessed (ISWT and ESWT), chronic respiratory self-esteem from (CRQ-SR), anxiety and depression scale (HADS), evaluation of COPD manifestations (CAT), PR Adapted self-efficacy index (PRAISE), evaluation of COPD knowledge (BCKQ), quality of life(EQ-5D-5L), patient cost questionnaire	Duration of the program of pulmonary rehabilitation 6–8 weeks. The program included a standard introductory session providing access to the website and printed materials for the website navigation, and daily self-training by the online program, as well as weekly contact with a rehabilitation specialist (telephone call or email). The educational material of the web program was based on the manual "SPACE for COPD." Patients worked through a website at their own pace; however, specific steps need to be taken or achieved before gaining access to further content in order to ensure appropriate progress in the program
3	Garvey C. et al., 2018 [30]	Review/ Describe the options for a home-based pulmonary rehabilitation program	Electronic databases MEDLINE, CINAHL, EMBASE, AMED, PubMed, Cochrane, PEDro	The search strategy applied in MEDLINE was adapted for other databases	The need for personalized, affordable, and effective pulmonary rehabilitation at COPD will stimulate the development of devices, platforms, and programs in order to meet these essential needs and gaps in treatment. Funds for such programs of pulmonary rehabilitation and patient motivation remain unresolved
4	Wilson A.M. et al., 2015, UK [24]	Randomized controlled trial/ Rate the support program after the completion of pulmonary rehabilitation	148 participants: 91♂ + 57♀; 67.3 (15.1)–69.3 (8.9)	CRQ questionnaire, clinical test ESWT, EQ5D questionnaires, HADS, a diary of physical activity	The support program consisted of one session lasting 2 hours, held every 3 months, including 1 year of learning and 1 year of training
5	Kiongera G.M., Houde S.C., 2015, UK [27]	Clinical study/ Evaluate the effectiveness of the in-patient program for pulmonary rehabilitation for patients with COPD in an institution of long-term care	23 participants: 11♂ + 12♀; 68–72.	Physical performance (6MWD), dyspnea rate (Borg scale CR10), quality of life (SGRQ), satisfaction survey form	The 6–8 weeks program, which consisted of 24 series of activities. IPR program activities
6	Desveaux L. et al., 2015 [26]	Systematic review/ To describe the international experience of providing pulmonary rehabilitation, and to compare its structure and indicators in different countries	7 studies	The review was conducted in accordance with PRISMA recommendations, publications published before September 2013 were considered	The current availability of PR programs service less than 1.2% of individuals living with COPD across seven countries with wealthy economies

7	Marques A. et al., 2015, Portugal [28]	Randomized controlled trial/ Study the effects of a family program of pulmonary rehabilitation on COPD management	42 couples (a person with COPD and a family member): 28♂*** + 14♀; 65.9 (13.4)–68.8 (7.3)	Functional balance ("Get up and go" test), estimation of shin extensor's force, quality of life (SGRQ)	Duration of the program of pulmonary rehabilitation – 12 weeks. The program consisted of training, psychological support, and education, conducted in primary care centers. Family members attended sessions of psychological support and training along with patients with COPD

Notes: ISWT – Incremental Shuttle Walking Test; ESWT – Endurance Shuttle Walk Test; CRQ-SR – self-reported Chronic Respiratory Questionnaire; HADS – Hospital Anxiety and Depression Scale; CAT – COPD Assessment Test, PRAISE – The Pulmonary Rehabilitation Adapted Index of Self-Efficacy; BCKQ – Bristol COPD Knowledge Questionnaire; EQ-5D-5L – 5-level EuroQol 5-dimensional questionnaire; CRQ – Chronic Respiratory Disease Questionnaire; SGRQ – St. George's Respiratory Questionnaire; 6MWD – six-minute walk distance.
* – if the subject of study is articles, the information about country was not given;
** – M (SD);
*** – information about participants with COPD.

In general, the practice of providing pulmonary rehabilitation in different countries involves specific educational programs [26]. Basically, there are about 38 educational topics for patients with COPD , and "Medicines" and "Relaxation" are considered in most cases.

There are pulmonary rehabilitation programs that include the provision of educational sessions for inpatients at long-stay institutions twice per week for six weeks [27], being held by pulmonologists, physical therapists and occupational therapist.

The family-based program of pulmonary rehabilitation had the same positive effects as usual ones focused on the ability to withstand the physical load, increase the strength of quadriceps, and functional balance [28]. It is suggested to attract family members to educational events and psychological support events. It is recommended to use didactic methods (discussion, role-playing games, homework, and brainstorming) during weekly training held by a multidisciplinary team consisting of a physical therapist, a gerontologist, a psychologist, a nurse, and a doctor. Such a version of the program is of great benefit to the family and helps its members to have a better insight into the disease and better control COPD while improving family relations.

A comparison of the usual pulmonary rehabilitation program with a web-based program revealed that 38% of the subjects prefer a web-version [29], 23.5% said they required a usual program, while others did not have preferences or refused rehabilitation at all. Assessment before the start of a web-based program was carried out in order to select educational material by the topics with low level of awareness. These studies have shown that interactive web-based programs can be an acceptable alternative to the usual pulmonary rehabilitation programs.

Possibilities and methods for organizing pulmonary rehabilitation in a remote mode are of interest to patients, healthcare personnel, and researchers. Garvey C. et al. [30] attempted to systematize data and analyze options for home-based pulmonary rehabilitation programs. Special attention is paid to the educational component of home-based pulmonary rehabilitation programs, which focuses primarily on improving the level of self-management. Based on the official statement of the American Thoracic Society and the European Respiratory Society, the following main educational topics on self-management are recommended [30]:

1. Systemic anatomy and physiology of the lungs.
2. Pathophysiology of chronic respiratory diseases.
3. Communication with a doctor.
4. Interpretation of medical screening.
5. Breathing techniques.
6. Airway clearance techniques (ACTs).
7. The role and justification for the need of treatment, in particular, oxygen therapy.
8. Effective use of respiratory devices.
9. Advantages of workouts and physical loading.
10. Energy saving during daily activities.
11. Healthy eating.
12. Avoiding provocative factors.
13. Early recognition and treatment of exacerbations.
14. Leisure.
15. Managing COPD.

A significant amount of scientific research in the field of educational services for patients with COPD is focused on the strategy of self-management. Self-management support interventions for patients with COPD are "structured but personalized and often multi-component interventions, with goals of motivating, engaging and assisting the participants

to positively adapt their behavior(s) and develop skills to manage their disease better" [31].

The self-management concept includes self-monitoring, symptom management, management of emotional, psychosocial, and functional consequences of the disease, and collaboration with family, community, and healthcare professionals [32].

Interventions for supporting self-management are primarily based on informing patients and the formation of individual goals and strategies, focusing on motivation, achievements encouraging, and mental health [33].

Although at first sight they might look similar, the components of patient`s education and self-management education are really different [34]:

– self-management education is based on the person's commitment and active involvement;

– issues, purpose, and tasks are to be set by patients, not by healthcare specialists;

– provided information and skills are problem-oriented, not nosological;

– it is suggested that behavior changes as a result of the increase in the level of self-efficacy regarding the ability to participate in self-management, rather than as a result of raising the level of awareness.

In general, self-management education strategy is based on the promotion of disease control and its consequences [35]. The educational component itself in pulmonary rehabilitation programs is inefficient, it is necessary to change behavior, in particular acquire self-care skills [36]. Moreover, Sohanpal R. et al. [37] state that education is a part of the self-management support component.

In the short term, self-management education can ensure improved health [38] and functional level, reduce the hospital stay, facilitate the development of planning, organization and control skills in patients with COPD , and improve management [39]. Thus, the study of the effectiveness of the relevant programs has revealed their positive influence on some areas of self-management ("Constructive attitudes and approaches," "Skills and technique acquisition," "Self-monitoring and insight") [33], improving life quality [40, 41], awareness of the disease [42], prolongation of the remission period [40], reducing hospital stay and number of visits to a doctor [43, 44]. In a cohort study by Khan A. et al. [45], patients with a developed self-management plan more often attended training courses or consultations on physical activity, they obtained a higher level of awareness of COPD and better adherence to treatment. The optimal variant for implementation of self-management programs, their substantive content, and maintaining of self-management and self-monitoring skills, as well as feedback from healthcare professionals, can be considered as an introduction of the practice of online diary [46]. Patients with COPD who used such diaries were able to control their own lives and their disease. The influence of self-management program on the quality of life, physical performance or psycho-emotional state is still a controversial issue, its effectiveness may also be unsatisfactory, and the introduction of specific programs may cause certain barriers for both patients and those engaged into treatment/rehabilitation [47].

The main goal and related tasks addressed by the strategy of self-management [48]:

1. Health behaviors:
   – leaving off smoking (as necessary);
   – increasing physical activity;
   – medical treatment (devotion and adequate inhalation technique).
2. Disease management:
   – avoidance of deteriorating factors (smoking, dust);
   – dyspnea control (taking the appropriate medications, breathing through the pursed lips);
   – use of energy saving methods (e.g., choosing the pace of walking);
   – formation of exacerbation management strategies (a written action plan that includes key components to make exacerbation management easier);
   – use stress management strategies (exercises for relaxation).

There have been highlighted more different categories of self-care behaviors and strategies that can be used by patients with COPD [49]:

1. Self-care for the prevention, control, and management of COPD and respiratory symptoms.
2. Self-care for the prevention, control, and management in everyday activities.
3. Self-care for addressing trouble sleeping.
4. Self-care for exacerbation control and management.
5. Self-care for emotional-distress management.
6. Self-care for managing social life changes.
7. Contact with healthcare institutions.
8. Acquisition of self-care knowledge and skills.

Discussion

The educational component is an indispensable component of all and any medical and rehabilitation measures [18]. Without raising the level of patient's awareness of all COPD aspects, it is difficult to achieve a sufficient level of motivation to follow medical recommendations for treatment, physical therapy, behavioral changes in nutrition, physical activity, and daily routine [4].

It might look easy to provide specific knowledge on the disease and various aspects of life for patients with COPD , but it requires thorough planning [25], assessment, preparation of study and handout materials, subsequent support and access to educational resources (Figure 2).

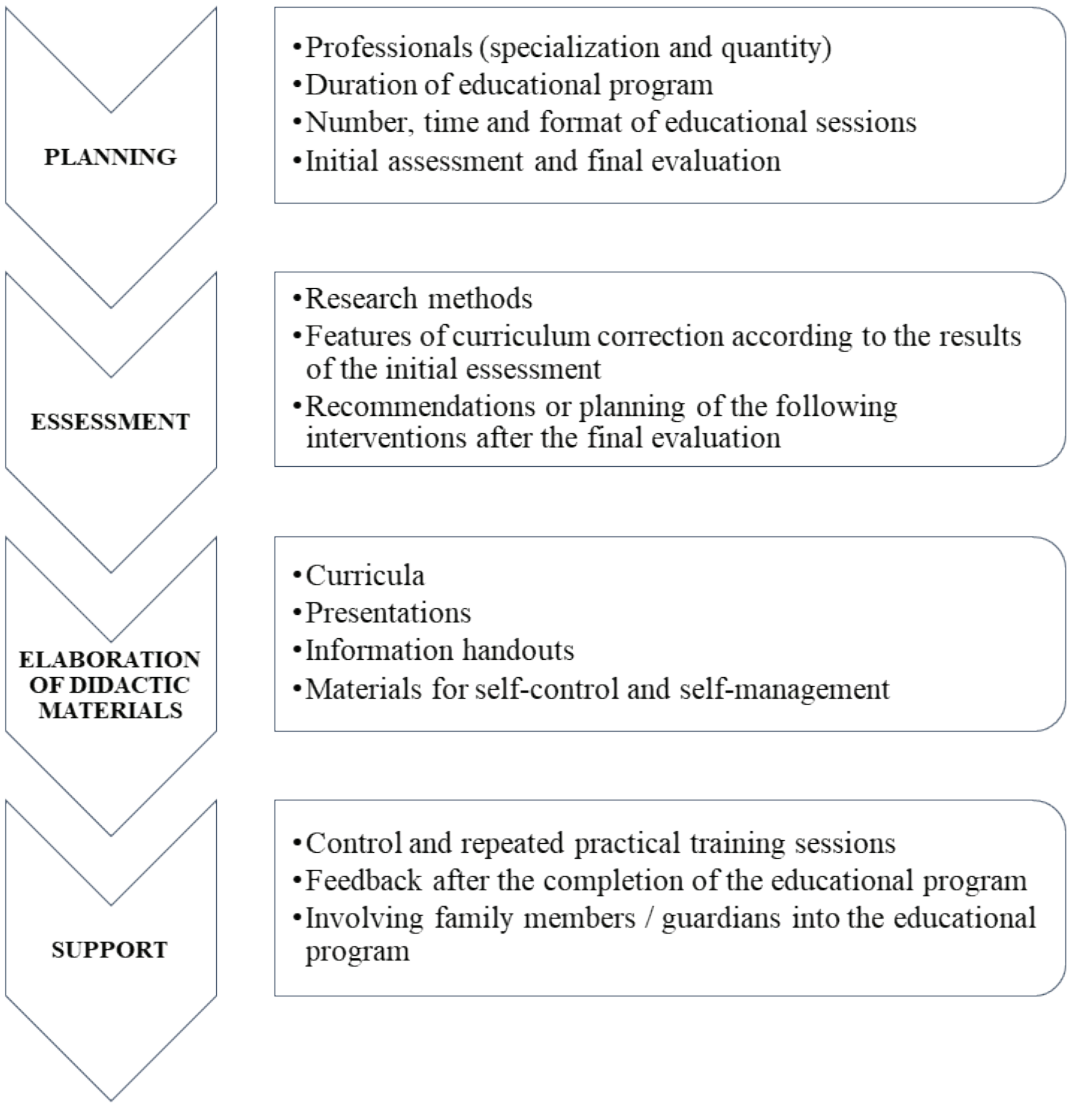

Fig. 2. Stages and components of the educational program for patients with COPD

Based on already existing practice, it is advisable to review the recommendations which consider modern researches on the implementation of the educational component in the treatment and rehabilitation of patients with COPD (Table 5).

The educational component is one of the crucial and significant parts of the pulmonary rehabilitation program [12]. The issue of accessibility and the proper level of educational services are of concern to many researchers and practitioners. A sufficient level of implementation of educational services and the professional provision of information on the given topics may be ensured by several specialists of different specialties, although a pulmonologists, physical therapists and psychologists are the key specialists [50].

Tab. 5. Recommendations on the implementation of the educational component in pulmonary rehabilitation programs based on the results of modern scientific researches

No.	Recommendation	Implementation		Goal
1	**Attract professionals of different specialties for elaborating and implementing educational programs**	**Specialists**	✓ pulmonologist ✓ physical therapist ✓ psychologist ✓ speech therapist ✓ occupational therapist ✓ pharmacist	the involvement of professionals in certain specialties will enable the educational materials to be presented as efficiently as possible, and individual characteristics of patients with COPD should be considered
2	**Additionally assess the knowledge level, self-management behavior, and psycho-emotional state before the implementation of the educational component of rehabilitation**	**Assessment**	✓ patient's awareness and knowledge level of COPD ✓ self-management behavior (motivation, readiness to change the behavior) ✓ psycho-emotional state, anxiety and depression levels ✓ daily needs, social activity, access to physical rehabilitation institutions and Internet resources	Definition of the initial level, elaboration of topics according to relevance for inclusion in the curriculum, the extraction of unnecessary or in-depth information from the curriculum, solving the issue with the method of training and providing training materials
3	**Choose the most convenient for the patient methods and organization of training and ways to provide training materials**	**Educational methods**	✓ individual ✓ group ✓ self-education	Cost-effective, result-oriented learning that reaches The maximum number of patients with COPD
		Ways of providing learning materials	✓ lections ✓ printed materials ✓ video materials ✓ online materials	
4	**Provide patients with the opportunity to maintain the achieved level upon completion of the educational program**	**Methods**	✓ monitoring appointments ✓ on-line consultations (e.g. Skype) ✓ telephone communication ✓ emails	Achieving the maximum effect and availability of learning for each patient
5	**Involve patients in choosing and planning strategies**	**Occurs at the stage of initial assessment and definition of curriculum purpose and objectives**		Increase understanding and motivation, and patient's active participation in the treatment, pulmonary rehabilitation, and self-management
6	**Operate the maximum amount of educational topics for a flexible choice according to patients' needs**	**It is expedient to choose the subjects of studies after determining the knowledge level, and take into consideration the patient's vision of the sphere where he/she is most in need of information**		To improve the individual approach to the implementation of an educational component of a pulmonary rehabilitation program
7	**Include self-management strategy for improving efficiency**	**Main components**	✓ self-control ✓ symptom management ✓ managing the effects of the disease (emotional, psychosocial, and functional) ✓ cooperation with family, community, and specialists in the field of health care	Increase the effectiveness of treatment and rehabilitation, prevent exacerbations, optimize financial savings

Assessment and determination of the patient's initial level of awareness, anxiety, depression [11], motivation, and peculiarities of everyday life will make it possible to consider the results while correcting the studied indicators and the educational program itself.

The search for an alternative way, except for traditional lectures, [13,21,29] and methods of providing educational services [30] for patients with COPD , and assessment of their effectiveness aims at attracting more patients to pulmonary rehabilitation programs, improving access to all components of pulmonary rehabilitation, in particular, educational ones. Thus, the choice of providing educational services through the use of traditional lectures, printed materials, videos, or online materials should be considered.

Increasing patient's motivation, their cooperation with healthcare personnel, and active participation in the continuation of pulmonary rehabilitation programs will help to get feedback from the providers of pulmonary rehabilitation services. Once the pulmonary rehabilitation program is completed it is advisable to choose the most convenient ways of communication with patients. Such steps, along with the provision of awareness and skills in self-management, will allow the patients to monitor their condition more effectively and follow the recommendations of physicians and physical therapists more responsibly.

Having analyzed the studies it has been revealed that the issue of relationships between the effectiveness of the educational component or general rehabilitation program and the stage of COPD is poorly understood. Thus, the issue of improving the educational part, correction of frequency and duration of meeting, taking into account the phenotype or stage of COPD, remains crucial. It can be assumed that the COPD`s stage is vital for choosing the most appropriate topics to be included in the education component. In the mild stage, it is advisable to devote time to the issue of lungs' work and functions, the benefits of exercise, healthy nutrition, active leisure, avoidance of provoking factors, and the issues of diseases management. In patients with moderate/severe COPD, it is essential to focus on breathing strategies, airway techniques, the role and justification for treatment, including oxygen therapy and effective use of respiratory devices, energy saving during daily activities, and early recognition and treatment of exacerbations. A critical issue to be considered with severe patients and their caregivers are the possible prognosis, treatment options, including non-invasive ventilation, admission to the intensive care unit, end of life.

Despite the great potential and benefits of the educational component of pulmonary rehabilitation programs, a lot of human, financial [25], organizational and intellectual resources are required for its appropriate introduction [2]. Considering modern practice of conducting and recommendations for the provision of education for patients with COPD, as well as modern technologies, will make it possible to properly implement this component in pulmonary rehabilitation programs, achieve the objectives and positive impacts.

Conclusions

Much attention is being paid to the study of the effective ways of implementation of the educational component in the treatment and pulmonary rehabilitation of patients with COPD . Effective educational strategies ensure long-term benefits for the patients, fewer exacerbations, better physical performance and quality of life. The correct inhaler technique is the fundamental practical skill to be learned by patients with COPD during training sessions. Based on the analyzed publications, a set of recommendations has been developed, and they should be considered when elaborating on the curriculum within the pulmonary rehabilitation for patients with COPD .

The prospect of further publications and research is a description of the educational component of pulmonary rehabilitation, evaluation of the effectiveness of the interventional program, considering practical recommendations given in this article. The educational topics will be divided into obligatory and selective parts, depending on the results of the assessment at the beginning of the pulmonary rehabilitation program, COPD`s severity and patient`s demands.

References

1. Global initiative for chronic obstructive lung disease global initiative for chronic obstructive lung disease. Pocket guide to COPD diagnosis, management, and prevention. A Guide for health care professionals [Internet]. 2019. Available from: www.goldcopd.org
2. Patel JG, Nagar SP, Dalal AA. Indirect costs in chronic obstructive pulmonary disease: A review of the economic burden on employers and individuals in the United States. Int J Chron Obstruct Pulmon Dis. 2014;9:289.
3. Toy EL, Gallagher KF, Stanley EL, Swensen AR, Duh MS. The economic impact of exacerbations of chronic obstructive pulmonary disease and exacerbation definition: a review. COPD J Chronic Obstr Pulm Dis [Internet]. 2010 May 20;7(3):214–28.
4. Nici L, Donner C, Wouters E, Zuwallack R, Ambrosino N, Bourbeau J, et al. American Thoracic Society/European Respiratory Society statement on pulmonary rehabilitation. Am J Respir Crit Care Med [Internet]. 2006 Jun 15;173(12):1390–413.
5. Spruit MA, Singh SJ, Garvey C, ZuWallack R, Nici L, Rochester C, et al. An official American Thoracic Society/European Respiratory Society Statement: key concepts and advances in pulmonary rehabilitation. Am J Respir Crit Care Med [Internet]. 2013 Oct 15;43(5):1326–37.
6. McCarthy B, Casey D, Devane D, Murphy K, Murphy E, Lacasse Y. Pulmonary rehabilitation for chronic obstructive pulmonary disease. Cochrane Database Syst Rev. 2015 Feb 24;188(8):e13-64.
7. Yang H, Wang H, Du L, Wang Y, Wang X, Zhang R. Disease knowledge and self-management behavior of COPD patients in China. Medicine (Baltimore). 2019 Feb;98(8):e14460.

8. Collinsworth AW, Brown RM, James CS, Stanford RH, Alemayehu D, Priest EL. The impact of patient education and shared decision making on hospital readmissions for COPD. Int J Chron Obstruct Pulmon Dis. 2018;13:1325–32.
9. Abdulsalim S, Unnikrishnan MK, Manu MK, Alrasheedy AA, Godman B, Morisky DE. Structured pharmacist-led intervention programme to improve medication adherence in COPD patients: A randomized controlled study. Res Soc Adm Pharm. 2018 Oct 1;14(10):909–14.
10. Zhang Q, Liao J, Liao X, Wu X, Wan M, Wang C, et al. Disease knowledge level is a noteworthy risk factor of anxiety and depression in patients with chronic obstructive pulmonary disease: a cross-sectional study. BMC Pulm Med [Internet]. 2014 May 28;14:92.
11. Schüz N, Walters JAE, Cameron-Tucker H, Scott J, Wood-Baker R, Walters EH. Patient anxiety and depression moderate the effects of increased self-management knowledge on physical activity: a secondary analysis of a randomised controlled trial on health-mentoring in COPD. COPD J Chronic Obstr Pulm Dis. 2015 Sep 3;12(5):502–9.
12. Nakken N, Janssen DJA, van den Bogaart EHA, Muris JWM, Vercoulen JH, Custers FL, et al. Knowledge gaps in patients with COPD and their proxies. BMC Pulm Med. 2017 Oct 30;17(1):136.
13. Windisch W, Schwarz SB, Magnet FS, Dreher M, Schmoor C, Storre JH, et al. Using web-based videos to improve inhalation technique in COPD patients requiring hospitalization: A randomized controlled trial. PLoS One. 2018;13(10):e0201188.
14. Beatty CR, Flynn LA, Costello TJ. The impact of health literacy level on inhaler technique in patients with chronic obstructive pulmonary disease. J Pharm Pract. 2017 Feb 10;30(1):25–30.
15. Purohit AN, Patel PP, Gandhi AM, Desai MK. An evaluation of impact of educational interventions on the technique of use of metered-dose inhaler by patients. Indian J Pharmacol. 2017;49(2):194–200.
16. Bouwmeester C, Kraft J, Bungay KM. Optimizing inhaler use by pharmacist-provided education to community-dwelling elderly. Respir Med. 2015 Oct 1;109(10):1363–8.
17. Takaku Y, Kurashima K, Ohta C, Ishiguro T, Kagiyama N, Yanagisawa T, et al. How many instructions are required to correct inhalation errors in patients with asthma and chronic obstructive pulmonary disease? Respir Med. 2017 Feb 1;123:110–5.
18. Tymruk-Skoropad K, Tsizh L, Vynogradskyi B, Pavlova I. Physical therapy in chronic obstructive pulmonary disease (analysis of the evidence-based medicine). Physiotherapy Quarterly. 2018;26(2):1-8.
19. Bhattacharyya P, Ghosh R, Saha D, Chakraborty B, Bhattacharyya P, Sarma M, et al. The impact on health status in short- and long-terms of a novel and non-orthodox real-world COPD rehabilitation effort in rural India: an appraisal. Int J Chron Obstruct Pulmon Dis. 2018;13:3313–9.
20. Ward S, Sewell L, Singh S. Evaluation of multidisciplinary pulmonary rehabilitation education delivered by either DVD or spoken talk. Clin Respir J. 2018;12(11):2546–50.
21. Stellefson M, Chaney B, Ochipa K, Chaney D, Haider Z, Hanik B, et al. YouTube as a source of COPD patient education: a social media content analysis. Chron Respir Dis. 2014;11(2):61.
22. Alison JA, McKeough ZJ, Johnston K, McNamara RJ, Spencer LM, Jenkins SC, et al. Australian and New Zealand pulmonary rehabilitation guidelines. Respirology. 2017 May;22(4):800–19.
23. Tymruk-Skoropad K. Use of research methods in the process of pulmonary rehabilitation and physical therapy of persons with chronic obstructive pulmonary disease (review of clinical guidelines). Slobozans'kij Nauk Visn. 2018;4(66):5–12.
24. Wilson AM, Browne P, Olive S, Clark A, Galey P, Dix E, et al. The effects of maintenance schedules following pulmonary rehabilitation in patients with chronic obstructive pulmonary disease: a randomised controlled trial. BMJ Open. 2015 Mar 11;5(3):e005921.
25. Gardener AC, Ewing G, Kuhn I, Farquhar M. Support needs of patients with COPD: a systematic literature search and narrative review. Int J Chron Obstruct Pulmon Dis. 2018;13:1021–35.
26. Desveaux L, Janaudis-Ferreira T, Goldstein R, Brooks D. An international comparison of pulmonary rehabilitation: a systematic review. COPD J Chronic Obstr Pulm Dis. 2015 Mar 4;12(2):144–53.
27. Kiongera GM, Houde SC. Inpatient pulmonary rehabilitation program in a long-term care facility: short-term outcomes and patient satisfaction. J Gerontol Nurs. 2015 Aug 1;41(8):44–52.
28. Marques A, Jácome C, Cruz J, Gabriel R, Brooks D, Figueiredo D. Family-based psychosocial support and education as part of pulmonary rehabilitation in COPD: a randomized controlled trial. Chest. 2015 Mar 1;147(3):662–72.
29. Chaplin E, Hewitt S, Apps L, Bankart J, Pulikottil-Jacob R, Boyce S, et al. Interactive web-based pulmonary rehabilitation programme: a randomised controlled feasibility trial. BMJ Open. 2017;7(3):e013682.
30. Garvey C, Singer JP, Bruun AM, Soong A, Rigler J, Hays S. Moving Pulmonary Rehabilitation Into the Home. J Cardiopulm Rehabil Prev. 2017 Dec;38(1):1.
31. Global Initiative for Chronic Obstructive Lung Disease – GOLD. 2017. Available from: https://goldcopd.org/
32. Richard AA, Shea K. Delineation of Self-Care and Associated Concepts. J Nurs Scholarsh. 2011 Jul 1;43(3):255-64.
33. Bringsvor HB, Langeland E, Oftedal BF, Skaug K, Assmus J, Bentsen SB. Effects of a COPD self-management support intervention: a randomized controlled trial. Int J Chron Obstruct Pulmon Dis. 2018;13:3677–88.

34. Bourbeau J, Lavoie K, Sedeno M. Comprehensive self-management strategies. Semin Respir Crit Care Med. 2015 Aug 3;36(04):630–8.
35. Kaptein A, Fischer M, Scharloo M. Self-management in patients with COPD: theoretical context, content, outcomes, and integration into clinical care. Int J Chron Obstruct Pulmon Dis. 2014 Sep 1;9(1):907.
36. Rice K, Bourbeau J, MacDonald R, Wilt TJ. Collaborative self-management and behavioral change. Clin Chest Med. 2014 Jun 1;35(2):337–51.
37. Sohanpal R, Epiphaniou E, Taylor S. Self-management for COPD?: why does it generate negative connotations? Br J Gen Pract. 2014 Aug 1;64(625):e522-4.
38. Murphy LA, Harrington P, Taylor SJ, Teljeur C, Smith SM, Pinnock H, et al. Clinical-effectiveness of self-management interventions in chronic obstructive pulmonary disease: An overview of reviews. Chron Respir Dis. 2017 Aug 24;14(3):276–88.
39. Ng WI, Smith GD. Effects of a self-management education program on self-efficacy in patients with COPD: a mixed-methods sequential explanatory designed study. Int J Chron Obstruct Pulmon Dis [Internet]. 2017;12:2129–39.
40. Johnson-Warrington V, Rees K, Gelder C, Morgan MD, Singh SJ. Can a supported self-management program for COPD upon hospital discharge reduce readmissions? A randomized controlled trial. Int J Chron Obstruct Pulmon Dis [Internet]. 2016;11:1161–9.
41. Newham JJ, Presseau J, Heslop-Marshall K, Russell S, Ogunbayo OJ, Netts P, et al. Features of self-management interventions for people with COPD associated with improved health-related quality of life and reduced emergency department visits: a systematic review and meta-analysis. Int J Chron Obstruct Pulmon Dis. 2017;12:1705–20.
42. Mitchell KE, Johnson-Warrington V, Apps LD, Bankart J, Sewell L, Williams JE, et al. A self-management programme for COPD: a randomised controlled trial. Eur Respir J [Internet]. 2014 Dec 1;44(6):1538–47.
43. Bernabeu-Mora R, Sánchez-Nieto JM, Andújar-Espinosa R, Hu C, Gálvez-Martínez B, Carrillo-Alcaraz A, et al. Efficacy of a self-management plan in exacerbations for patients with advanced COPD. Int J Chron Obstruct Pulmon Dis. 2016 Aug 17;Volume 11(1):1939–47.
44. Wang T, Tan J-Y, Xiao LD, Deng R. Effectiveness of disease-specific self-management education on health outcomes in patients with chronic obstructive pulmonary disease: An updated systematic review and meta-analysis. Patient Educ Couns. 2017 Aug 1;100(8):1432–46.
45. Khan A, Dickens AP, Adab P, Jordan RE. Self-management behaviour and support among primary care COPD patients: cross-sectional analysis of data from the Birmingham Chronic Obstructive Pulmonary Disease Cohort. npj Prim Care Respir Med. 2017 Dec 20;27(1):46.
46. van Kruijssen V, van Staa A, Dwarswaard J, In 't Veen JC, Mennema B, Adams SA. Use of Online Self-Management Diaries in Asthma and COPD: a qualitative study of subjects' and professionals' perceptions and behaviors. Respir Care. 2015 Aug 1;60(8):1146–56.
47. Harrison SL, Janaudis-Ferreira T, Brooks D, Desveaux L, Goldstein RS. Self-management following an acute exacerbation of COPD: a systematic review. Chest. 2015 Mar 1;147(3):646–61.
48. Barrecheguren M, Bourbeau J. Self-management strategies in chronic obstructive pulmonary disease: a first step toward personalized medicine. Curr Opin Pulm Med [Internet]. 2018 Mar 1;24(2):191–8.
49. Clari M, Matarese M, Ivziku D, De Marinis MG. Self-care of people with chronic obstructive pulmonary disease: a meta-synthesis. Patient - Patient-Centered Outcomes Res. 2017 Aug 14;10(4):407–27.
50. Ortenburger D, Rodziewicz-Gruhn J, Wąsik J, Marfina O, Polina N. Selected problems of the relation between pain-immunity and depression. Phys Act Rev. 2017;5:74–7.

Efficacy of occupational therapy in the rehabilitation of the distal radius fracture – systematic review

A – preparing concepts
B – formulating methods
C – conducting research
D – processing results
E – interpretation and conclusions
F – editing the final version

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Abstract

Introduction: Distal radius fracture (DRF) is the most common injury leading to limitation of daily activities and functional independence. Occupational therapy (OT) through the therapeutic use of everyday activities is to ensure participation in various roles. The aim of this study was to compare the efficacy of occupational therapy in the treatment of patients after DRF.

Material and methods: The literature review was conducted as an electronic search in Pubmed and EBSCO. The results of the search were limited to: clinical controlled trials, the terms "occupational therapy and distal radius fracture" or "rehabilitation and distal radius fracture" and publication period between January 2008 and December 2018.

Results: Three scientific studies have shown significant benefits of OT for patients undergoing supervised therapy, 5 studies have revealed no significant differences between the various therapeutic programs, and two studies have revealed that home exercise programs are superior than other.

Conclusions: There is no clear evidence showing the benefits of occupational therapy performed instead of or in addition to other forms of patient rehabilitation after DRF. However, the use of various forms of occupational therapy (advice, consultation, exercise or supervised therapy process) brings significant benefits to patients, who did not receive any form of intervention.

Key words: **rehabilitation, hand therapy, upper limb injury**

Introduction

Distal radius fracture (DRF) is the most frequent injury of the upper limb [1-4]. This fracture often occurs in the group of women over 65 years of age suffering from low-energy injuries and for young men suffering from high-energy injuries, which are often associated with sports activities, high-altitude falls or traffic accidents [3,5,6]. Due to the large number of fracture types, many classifications have been used, introducing the division according to specific criteria, which allows determination of correct treatment and possible complications. Because of a good healing potential of these type of fractures, as well as, rare occurrence of non-union or formation of pseudoarthrosis, patients are usually treated conservatively [7,11]. Comminuted fractures, interarticular fractures, fractures after unsuccessful reposition or with secondary fracture displacement require surgical treatment. The

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most common methods of surgical treatment are: close reduction and internal fixation (CRIF), open reduction and internal fixation (ORIF) or external stabilization [4,7,8]. Żyluk and Janowski [9] found that DRF treated conservatively leads to displacement in load 30-50% of cases, which is why the tendency to use ORIF technique prevails today among unstable fractures [4].

Anyone who sustains an upper limb fracture will experience a period where they have difficulty participating in personal, occupational and sporting activities that may extend to 12 months beyond the time of fracture [10,11]. The degree of difficulty may be related to the type of fracture, length and position of immobilization or any complications such as CRPS. Problems during treatment are most often associated with pain and swelling [12]. Pain consequently makes it difficult to perform everyday activities, which many patients did not have previously had difficulties with [12]. Research by Ydreborg et al. [13] showed that despite regaining the range of mobility (ROM) and grip strength in 12 months, pain during rest and activity was still a problem.

Immobilization of one of the limbs prevents bimanual use of upper limbs, which leads to problems with performing basic activities of daily living (ADL), such as bathing, dressing, undressing and self-catering. In addition, problems with the upper limb can cause dependence of patients on other people. Immobilization of the limb also limits the mobility, which together with the weakening of muscle strength results in graphomotor problems as well as manipulative problems.

Distal radius fractures also occur in people at working age, which can significantly impede the performance of paid work during the rehabilitation period [14,15]. Valdes et al. [16] points out that pain has a significant impact on the performance of paid work among the DRF, which is an area for an occupational therapist who prepares the patient to return to work.

Considering that the upper limbs form the foundation for performing basic (ADL) and instrumental ADL (IADL), the occurrence of a fracture leads to some limitations in the performance of activities and functional independence [17]. A study by Vergar et al. [17] showed that for about 23-24% of people after breaking, the limitations persist after 6 months from the injury. Limitations of limb activity during exercise may be caused by a decrease in ROM, pain, swelling or weakness in muscle strength [13]. During the fracture injuries there are also possibilities of soft tissue damages, which is why later patients often present more physical and functional restrictions [18].

Occupational therapy (OT) is a crucial component in the process of comprehensive rehabilitation [15,19-21]. Occupational therapist cooperates with the patient after a fracture in the field of medical, social and vocational rehabilitation [20]. Occupational therapy through the therapeutic use of everyday activities is to ensure participation in various roles performed at home, work, school or in the community. The fundamental aim of therapeutic intervention is to support the beneficiary in order to provide him/her with the opportunity to participate in activities that are crucial, needed by the patient in everyday functioning or show willingness to perform them [19].

Although DRF is one of the most common fractures, current scientific research does not indicate a standardized, comprehensive rehabilitation program, which aims to optimize the functioning level of various patients. Current research carried out on the subject of a therapy program for people after breaking the DRF does not give univocal evidence about the superiority of any of the methods over others.

Taking into consideration the uncertainty about the role of exercise in the rehabilitation process after upper limb fracture, the aim of this review was to assess the efficacy of OT in the treatment of patients after DRF.

Material and methods

Due to the low availability of studies comparing occupational therapy with other forms of treatment, it was decided to include a review comparing physiotherapy [22-24] to the scope of occupational therapy. According to the definition of the International Classification of Functioning, Disability and Health (ICF), rehabilitation including both physiotherapy and OT includes comprehensive activities, among others, in the field of physiological impairments [25]. Occupational therapist during the first contact with the patient usually begins with reducing swelling, stiffness and increasing the ranges of motion and muscle strength, which was weakened by immobilization of the limb [15,22,26,27]. Working on these elements is necessary to regain hand lost

functions. Occupational therapist at later stages of rehabilitation may advise the patient to perform activities of other departments e.g. ergotherapy or art therapy. The occupational therapist's forms of work do not differ from the physiotherapist's forms of work with the patient, especially after breaking over physiological impairments (e.g. ROM, swelling, strength of grip) [25].

In order to find clinical controlled trials used in the review, we conducted an electronic search without language restrictions using EBSCO and Pubmed. The following search terms were used: (occupational therapy AND distal radius fracture) or (rehabilitation AND distal radius fracture). Search results have been limited by the date of publication: January 2008 – December 2018. The electronic search was supplemented by a hand search of reference lists of relevant studies and reviews. Citation tracking and list checks of the included studies was performed also in previously used articles.

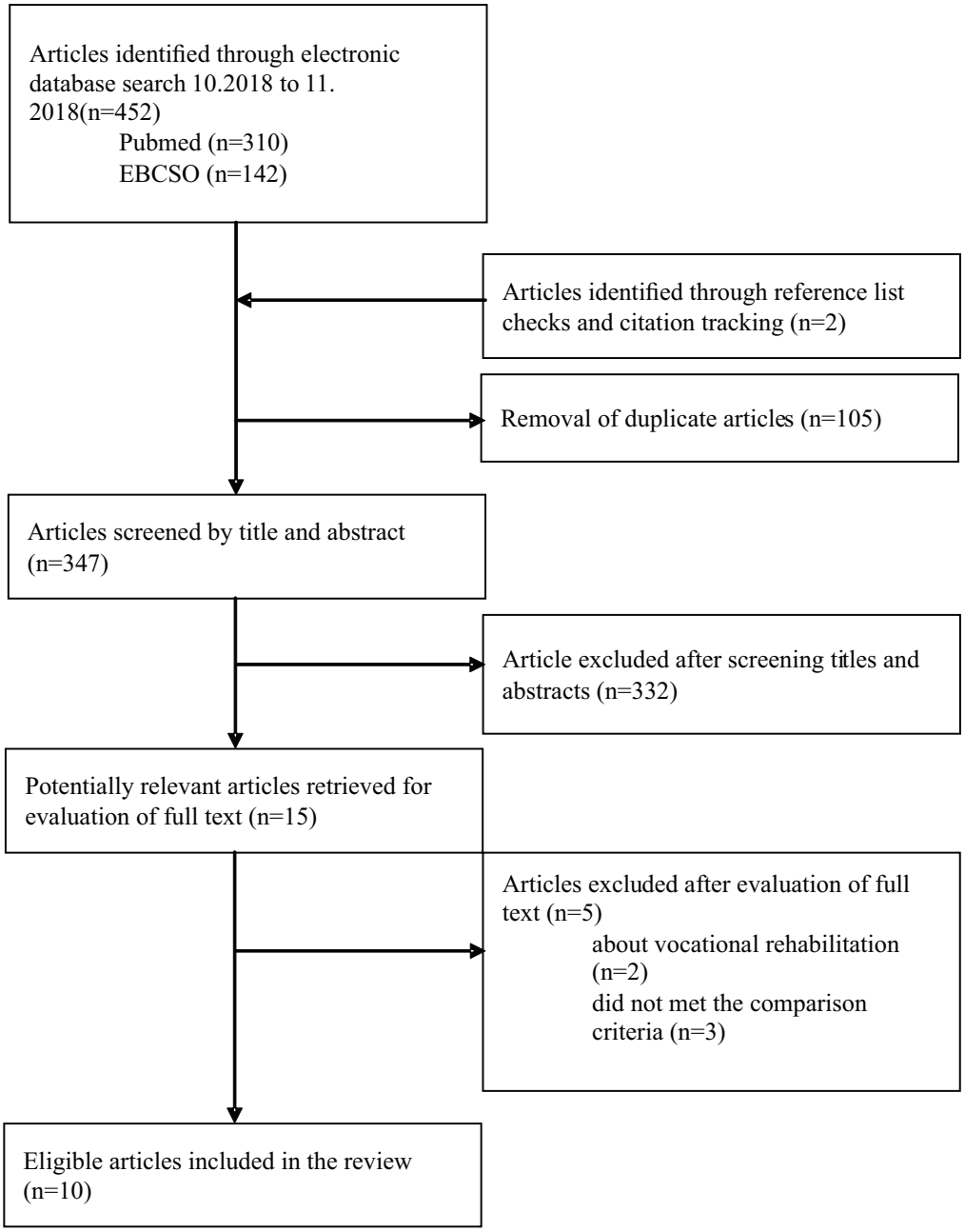

Fig. 1. Flow of studies through the review

The reviewer examined study titles and abstracts to determinate if they satisfied the eligibility criteria (table 1). If there were any doubts about the suitability of a trial for review, its full text has been analyzed. Other researches were analyzed according to included criteria (fig. 1.). Finally, 10 trials were extracted for systematic review.

Tab. 1. Inclusion criteria scientific research to review

Design of the study	– Full-text publication – Randomized controlled trial or controlled trial
Participants	– Humans – Age over 18 – Diagnosis: distal radius fracture
Intervention	– Involving occupational therapy, physiotherapy or home exercise program (HEP)
Comparisons intervention	– Comparisons of two different therapy programs – Comparison of home exercise program versus therapy observed by therapist – Comparison of exercise therapy program versus natural recovery

The data extracted from eligible trials were: trial design, age, gender, inclusion criteria participants, description of the intervention, results measure and constraints research (exclusion criteria).

Participants

Ten studies comparising 490 participants who had sustained distal radius fracture. Over 71% participants of this study were female.

Intervention

Seven trials evaluated the effect of therapy provided by an allied health professional that included supervised exercise plus home exercise program compared with home exercise program alone. Four of these seven assessed programs were led by an occupational therapist [15,28-30], two of them by a physiotherapist [16,22] and one by a hand therapist [24]. The remaining three trials evaluated the impact of exercise/advice following upper limb fracture by prescription of exercise only to the intervention group [23,31,32].

Six trials included patients during fracture immobilization period (first 5 weeks after fracture) [15,16,22,24,29,30]. In three trials the intervention began after immobilization (approximately 6 weeks after fracture) [23,28,32]. One trial did not contain information about the timing of intervention after the fracture [31]. Summary of included studies is presented in table 2).

Tab. 2. Summary of included trials

Trial	Design	Participants	Intervention	Result measure	Trial limitations
Bruder et al. (2016) [47]	RCT	EXP(n=19) CON(n=14) Avarage age (years): EXP = 51; CON = 58 Gender: 25F,8M Diagnosis: DRF after removal cast.	EXP – HEP (AROM, stretching and strengthening exercise wrist and forearm) and advice. The advice program included on movement, swelling, pain management, skincare, sleep and relaxation strategies, return to work (three consultation with PT in weeks 1,3,5 after removal of cast). CON – the same advice program as experimental group. Three sessions over 6 weeks (after removal of cast)	Primary endpoint: QuickDASH Secondary endpoint: AROM wrist, grip strength, pain (VAS), PRWE Measurement time: 7 weeks (post intervention), 6 months	Exclusion criteria: age >21 years, history of a pre-existing inflammatory joint condition, signs/symptoms CRPS, previous wrist fracture, bilateral wrist fractures, unable to understand written/spoken English, deficiency provide informed consent to participate Weak statistical power
Filipova et al. (2015) [38]	RCT	EXP(n= 30) CON(n=31) Avarage age (years): EXP =62; CON=58 Gender: 47F,14M Diagnosis: DRF treated conservatively	EXP – received to the same PT as control group and OT program – additional 9 session x 30 minutes (3 times in weeks). The OT strengthening program included different exercises for the hand, wrist, and forearm using functional samples movements CON – received PT (20 minutes galvanic baths and 30 minutes of individual kinesitherapy) 9 session for 3 weeks. The PT program included strengthening and gripping exercises	AROM, grip strength, DASH T1 first week after removal of cast T2 immediately after end of rehabilitation (8-12 weeks) T3 one month after end of rehabilitation (12-16 weeks)	Exclusion criteria: bilateral fracture, prior trauma of the wrist, malignant conditions and symptomatic osteoarthritis of wrist and hand, age > 30 years. Weak statistical power Lack of long-term outcome

Kay et al. (2008) [43]	RTC	EXP(n=28) CON(n=28) Avarage age (years): EXP=55,0; CON=55,8 Gender: 39F,17M Diagnosis: DRF which was managed with pins and/or cast	EXP- standardized advice on fracture protection, swelling control, skin care and everyday activities, and one session of instruction to perform HEP (AROM exercises, soft tissue stretches, isometric stabilizing wrist, strengthening and grip exercises). The average duration of therapy is 13h. CON – received no physiotherapy intervention (natural recovery)	Primary endpoint: wrist extension Secondary endpoint: wrist and elbow ROM, pain, grip strength, QuickDASH, PRWE Measurement time: before intervention, after 3 and 6 weeks	Exclusion criteria: unwilling/unable to participate; unable to understand written/spoken English; bilateral wrist fractures; previous wrist fracture; concurrent ipsilateral limb injury, pre-existing inflammatory joint condition; managed with internal/external fixation.
Krischak et al. (2009) [39]	RTC	EXP(n= 23) CON(n=23) Avarage age (years): EXP=56; CON=54 Gender: 30F,16M Diagnosis: DRF stabilized by Volar plate	EXP (B) – supervised exercises program and HEP, advice and other interventions at PT. Received a prescription for a total of 12 sessions (20-30 minutes each), over a 6-week period. Patients were free to choose their own therapist, who were free to choose the type of therapy based on their own evaluation. CON (A) – detailed instructions and demonstrations in the HEP (exercise booklet). The details grouped 3-5 exercises in units requiring approximately 20 minutes in 2 training units (morning and evening).	PRWE, grip strength, wrist ROM Measurement time: T1 - one week after surgery (control examinations) T2- after 6 weeks rehabilitation (7 weeks from injury)	Exclusion criteria: age>18 years, unwilling to participate, lacked the cognitive capacity, lacked self-sufficiency in managing the requirements of daily life, psychiatric illness, bone disease responsible for the treated fracture (i.e. bone metastasis, osteolysis), previous fracture near the wrist, inflammatory joint disease (i.e. rheumatoid arthritis) or reflex sympathetic dystrophy
Kuo et al. (2013) [45]	RCT	n=22 Avarage age (years): EXP=59,3; CON=64,9 Gender: 15F,7M Diagnosis: DRF	EXP –exercises program supervised by OT and HEP. Group received 3 sessions (45 minutes) each per week until the external fixator was removed 6 weeks after fracture. After removing fixators, groups received regular rehabilitation programs (the same as Con group). CON- in basic care (basic exercises, advice and wound care). The limb was immobilized in the stabilizer for 6 weeks. After removing fixators, groups received regular rehabilitation programs until 12 weeks after surgery.	SF-36, grip and pinch strength, finger AROM, MAM-36, radiographic evaluation (volar tilt, radial inclination and radial height shorting) Measurement time: 1,3,6,12 weeks after surgery	Weak statistical power
Mitsukane et al. (2015) [46]	RCT	EXP(n=14) CON(n=14) Avarage age (years): EXP=62; CON=64 Gender: 19F,9M Diagnosis: unilateral DRF	EXP – received supervised wrist exercise (repeated 30 repetitive wrist extensions with maximal isometric 3 second hold and maximal extension than 3 second rest) and standard OT program. 30 repetitions were performed within 6 min (series of 10 repetitions/minute then minute rest). CON –received typical OT program. After the end of the program they had 6 minutes to rest.	Grip strength, pain (VAS), isometric strength of the wrist extension Measurement time: before and after 10 minutes exercises or relax	Exclusion criteria: bilateral fracture of upper limb Weak statistical power Lack of long-term outcome
Öken et al. (2011) [44]	CT	EXP(n=37) CON(n=20) Avarage age (years): 50,3+/-13,7 for both groups Gender: 52F,18M Diagnosis: DRF	EXP – each day for 3 weeks received rehabilitation in the hospital ward (passive ROM and wrist stretching exercises) under the supervision of a hand specialist. They were advised to do each exercise at home hourly, during the remaining part of the day. CON – HEP (hourly ROM and gentle wrist stretching exercises at home every day).	ROM, grip strength - pinch gauge, grip strength, oedema Measurement time: before treatment and after 3 weeks rehabilitation	Exclusion criteria: age<18 years, previous fracture of the injured and/or non-affected hand, any systemic disorder (e.g. diabetes mellitus, infections, etc.), complication (e.g. CRPS, arthritis, etc.) Lack of long-term follow-up results

Sen et al. (2014) [34]	CT	EXP(n=15) CON(n=15) Avarage age (years): 35 for both groups Gender: 20 F,10 M Diagnosis: Colles' fracture	EXP – received detailed instructions, demonstration HEP, which were in a specially prepared exercise booklet. Each session has been taken for 30 minutes and twice in a day (30 session). CON – received in OT, supervised by therapist over 6-week period for 30 sessions (1 hour). Therapists based on their own evaluation (reduce pain/swelling, isometric, passive and active exercises, PNF Technique, exercises against light resistance)	Test MMDT, pain (VAS), ROM, grip muscle Measurement time: before and after intervention	Weak statistical power Lack of long-term follow-up results
Souer et al. (2011) [40]	RCT	n= 94 Avarage age (years): EXP=48,6; CON=50,7 Gender: 61F,33M Diagnosis: unstable DRF stabilized by Volar plate or pins	EXP – exercises program supervised by OT (motion and strengthen the hand). The content, frequency and duration of the rehabilitation program were at the discretion of the therapist. CON – one session of advice by the surgeon to wear the splint and perform exercise program (HEP). Perform these exercises as often as possible, but at least 3-4 times a day (minimum 30 minutes).	Wrist ROM, grip strength, DASH, pain (10 gradual scale), radiographic evaluation, CES-D, PCS, PASS Measurement time: 3 and 6 months after surgery	Exclusion criteria: age>18 years, other injury, DRF treated with alternative or ancillary fixation, patience not planning to return for follow-up care, relying on others for basic functioning
Valdes et al. (2015) [48]	RTC	EXP(n=26) CON(n=24) Avarage age(years): EXP (28-81); CON (23-92) Gender: 42F,8M Diagnosis: unstable DRF stabilized by Volar plate and screws	EXP – exercised program supervised by HT and HEP (passive and active exercises ROM, mobilization, retrograde and scar massage, stretching, sensorimotor activities, prehension training, functional performance activities). 2 times a week for 30 minutes to an hour (16 visits) CON – received the same standard pictorial HEP	Primary endpoint: PRWE [measurement time - 6 months] Secondary endpoint: grip strength, pain (VAS), oedema, wrist ROM [measurement time - 2,4,8,12 weeks]	Exclusion criteria: conservatively treatment or other method of stabilization, age >18 years, unable to understand written/spoken English

(AROM – active range of motion; CES-D – Center for Epidemiologic Studies-Depression; CON – control group; CRPS – complex regional pain syndrom; CT – controlled trial; CTS – carpal tunnel syndrome; DASH - Disabilities of the Arm, Shoulder and Hand; DRF – distal radius fracture; EXP – experimental group; HEP – home exercise; HT – hand therapist; F – female; M – male; MMDT – Minnesota Manual Dexterity Test; OT – occupational therapist; PASS – Pain Anxiety Symptoms Scale; PCS – Pain Catastrophizing Scale; PRWE - Patient-Rated Wrist Evaluation; PT – physiotherapist; QuickDASH – short DASH; RCT – randomized, controlled trial; ROM – range of motion; SF-36 – short form 36, VAS – Visual Analogue Scale)

Results

Comparisons of advice and exercise or any advice versus no intervention

Research by Kay et al. [23] indicated that a single consultation with a qualified physiotherapist covering a programme of advice and exercise brought significant benefits in terms of activity, pain reduction and increased satisfaction with the improvement process in comparison to the control group that did not receive any sort of intervention (natural health restoring process). Kay et al. [23] believe that these results are of clinical significance. However, no significant differences were found between groups in terms of the primary result - wrist extension nor secondary results for other ranges of movement and gripping force [23].

No significant difference was found between results of individual patients after distal radius fracture, who performed a six-minute exercise programme of wrist extension and the group where no intervention was conducted. The group performing the exercise experienced grip force increase, however it did not result in pain alleviation therein. Mitsukane et al. [31] found that pain did not correlate with grip strength increase.

Comparison of advice and exercises versus any advice

There is no proof that adding exercise to the advice programme has a positive impact on decreasing the limitations and handicaps of DRF patients. One study found no difference in upper limb activity between patient groups, which received a programme of exercise and advice and those that

received only advice during three consultations with a physiotherapist on the subject of basic activities connected with the QuickDASH assessment at week 7 and week 24. Also, no differences were found in secondary results that included the scope of mobility, grip strength and pain [32].

Comparison of OT with physiotherapy versus physiotherapy only

Research by Filipova et al. [28] proved that combination therapy, i.e. OT and physiotherapy in conjunction, is more effective in decreasing the limitations after distal radius fracture. It was proven that introducing occupational therapy between week 8 and week 16 after the fracture to the rehabilitation process has indeed significantly improved the grip strength for up to a month from completing the 3-week exercise programme. However, no differences were found in the scope of activity, measured with the DASH Questionnaire [28].

Comparison of therapeutic program supervised by therapist versus home exercise program

One study indicated that OT was comparable or slightly worse from independent exercises after surgical treatment of unstable DRF [29]. Two studies showed greater effectiveness of a home exercise programme over a rehabilitation programme [15, 22]. Patients following a house exercise programme achieved a significantly greater improvement in grip strength and scope of wrist extension and bending [22]. Evidence from one of the tests showed that introduction of the exercise process supervised by an occupational therapist during immobilisation after a DRF significantly improved the dexterity of the thumb and other fingers. Research conducted by Kuo et al. [30] did not show additional benefits in the scope of arm strength and finger dexterity as well as functional results during immobilisation or another time after removing the stabiliser.

Comparison of therapeutic program supervised by therapist with home exercise program versus home exercise program only

In tests conducted by Öken et al. [24], a group of patients participating in rehabilitation conducted by a qualified therapist achieved a significant improvement of ROM results (wrist bending and extension, forearm supination) as well as hand grip and pincer grip strength, and a significant reduction of swelling, whereas the group participating in the home exercise programme achieved a significant improvement in wrist bending and radioulnar deviation.

Research conducted by Valdes et al. [16] indicated a lack of significant differences between the groups in the final PRWE, scope of active wrist and forearm motion, pain, and grip strength. However, both groups experienced an improvement of all the measures [16]. Summary of results is presented in table 3.

Tab. 3. Summary of results

Trial	Effectiveness
Bruder et al. (2016)	0
Filipova et al. (2015)	+
Kay et al. (2008)	+
Krischak et al. (2009)	-
Kuo et al. (2013)	0
Mitsukane et al. (2015)	0
Öken et al. (2011)	+
Sen et al. (2014)	-
Souer et al. (2011)	0
Valdes et al. (2015)	0

+ the study reported strong evidence that therapy was effective
0 the study did no report significant difference
- the study reported that therapy was less effective than home exercises program or other programs

Discussion

Analysis of published controlled trials did not yield clear evidence to show the benefits of occupational therapy instead of or in addition to other forms of patient rehabilitation after a distal radius fracture. In their research, Oken et al. [24] proved that home exercise programme after a DRF is less efficient then supervised rehabilitation. Nielsen et al. [28] recognised the efficacy of OT, if it is conducted within a year from the injury. Sen et al. [15] and Souer et al. [29] showed that occupational therapy is comparatively effective to patients exercising on their own in improving hand ability. Filipova et al. [28] showed that a combination of occupational therapy and physical therapy in the rehabilitation process benefit patients' recovery. Kuo et al. [30] did not show any additional benefits of introducing OT for DRF patients. It was shown that patients without complications benefit equally from the advice programme and home exercises, as well as from therapy supervised by a therapist [16].

Besides individual therapeutic interventions adapted to the patient's needs, a therapist may

participate in creating and implementing home exercise programmes, as well as to conduct individual consultations for patients with fractures. Exercise programmes and consultations are aimed at speeding up the recovery process and maximising the achieved results. Sen [15] emphasises that during the consultations, the patient should be informed on the details of the exercise programme and receive an explanation that the treatment may be successful only if the patient performs it in accordance with the therapist's instructions and emphasise that the basis for achieving therapy goals is confidence in the treatment.

Filipova et al. [28] claim that patient education and training is also of crucial importance and differentiate between the areas of work of occupational therapists and physiotherapists. The former mainly educates the patient in the scope of performing functional tasks and defined daily activities, and the latter, in movement scope exercises [24]. Due to the age bracket of patients suffering from distal radius fractures most often (the elderly), it would seem that obtaining the maximum scope of movement is a secondary goal to enabling self-reliance and a return to normal day-to-day functioning. By working with the patient on function, the occupational therapist also makes use of exercises to increase ROM necessary to perform functional tasks.

In addition to working on movement disorders, the occupational therapist also influences how the patients perceive their own disability, which will allow for an optimal reflection of recovery. Research done by Kay et al. [23] showcased that 13 persons from the control group (46%) who received no rehabilitation provided information about concerns in connection with lack of advice or guidelines provided during recovery. In comparison to the experimental group, 20 participants (71%) indicated a beneficial effect of advice and exercise provided by the physiotherapist [15]. Research may also indicate that the results of the experimental group were also influenced by psychological factors such as reduction of fear and anxiety connected with using the broken limb. Occupational therapy conducted in the form of consultations after a DRF allows for an explanation of all the possibilities and limitations in using the limb in day-to-day activities.

A distal radius fracture oftentimes results in complications, and the criteria for disorders are not always possible to determine and eliminate. In case of complications, the most important thing is an early diagnosis that enables appropriate action to be taken. Kay et al. [23] indicate that diagnosing many complications would be overlooked or delayed if not for the test protocol provided by the therapist.

Research by Valdes et al. [16] indicated that the most common complication after a fracture is CSPS / complex regional pain syndrome/, however, patients with soft tissue damage, swelling, or concomitant diseases also require increased supervision during treatment in order to maximise their results. Filipova et al. [28] suggest that adding an intervention to occupational therapy is recommended for persons with significantly decreased grip strength after cast removal. Research by Valdes [16] and MacDerimd [24] confirms that patients with complications benefit from clinical therapy. Kay et al. [23] indicate that persons after DRF should routinely be directed to a therapist in order to receive a set of exercises and enable early detection of complications.

Occupational therapy for patients with DRF may be conducted in the form of advice, consultations, or a supervised therapeutic process. Nielsen and [33] emphasise that in Denmark, DRF patients are directed to an occupational therapist by a surgeon, for a single consultation or a prolonged rehabilitation, depending on their needs. Case-Smith [25] acknowledged that "arm rehabilitation includes both outpatient services and a recommended home exercise programme" (Case-Smith J., 2003). The attached occupational therapy efficacy assessment confirms this thesis.

Analysis of the literature failed to indicate clear evidence for occupational therapy efficacy in the rehabilitation period of patients with DRFs. However, research demonstrated a necessity to introduce an intervention conducted by an occupational therapist with patients in danger of complications or those who already suffer from such complications.

The analysis emphasised the importance of the moment of occupational therapy introduction in relation to the time of injury. Aydog et al. [15] determined that patients should undergo rehabilitation shortly after treatment in order to improve the function of the arm, elbow and radiocarpal joints, as it will prevent complications. Efficacy analysis indicated a variance in timing of occupational therapy inclusion in the patient rehabilitation process. Six researchers suggested that this form of therapy should be included during

the immobilisation period, and three postulated that it should be included after cast removal.

All of the presented research has weak statistical capacity, which hinders translating the results into the general population of DRF patients. An additional factor hindering result translation to the entire group of patients are the exclusion criteria. Without a doubt, subsequent research should include persons with bilateral wrist fractures, persons who suffered from previous DRFs of the same limb, persons with concomitant diseases and complications.

Analysis of literature on the effectiveness of OT during rehabilitation of patients with distal radius fractures indicates that this topic is rarely the object of scientific research. Considering how significant they are for the patients' health and quality of life, further research is required. It should include a larger sample, consider an earlier introduction of an occupational therapy intervention in the recovery process, and perform long term measurements.

Analysis of literature on occupational therapy with DRF patients indicated no research on using detailed methods of working with the patient. A review of literature indicated a lack of protocols from the conducted therapeutic programmes in conducted tests that would compare the efficacy of methods for recovering the functions from before the injury. In case of DRF treatment, no standardised treatment rehabilitation programme exists, therefore it seems warranted to publish protocols on the conducted activities in order to determine the most efficient activities.

Conclusions

The inclusion of occupational therapy to the rehabilitation process (advice, consultations, exercises or supervised therapy process) leads to better results in patients after DRF. There is no clear evidence showing the benefits of occupational therapy performed instead of or in addition to other forms of patient rehabilitation after DRF.

References

1. Bruder AM, Taylor NF, Dood KJ, Shields N. Physiotherapy intervention practice patterns used in rehabilitation after distal radius fracture. Physiotherapy. 2013;99(3):233-40.
2. Waljee JF, Zhong L, Shauver M, Chung KC. Variation in the Use of Therapy following Distal Radius Fractures in the United States. Plast Reconstr Surg. 2014.
3. Xu W, Ni C, Yu R, Gu G, Wang Z, Zheng G. Risk factors for distal radius fracture in postmenopausal women. Orthopade. 2017;46(5):447-50.
4. Szuba O, Nagraba Ł, Mitek T, Stolarczyk A, Kuropatwa K. Porównanie efektów leczenia złamań DNKP z zastosowaniem różnych metod stabilizacji na podstawie piśmiennictwa i przeglądu prac naukowych z bazy danych Pubmed. Artroskop Chir Stawow. 2011;7(3-4):21-37.
5. Skorupińska A, Tora M, Bojarska-Hurnik S. Klasyfikacja oraz elementy leczenia złamań dalszej nasady kości promieniowej. Fizjoter. 2015;23(3):40-6.
6. Unglaub F, Langer MF, Hohendorff B, Muller LP, Unglaub JM, Hahn P et al. Distale radiusfraktur. Osthopäde. 2017;46:93-110.
7. Żyluk A. Złamanie dalszego końca kości promieniowej. PZWL. Warszawa; 2014.
8. Grabicki M, Grzegorzewski A. Ocena wyników leczenia operacyjnego złamań dalszego końca kości promieniowej metodą zachowawczą oraz metodą przezskórnej stabilizacji odłamów złamania. Chir Narzadow Ruchu Ortop Pol. 2010;75(4):205-10.
9. Żyluk A, Janowski P. Porównanie wyników leczenia złamań nasady dalszej kości promieniowej metodą zachowawczą i przezskórnym zespoleniem drutami Kirschnera. Chir Narzadow Ruchu Ortop Pol. 2007;72(5):327-34.
10. Clement N, Duckworth M, Court-BrownCM. The outcome of proximal humeral fractures in the elderly. J Bone Joint Surg Am. 2014;96:970-7.
11. Moore CM, Leonardi-Bee J. The prevalence of pain and disability one year post fracture of the distal radius in a UK population: A cross sectional survey. BMC Musculoskelet Disord. 2008;9:129-39.
12. Aviv B, Bar-On E, Weigl D, Becker T, Katz K. Children's daily living activities during immobilization of upper-limb fractures with an above- or below-elbow cast. J Child Orthop. 2008;2(3):221-4.
13. Ydreborg K, Engstrand C, Steinvall I, Larsson EL. Hand function, experienced pain, anddisability after distal radius fracture. Am J Occup Ther. 2015; 69(1).
14. Bac A. Terapia zajęciowa w dysfunkcjach narządu ruchu. PZWL. Warszawa; 2018.

15. Sen R, Mohapatra J. Home–based Exercise Program (HEP) vs. Institution–based Occupational Therapy (OT) in improving hand skills in post Collies' fractures: A comparative study. Indian J Occup Ther. 2014;46(3):90-7.
16. Valdes K, Naughton N, Burke CJ. Therapist-supervised hand therapy versus home therapy with therapist instruction following distal radius fracture. J Hand Surg Am. 2015;40:1110–6.
17. Vergara I, Vrotsou K, Orive M, Garcia-Gutierrez S, Gonzalez N, Hayas CL et al. Wrist fractures and their impact in daily living functionality on elderly people: a prospective cohort study. BMC Geriatr. 2016 [cited 2018 Dec 17]; 16(1). Available from: https://bmcgeriatr.biomedcentral.com/articles/10.1186/s12877-015-0176-z.
18. Białoszewski D. Fizjoterapia w ortopedii. PZWL: Warszawa; 2014: 246.
19. Bac A. Terapia zajęciowa. PZWL, Warszawa; 2016.
20. Rottermund J, Nowotny J. Terapia zajęciowa w rehabilitacji medycznej. Alfa Medica Press. Bielsko-Biała; 2014.
21. Svestkova O, Svecena K, Formankova P. Czy terapia zajęciowa jest istotna w procesie rehabilitacji?. Niepełnosprawność – Zagadnienia, Problemy, Rozwiązania. 2014;3(12):81–102.
22. Krischak GD, Krasteva A, Schneider F, Gulkin D, Gebhard F, Kramer M. Physiotherapy after volar plating of wrist fractures is effective using a home exercise program. Arch Phys Med Rehabil. 2009;90:537–44.
23. Kay S, McMahon M, Stiller K. An advice and exercise program has some benefits over natural recovery after distal radius fracture: a randomised trial. Aust J Physiother. 2008;54:253–9.
24. Öken Ö, Ceclia E, Öken FÖ, Yorgancioglu RZ. Hospital-based versus home-based program in rehabilitation of distal radius fractures. Turk J Phys Med Rehab. 2011;57:139-42.
25. Case-Smith J. Outcomes in hand rehabilitation using occupational therapy service. Am J Occup Ther. 2003;57(5):499-506.
26. Bac A, Czechowska D, Szczygiel A. Propozycja rehabilitacji pacjentów po leczeniu zachowawczym i w powikłaniach złamań typu Collesa dalszej nasady kości promieniowej – wybrane zagadnienia. Fizjoter Pol. 2009;2(4):181-90.
27. Mooney M, Ireson C. Occupational Therapy in Orthopedics and Trauma. Wiley. 2009, p.234-49.
28. Filipova V, Lonzaric D, Jesensek Papez B. Efficacy of combined physical and occupational therapy in patients with conservatively treated distal radius fracture: randomized controlled trial. Wien Klin Wochenschr. 2015;127(5):282–7.
29. Souer JS, Buijze G, Ring D. A prospective randomized controlled trial comparing occupational therapy with independent exercises after volar plate fixation of a fracture of the distal part of the radius. J Bone and Joint Surg Am. 2011;93(19):1761–6.
30. Kuo LC, Yang TH, Hsu YY, Wu PT, Lin CT, Hsu HY et al. Is progressive early digit mobilization intervention beneficial for patients with external fixation of distal radius fracture? A pilot randomized controlled trial. Clin Rehabil. 2013;27:983-93.
31. Mitsukane M, Sekiya N, Kimei S, Oyama K. Immediate effects of repetitive wrist extension on grip strength in patients with distal radius fracture. Arch Phys Med Rehabil. 2015;96:862-8.
32. Bruder AM, Shields N, Dodd KJ, Hau R, Taylor NF. A progressive exercise and structured advice program does not improve activity more than structured advice alone following a distal radial fracture: A multi-centre phase I/II randomized controlled trial. J Physiother. 2016;62:145-52.
33. Nielsen TL, Dekkers MK. Progress and prediction of occupational performance in women with distal radius fracture: A one-year follow-up. Scand J Occup Ther. 2014;20(2):143-51.

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III Spotkanie Ekspertów

spotkanieekspertow.pl

Termin: 13 grudnia 2019
Godzina: 11:00- 17:00
Miejsce: Sala Senatu w Centrum Kongresowo- Dydaktycznym Uniwersytetu Medycznego im. Karola Marcinkowskiego ul. Przybyszewskiego 37 A, Poznań

Sejsa I: Leczenie dysfunkcji kończyny górnej
Sesja II: Leczenie skoordynowane

Wykładowcy:

prof. Marilyn Moffat
dr hab. Przemysław Lubiatowski
dr Anne Kärki
dr Piotr Czarnecki
dr Piotr Godek
dr Ryszard Biernat
dr Grzegorz Gamma
dr Grzegorz Srokowski
dr Kay Stevenson
dr Marta Jokiel
mgr Tomasz Niewiadomski
mgr Jacek Tuz

Moderatorzy:

prof. dr hab. Włodzimierz Samborski
prof. dr hab. Leszek Romanowski
dr hab. Sławomir Marszałek
dr hab. Przemysław Lisiński
dr Martyna Jarocka
dr Mateusz W. Romanowski
dr Adrian Chudyk
dr Grzegorz Biliński
dr Krzystof Dudziński
dr Piotr Kotajny

Organizatorzy:

Katedra Rehabilitacji i Fizjoterapii i Katedra Reumatologii i Rehabilitacji Uniwersytetu Medycznego im. K. Marcinkowskiego w Poznaniu

Przewodniczący komitetu organizacyjnego:

dr Mateusz W. Romanowski

PATRONAT HONOROWY:

Ministerstwo Zdrowia
Łukasz Szumowski
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KOMUNIKAT

Akademia Wychowania Fizycznego Józefa Piłsudskiego w Warszawie
Wydział Rehabilitacji

zaprasza na

IX Międzynarodową Konferencję Naukową „Myśl Rehabilitacyjna Profesora Andrzeja Seyfrieda” pt. TRENING FUNKCJONALNY CZY MEDYCZNY?

Warszawa, 15-16 maja 2020 r.

W 2020 roku, w dniach 15-16 maja, odbędzie się IX edycja Międzynarodowej Konferencji Naukowej „Myśl Rehabilitacyjna Profesora Andrzeja Seyfrieda” pt. Trening funkcjonalny czy medyczny?

Organizując Konferencję, podejmujemy próbę odpowiedzi na pytanie czym jest trening funkcjonalny we współczesnej fizjoterapii. W ostatnich latach stosowane są zamiennie terminy „trening funkcjonalny” i „trening medyczny”, które są różnie definiowane. Jedni uważają, za trening funkcjonalny ten, który odwzorowuje ruchy specyficzne dla danej dyscypliny czy aktywności ruchowej, inni natomiast ten oparty o wykorzystanie specyficznych narzędzi czy metod.

Liczymy, że nieskrępowana wymiana poglądów i dyskusja będą okazją do wypracowania wspólnej płaszczyzny zrozumienia tego istotnego w dzisiejszej fizjoterapii obszaru.

Do aktywnego udziału zapraszamy wszystkich zaangażowanych w różne formy aktywności od terapii po krzewienie aktywności w populacjach osób zdrowych. Mamy nadzieję, że obecność w jednym miejscu fizjoterapeutów, lekarzy, trenerów, instruktorów, nauczycieli przyczyni się do owocnej wymiany poglądów i dyskusji.

W trakcie dwudniowej konferencji odbędą się sesje naukowe, warsztaty oraz panel dyskusyjny. Zapraszamy uczestników do udziału w warsztatach, które będą ukierunkowane na problematykę związaną z treningiem funkcjonalnym w fizjoterapii, treningiem stabilizacji tułowia, odbudową zdolności motorycznej, treningiem oddechowym w GDS, treningiem funkcjonalnym w neurologii, czy też treningiem motywacyjnym.

Miejsce Konferencji
Akademia Wychowania Fizycznego Józefa Piłsudskiego w Warszawie,
ul. Marymoncka 34, Aula Główna

Opłata konferencyjna (*zgodnie z Regulaminem – wpłata 7 dni od momentu rejestracji)*
– 390 zł
Opłata konferencyjna dla studentów *(j.w.)*
– 320 zł

Warsztaty
W cenie Konferencji proponujemy udział w warsztatach (do wyboru przez uczestnika z grupy ośmiu warsztatów). Wyboru uczestnik dokonuje w kwestionariuszu zgłoszeniowym. Liczba miejsc na poszczególne warsztaty jest ograniczona – decyduje kolejność zgłoszeń.

Formularz zgłoszeniowy zostanie zamieszczony na stronie awf.edu.pl w połowie stycznia 2020 r.

Szanowni Państwo,

Uprzejmie informujemy, iż wraz z 4. numerem XXXIII tomu 2019 roku kończymy publikację wersji papierowej czasopisma Advances in Rehabiliation (Postępy Rehabilitacji).
Od 2020 roku czasopismo wydawane będzie wyłącznie w wersji elektronicznej, w formie Open Access. Wierzymy, że dzięki temu Advances in Rehabilitation (Postępy Rehabilitacji) dotrze do większej liczby odbiorców. Podjęcie tych działań powinno spowodować, że Kwartalnik uzyska wyższą rangę naukową i będzie bardziej skutecznie pomagał autorom w ich awansach naukowych. Starania redakcji o awans publikacyjny na liście punktowanych w Polsce i zagranicą czasopism naukowych mogą być realizowane nie tylko poprzez publikowanie wartościowych naukowo artykułów lecz także poprzez zmianę formy drukowanych prac. Mam przekonanie, że akceptacja tej zmiany przez naszych czytelników i autorów, zamierzających publikować wyniki swoich badań na forum Advances in Rehabilitation, spotka się z przychylny przyjęciem i będzie dobrze dalej służyć rozwojowi rehabilitacji i fizjoterapii w systemie opieki zdrowotnej.
Dziękujemy bardzo za prenumerowanie naszego czasopisma i zapraszamy do korzystania z wersji elektronicznej na stronie http://www.advrehab.org .

Przy tej okazji chciałbym także złożyć serdeczne życzenia Wesołych i Spokojnych Świąt Bożego Narodzenia, niech ten czas będzie dla Państwa radosny i pełen pozytywnych przeżyć.

Łączę wyrazy szacunku i pozdrowienia

Prof. dr hab. Bartosz Molik
Redaktor Naczelny Czasopisma
Postępy Rehabilitacji / Advances in Rehabilitation

INSTRUCTIONS FOR AUTHORS

AIM AND SCOPE

Advances in Rehabilitation [Adv Rehab] is a scientific journal published continuously since 1987. The journal is addressed to professionals from different fields of rehabilitation such as cardiology, neurology, orthopedics, traumatology, internal medicine or pediatrics. The journal also includes papers concerning psychological, sociological and ethical aspects related to the process of rehabilitation. We publish articles from the fields of medical rehabilitation, physiotherapy, adapted physical activity and occupational therapy.

The journal is published in paper (ISSN 0860-6161) and electronic (ISSN 1734-4948) versions. The editorial team accepts **original papers, reviews as well as letters to editor**.

Journal is cofinanced by the Polish Rehabilitation Society.

EDITORIAL PROCESS

The editorial team examines the submitted manuscripts under the following conditions:

a) they have not been published elsewhere – both fully and in their essential parts – in print or electronic media (except in the form of an abstract or a report from a scientific meeting or a conference, whose copies are to be submitted together with the paper);
b) they have not been submitted to the editorial office of other journals;
c) all authors agree on the publication of the presented material;
d) information about the specific contribution that each author made to the manuscript is provided (in order to prevent the practice of "ghostwriting" and "guest authorship");
e) all sources of financial support for publication are disclosed.

The above information is included in the statement submitted by the first author (statement_Adv_Rehab).

The editing process starts after the correct version of the manuscript together with necessary attachments is submitted.

Once accepted for publication, the paper becomes the property of Józef Piłsudski University of Physical Education in Warsaw. Thus, any and all copyrights – to publish and distribute the submitted material in any form known – shall be transferred to the publisher. Therefore, the paper may not be published (in whole or in part) by other publishers in Poland or abroad without the publisher's prior consent.

Manuscripts that do not conform to the editorial rules will be returned for improvement without any content-related analysis.

REVIEW PROCESS

The manuscript of each paper is subject to review. The reviews are anonymous ("double-blind review process"); at the request of the reviewer their name may be disclosed to the author(s). The reviewers prepare opinions which include justified recommendations and suggestions of changes and supplements to the content and form of the article. The review is in a written form and ends with an approval or rejection of the article.

Based on reviews editorial team makes a decision concerning publication, either:

- **Reject** – the paper is not acceptable for publication and re-submission will not be considered; or
- **Major Revision** – the paper requires major changes and needs to go through the review process again with no guarantee of acceptance; or
- **Minor Revision** – the paper is provisionally accepted, subject to conditions that need to be addressed in producing a final version of the manuscript; or
- **Accept** – the paper is accepted without any changes.

Author is obliged, within 3 weeks, to take a position on the comments and possibly to make the suggested corrections.

The list of reviewers is published once a year, i.e. in the fourth issue and on the website of the journal.

ETHICAL CONSIDERATION

The Editor-in-Chief has the right to refuse to print the paper including the results of research during which ethical rules for clinical trials, defined in the declaration of the World Medical Association in Helsinki in 1964 and in Tokyo in 1975, and in the recommendations of the World Health Organization from 1982, have not been complied with.

All experimental studies using human or animal subjects should include an explicit statement in the Material and Methods section identifying the ethics committee approval for each study.

LANGUAGE

Authors of manuscripts in polish that are accepted for publication are given two weeks to have their papers translated into English by the translators indicated by the journal editors. An article translated by the authors will be checked in terms of language by the translators cooperating with the editorial board. Both the costs of translation and correction are covered by the authors.

MANUSCRIPT PREPARATION AND SUBMISSION

All manuscripts should be submitted to Editorial Office by electronic Editorial System (www.editorialsystem.com/rehab)**.** The submission, apart from the manuscript, shall include a completed and signed statement. The main responsibility for the included information lies with the author submitting the manuscript.

The total length of the paper including abstracts, tables, figures and references must not exceed: original articles – 3500 words; reviews – 6000 words; letters to the editor – 500 words.

The manuscript should be prepared in the following way:

1. **First page** of the paper should include the title of the paper, names, surnames and affiliations of all authors, exact data – name and surname (address, telephone, fax for information of the editorial team) and an e-mail of the person responsible for preparing the manuscript and contacting the editorial team. The front page should also include information about sources of financial support available to the research.

2. **Second page** of the paper should include:
   – the title of the paper as well in order to enable anonymous reviews of the paper after having removed the first page
   – an abstract built structurally, i.e. including introduction, material and methods, results and conclusions – in separate paragraphs, including, in total, from 200 to 250 words
   – 3-5 key words chosen from the MeSH catalogue (Medical Subject Headings Index Medicushttp://www.nlm.nih.gov/mesh/MBrowser.html). Key words should not duplicate words from the title of the paper.

3. **Main text** should be divided into the following parts:
   – **introduction** – summary of current knowledge leading to the overall design and purpose of the study;
   – **materials and methods** – clear description of methods applied in the study including subjects, intervention, measurements, data collection procedure and statistics. The International System of Units (SI) and standard abbreviations should be used. Any methods already well described and widely known should not be described in detail and should refer to an appropriate reference. Authors must declare that the experiments reported in the manuscript were performed in accordance with the ethical standards of the Helsinki Declaration and that the participants signed an informed consent form;
   – **results** – this section should rely on tables and figures with a minimum of accompanying text. Titles and legends of tables and figures should allow them to be regarded as self-explanatory. There should be no repetition of data already presented in tables or figures;

- **discussion –** results of the study should be critically discussed from the point of view of limitations of the research project, method applied, and current knowledge available in the literature. Interpretation of the results is encouraged, while avoiding speculations. The end of the discussion section should present practical implications of the results of the study;
- **conclusions** – Main findings and novel elements of the results should be summarized in the Conclusions. The authors should refrain from making conclusions about facts not demonstrated by their study;
- **references.**

4. the paper should be written in font Times New Roman normal –12 point, space between the lines – 1.5 point, adjusted text. The title of the article – 14 point, bold; titles (Introduction, Results etc.) 12 point, bold, separated from the main text with double-space. Additional formatting elements (e.g. bold, italics, underline) should be avoided in the text.

5. **Tables and figures**
   - the desired position of the figures and tables in the text should be indicated in the left margin (number and heading);
   - tables and figures numbered with Arabic numerals, in the order that they appear in the article (Tab. 1; Fig. 1.);
   - each table and figure should be prepared in separate file;
   - each figure (charts, photos, pictures) should be supplied in a separate electronic file in bitmap formats (TIFF, GIF, JPEG, etc.). Bitmap images should be of a resolution of at least 300 dpi. In the appropriate places in the text number and title of the figure should be given. Figures should be black and white;
   - a maximum of 6 tables and 4 figures is allowed.

REFERENCES

References (only the papers used, without academic sources) should be presented in order of quotation in the text. Papers which has not been published and oral information should not be quoted. Abbreviations of titles of the quoted journals should be compatible with Medline (Index Medicus www.nlm.nih.gov/tsd/serials/lji.html). References used in the text should be numbered with Arabic numerals in square brackets. Internet sources – because of easiness to change or correct texts – should include the date of downloading or checking the file. In relation to the list of authors, if the number of authors of the quoted position exceeds 6, the term "et al." should be used.

Reference positions should be formatted according to the examples presented below.

Journal articles

Vega KJ, Pina I, Krevsky B. Heart transplantation is associated with an increased risk for pancreatobiliary disease. Ann Intern Med 1996 Jun 1:124(11):980-3.

Supplement to the annual bound volume (volume)

Shen HM, Zhang QF. Risk assessment of nickel carcinogenicity and occupational lung cancer. Environ Health Perspect1994; 102 Suppl 1:275-82.

Supplement to the number (number)

Payne DK, Sullivan MD, Massie MJ. Women's psychological reactions to breast cancer. SeminOncol 1996; 23(1 Suppl2):89-97.

No labelling of the edition and volume of publication

Browell DA, Lennard TW. Immunologic status of the cancer patient and the effects of blood transfusion on antitumor responses. CurrOpin Gen Surg 1993:325-33.

Book

Ringsven MK, Bond D. Gerontology and leadership skills for nurses. 2nd ed. Albany (NY) Publishers; 1996.

Book edited by (…)

Norman IJ, Redfern SJ, editors. Mental health care for elderly. New York: Churchill Livingstone; 1996.

Chapter in the book

Phillips SJ, Whisnant JP. Hypertension and stroke. In: Laragh JH, Brenner BM, editors. Hypertension: pathophysiology, diagnosis, and management. 2nd ed. New York: Raven Press; 1995.p.465-78.

Conference materials

Kimura J, Shibasaki H, editors. Recent advances in clinical neurophysiology. Proceedings of the 10th International Congress of EMG and Clinical Neurophysiology; 1995 Oct 15-19; Kyoto, Japan, Amsterdam: Elsevier; 1996.

ELECTRONIC MATERIAL

Article

Abood S. Quality improvement initiative in nursing homes: the ANA acts in an advisory role. Am J Nurs [Internet]. 2002 Jun [cited 2002 Aug 12];102(6):[about 1 p.]. Available from: http://www.nursingworld.org/AJN/2002/june/Wawatch.htmArticle

Web page

Cancer-Pain.org [Internet]. New York: Association of Cancer Online Resources, Inc.; c2000-01 [updated 2002 May 16; cited 2002 Jul 9]. Available from: http://www.cancer-pain.org/.

Additional information available at: http://www.nlm.nih.gov/bsd/uniform_requirements.html

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2. Digitalizacja artykułów naukowych w otwartym dostępie przez sieć Internet czasopisma Postępy Rehabilitacji
3. Zwiększenie udziału zagranicznych recenzentów w ocenie publikacji składanych do czasopisma Postępy Rehabilitacji

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