

MUSCULOSKELETAL PAIN IN PROFESSIONAL SYMPHONY ORCHESTRA MUSICIANS

ANTONINA KACZOROWSKA¹ A,B,D,E

• ORCID: 0000-0002-0488-8583

AGATA MROCZEK¹ A,C,E

• ORCID: 0000-0002-5246-0792

EWELINA LEPSY¹ A,D,F

• ORCID: 0000-0003-3663-9888

MAGDALENA KORNEK¹ A,B,F

• ORCID: 0000-0003-3278-7453

AGNIESZKA KACZOROWSKA² C,D

• ORCID: 0000-0002-2076-6201

MONIKA KACZOROWSKA³ D,F

• ORCID: 0000-0001-5665-540X

KAROLINA LEPSY⁴ D,F

• ORCID: 0000-0001-5453-2254

¹ Institute of Health Sciences, University of Opole, Poland

² Department of Physiotherapy, University School of Physical Education in Wrocław, Poland

³ Faculty of Medicine, Medical University of Lodz, Poland

⁴ Faculty of Medicine, Wrocław Medical University, Poland

A – study design, B – data collection, C – statistical analysis, D – interpretation of data, E – manuscript preparation, F – literature review, G – sourcing of funding

ABSTRACT

Background: A musician's many years of professional experience may contribute to the development of pain and musculoskeletal disorders. There are a few studies in Poland on gender differences in musculoskeletal pain among adult professional musicians.

Aim of the study: This study aimed to assess and compare pain in Polish women and men who are professional musicians, as well as to analyze the relationships between the intensity and frequency of pain and the time spent playing each week and the experience of playing the instrument in years.

Material and methods: Sixty professional musicians were examined (26 men and 34 women). Pain intensity was assessed using the visual analog scale (VAS). Participants reported the frequency of musculoskeletal system ailments, the location of the pain, the number of hours of playing the instrument per week, and the playing experience in years. In addition, body weight and height were measured and body mass index (BMI) was calculated.

Results: Most of the participants (94% of women and 69% of men) reported pain in the musculoskeletal system ($p=0.010$). Women experienced significantly greater pain in the musculoskeletal system assessed using the VAS ($p=0.036$), and also declared pain significantly more often compared to men ($p=0.002$). Significant positive correlations were found between frequency of symptoms per week with the number of hours of playing per week ($r=0.28$), year of playing the instrument ($r=0.38$), and pain assessment on the VAS ($r=0.57$). Moreover, negative correlations were found between frequency of symptoms per week with body height ($r=-0.45$) and body mass ($r=-0.36$).

Conclusions: Musculoskeletal disorders are very common among professional musicians, especially among women. In general, the greater the number of hours playing per week and the longer the history of playing, the greater the pain intensity. Future research should aim to evaluate the prevalence and risk factors of musculoskeletal disorders associated with playing an instrument in different groups of musicians.

KEYWORDS: musculoskeletal disorders, musicians, pain, orchestra, occupational health

BACGROUND

Specific occupational requirements are increasingly recognized as a cause of various types of work-related health ailments. One highly specialized group of professionals is musicians who, due to their work, experience various health problems related to the musculoskeletal system [1]. The latest research in Europe confirms the occurrence of musculoskeletal disorders in 70–90% of the studied musicians [2-4]. The prevalence of work-related health problems is an important issue from the perspective of the individual worker who has the potential to “lose” health and, consequently, the ability to work. However, it is also important from economic and organizational perspectives due to more frequent or prolonged absences, sick leave, and even the permanent inability to work [5].

Playing an instrument may overload the musculoskeletal system, both in terms of statics and dynamics [6]. When playing, individual sections of the musician’s body are in a forced position. Mastering the playing of an instrument involves daily practice – often many hours – so the period of being in a forced body position is quite long [6,7]. Performing repetitive movements for a long time and engaging the same muscle groups may lead to pathological changes in the musculoskeletal system [8]. Playing an instrument also requires effort in carrying the instrument, which especially applies to musicians playing the violin, cello, and clarinet. These loads translate into symptoms in the musculoskeletal system [9]. Pain is often the first warning sign that changes have occurred, but may be disregarded in the beginning [8]. Some musicians believe that the pain associated with playing an instrument is an acceptable and normal symptom in their profession [10, 11].

Previous studies have noted a difference between the sexes in terms of pain, such that female musicians have greater musculoskeletal problems than male musicians [8,12]. The most common studies on the differences in the musculoskeletal system problems between the sexes concern students at music schools or a population including musicians of various levels [12, 13, 2]. A small number of studies have examined pain in men and women who are professional musicians.

Despite medical advances, the prevalence of musculoskeletal ailments has remained at the same level for many years [9]. Although research on musculoskeletal disorders in musicians has been systematically conducted in Europe, the number of studies conducted in Poland is limited. Increasing musicians’ knowledge of risk factors and methods of preventing these conditions would be of significant importance for reducing ailments of the musculoskeletal system.

AIM OF THE STUDY

This study aimed to assess the frequency of pain in Polish men and women who are professional musicians, as well as to analyze the relationships between the intensity and frequency of pain and the time spent playing an instrument each week and the number of years of professional experience playing an instrument.

The research questions are:

- 1) Does the frequency of pain in the musculoskeletal system differ between men and women who are professional musicians?
- 2) Does the pain level, measured using the visual analog scale (VAS), differ between men and women?
- 3) Do time spent playing weekly and years of experience affect the level and frequency of musculoskeletal pain?

MATERIAL AND METHODS

Sample

This research was conducted in January and February 2020 at the institutions for artistic activity in Opolskie Voivodeship. This work is part of research registered on the ISRCTN platform under number 37451, which has been discontinued since March 2020 due to the COVID-19 pandemic. A total of 60 musicians were examined (26 men and 34 women) from the Symphony Orchestra of the Opole Philharmonic Józef Elsner and the Princely Symphony Orchestra in Brzeg. The inclusion criteria were: (1) a minimum of five years of experience playing an instrument and (2) written consent to participate in the study. The exclusion criteria were: (1) infections, (2) acute injuries, (3) tumors, (4) pregnancy in women, and (5) lack of written consent to participate in the study.

The participants were divided into two groups: men and women. Each group included violinists, cellists, and musicians playing wind instruments. In the group of women, there were 14 violinists, 11 cellists, and 1 musician playing a wind instrument. The group of men consisted of 3 violinists, 4 cellists, and 10 musicians playing wind instruments.

Methods

The research with the musicians was conducted at the Opole Philharmonic and at the City Hall in Brzeg in the afternoon. The research technique was a questionnaire. The VAS was used to assess pain intensity on a scale from 0 to 10, where 0 meant minimal pain and 10 meant intense, unbearable pain [14]. The respondents also reported the frequency of

musculoskeletal ailments (number of days per week) and the location of pain. The questionnaire was supplemented with questions about the number of hours spent playing the instrument per week and the playing experience in years. In addition, body weight and height were measured and participants' body mass index (BMI) was calculated.

Ethics

This study was carried out in accordance with the guidelines of the Declaration of Helsinki and Good Clinical Practice. All procedures were approved by the Bioethical Commission at Opole Medical School (permission no. KB/240/FI/2020). All participants gave written informed consent after thorough explanation of the procedures involved.

Statistical analyses

Descriptive statistics were calculated, including the mean (M), median (Me), standard deviation (SD), minimum (Min), and maximum (Max). The distribu-

tion of variables was assessed for normality using the Shapiro-Wilk test. Non-parametric methods were used. The Mann-Whitney U-test was used to assess the significance of differences between the groups of women and men. Spearman's rank correlation was used to assess the relationships between the number of hours of playing and years of experience with the intensity and frequency of pain. All analyses were performed using Statistica version 13.3 (TIBCO Inc., Tulsa, United States). A p-value ≤ 0.05 indicated statistical significance.

RESULTS

Descriptive data

The mean participant age was 31.32 ± 11.24 for women and 34.03 ± 14.68 for men. The women were shorter, weighed less, and had a lower BMI compared to the men. The differences between men and women for the age and somatic variables (height, weight, BMI) were statistically significant. Respondents' demographic characteristics and somatic variables are presented in Table 1.

Table 1. Descriptive statistics of age and somatic variables in the groups of women and men musicians

Variable	Group	M \pm SD	Me	Min-Max	Z	p
Age [years]	Women	31.32 \pm 11.24	29	16–59	-0.365	0.714
	Men	34.03 \pm 14.68	32.5	19–67		
Body height [cm]	Women	166.00 \pm 7.27	168	152–178	-5.400	<0.001*
	Men	177.69 \pm 5.58	178	167–191		
Body mass [kg]	Women	61.02 \pm 14.54	58	43–120	-5.273	<0.001*
	Men	81.15 \pm 11.17	83	61–101		
BMI [kg]/m ²	Women	22.00 \pm 4.17	21.04	16.69–40.09	-4.057	<0.001*
	Men	25.71 \pm 3.48	25.72	18.31–31.02		

Note: M – mean; SD – standard deviation; Me – median; Min – minimum; Max – maximum; Z – Mann-Whitney U test, p – p value, *p<0.05.

Main results

Of the total sample, 32 women (94%) and 18 men (69%) reported musculoskeletal system pain (p=0.010; Table 2). In the groups of men and women, pain was most often localized in the lumbar spine (46% vs. 94%), cervical spine (27% vs. 50%), and upper limbs (27% vs. 50%). Pain was very rarely localized in the lower limbs in men and women (7.5% vs. 3%). The differences between the sexes were not statistically significant (Table 3).

The results of the intensity and frequency of pain differed significantly between women and men. Women experienced significantly greater pain in the musculoskeletal system, assessed on the VAS (p=0.036), and also experienced pain significantly

Table 2. The occurrence of pain in women and men musicians

Group	n (%)
Women	32 (94%)
Men	18 (69%)

Note: Pearson's Chi² p= 0.01037.

Table 3. Typical localization of pain in professional musicians

Group	Cervical spine n (%)	Lumbar spine n (%)	Upper limb n (%)	Lower limb n (%)
Women	17 (50%)	23 (94%)	17 (50%)	1 (3%)
Men	7 (27%)	12 (46%)	7 (27%)	2 (7.5%)

Note: Pearson's Chi² p<0.05.

Table 4. Statistical characteristics of pain and playing an instrument in groups of women and men musicians

Variable	Group	M±SD	Me	Min-Max	Z	p
Pain assessment on the VAS scale [n]	Women	4.52±2.21	5	0–8	2.095	0.036*
	Men	3.07±2.75	3	0–8		
The frequency of symptoms per week [n]	Women	3.73±2.35	3	0–7	2.968	0.002*
	Men	1.96±2.05	2	0–7		
Hours of playing per week [hours]	Women	28.94±15.37	28	4–70	1.529	0.126
	Men	22.92±11.78	20	4–42		
Experience of playing an instrument [years]	Women	23.02±9.89	22	5–42	0.716	0.473
	Men	22.53±15.70	19	5–57		

Note: M – mean; SD – standard deviation; Me – median; Min – minimum; Max – maximum; Z – Mann-Whitney U test, p – p value, * p<0.05.

Table 5. Correlation of Spearman's ranks in musicians

Variable	BH [cm]	BM [kg]	BMI [kg/m ²]	Hours of playing per week [hours]	Experience of playing an instrument [years]	Pain assessment on the VAS scale [n]	The frequency of symptoms per week [n]
BH [cm]		0.78	0.49	-0.26	-0.00	-0.18	-0.45
BM [kg]	0.78		0.90	-0.18	0.10	-0.10	-0.36
BMI [kg/m ²]	0.49	0.90		-0.08	0.13	-0.01	-0.21
Hours of playing per week [hours]	-0.26	-0.18	-0.08		0.22	0.38	0.28
Experience of playing an instrument [years]	-0.00	0.10	0.13	0.22		0.45	0.38
Pain assessment on the VAS scale [n]	-0.18	-0.10	-0.01	0.38	0.45		0.57
The frequency of symptoms per week [n]	-0.45	-0.36	-0.21	0.28	0.38	0.57	

Note: BH – body height, BM – body mass; significant differences with p <0.05 is marked in bold.

more often compared to men (p=0.002). The number of hours spent playing the instrument per week and years of playing experience were similar in both groups and the differences were not statistically significant (Table 4).

In the study group, significant positive correlations were found for the frequency of symptoms per week with the number of hours spent playing per week (r=0.28), years of experience playing an instrument (r=0.38), and pain assessment on the VAS (r=0.57). Moreover, negative correlations between frequency of symptoms per week with body height (r=-0.45) and body mass (r=-0.36) were found (Table 5).

DISCUSSION

The aim of this study was to assess and compare the intensity and frequency of musculoskeletal system pain between men and women who are professional musicians in Poland. The results showed that women reported significantly more pain and greater intensity of pain. These observations are consistent with other research conducted among musicians and

students at music universities in different countries. Research confirms that women are more prone to pain in the musculoskeletal system [8,2,15-19]. These differences are already present in young musicians attending a music school, with girls reporting musculoskeletal pain much more often than boys [13].

The greater frequency of pain and intensity of pain in women may be related to sex differences in the structure and proportions of the body. Adult women are on average 7–8% shorter and 25–20% lighter than men. The muscle mass of women is also lower than that of men. By the age of 20–24, muscle mass accounts for about 36% of body weight in women and about 45% of body weight in men. Women are also characterized by lower bone mass, which amounts to approximately 12% of body weight; by contrast, this value in men is 15% [20]. Men also have greater absolute strength compared to women [21], while women are characterized by lower endurance of the joints and ligaments. Playing an instrument often requires carrying a heavy instrument and keeping the instrument in a forced position for a long time [9]. Therefore, due to differences in body proportions and physiology between men and women, pain in the

musculoskeletal system in women may be more frequent and intense.

Among the surveyed musicians, positive relationships were found between the number of hours spent playing per week and playing experience, and the degree of pain intensity and the frequency of ailments. It can be concluded that the degree of pain intensity and frequency of ailments depend on the number of hours spent playing per week and the number of years of playing the instrument. An interesting relationship was also observed between body height and body weight and the frequency of pain symptoms: the shorter and lighter the participants were, the more often they experienced pain. Keeping an instrument in one position for a long time while playing and carrying the instrument may overburden the musician's body. Of note, the sizes of the instruments for adults were similar. Perhaps for shorter and lighter people, activities related to playing require more effort, and therefore more frequent pain in the musculoskeletal system.

The relationship between years of experience playing an instrument and time spent playing has also been emphasized by other researchers. A long playing time and more hours of play have been reported to increase pain [2, 18, 19, 22]. Gomez-Rodriguez et al. conducted a study among 213 Spanish musicians and showed that spending more than 14 hours a week playing an instrument was a risk factor associated with symptoms of musculoskeletal disorders [2]. In the present study, the average number of hours spent playing per week in each group was over 20 hours. Perhaps that is why such a large percentage of respondents reported pain in the musculoskeletal system.

The concordance of the results of studies on the prevalence of musculoskeletal disorders among musicians proves that these symptoms constitute a serious health problem that warrants attention in this professional group. Research by Raymond et al. involving American classical orchestra musicians found that musicians reported limited formal training and education about health risks in the workplace. Risk information was only provided late in their professional development. This is particularly worrying due to the age at which music training begins [23].

More awareness and knowledge about health risks among musicians are needed, and strategies to

prevent overload and ailments related to playing an instrument should be introduced during their studies in order for musicians to pursue a healthy career. Education about the potential effects of risks associated with being a professional musician should also apply to teachers, doctors, and physical therapists working with musicians. Musicians' working conditions, i.e., requirements regarding the position and movements of the body while playing the instrument, can only be modified to a certain extent. It thus follows that a key to supporting the health of musicians is to find solutions to alleviate the pain and musculoskeletal ailments associated with work that will not affect the ability to play the instrument.

Limitations

This work is subject to several limitations. The study covered a small number of musicians from two orchestras in the Opolskie Voivodeship. Therefore, when interpreting the results, it is worth remembering that participants are only representative of musicians in this region of Poland. In addition, this study considered only a few risk factors for musculoskeletal pain in musicians. Further research should include a much larger number of musicians from different regions of Poland and analyze other risk factors, such as the type of instrument, low level of physical activity, and stress. Future research into the epidemiology of musculoskeletal disorders in musicians should focus on related risk factors and the prevention of work-related problems.

CONCLUSIONS

Playing-related musculoskeletal disorders were significantly more common in women and in musicians with lower body height and weight.

The greater the number of hours spent playing per week and the longer the period of experience, the greater the pain intensity.

Future research should aim to evaluate the occurrence and risk factors of playing-related musculoskeletal disorders in other groups of musicians.

REFERENCES

1. Nawrocka A, Mynarski W, Powerska A, Grabara M, Groffik D, Borek Z. Health-oriented physical activity in prevention of musculoskeletal disorders among young Polish musicians. *Int J Occup Med Environ Health* 2014; 27(1): 28-37.
2. Gómez-Rodríguez R, Díaz-Pulido B, Gutiérrez-Ortega C, Sánchez-Sánchez B, Torres-Lacomba M. Prevalence, disability and associated factors of playing-related musculoskeletal pain among musicians: a population-based cross-sectional descriptive study. *Int J Environ Res Public Health* 2020; 17(11): 3991.
3. Sousa CM, Machado JP, Greten HJ, Coimbra D. Occupational diseases of professional orchestra musicians from Northern Portugal: a descriptive study. *Med Probl Perform Art* 2016; 31(1): 8-12.
4. Jacukowicz A, Wężyk A. Dolegliwości mięśniowo-szkieletowe, słuchowe i skórne związane z grą na instrumencie. *Med Pr* 2018; 69(4): 383-394. (In Polish)

5. Peçiño M. Selected aspects of absence at work and work-related health problems in Polish enterprises. *Int J Occup Saf Ergon* 2015; 21(3): 268–275.
6. Janiszewski M, Gałuszka G, Ochwanowska A, Gąciarz A, Hak A, Ochwanowski P, et al. Analiza biomechaniczna dynamiki i statyki narządu ruchu u muzyków instrumentalistów. *Med Pr* 2005; 56(1): 25–33. (In Polish).
7. de Souza Moraes GF, Papini Antunez A. Musculoskeletal disorders in professional violinists and violists: a systematic review. *Acta Ortop Bras* 2012; 20(1): 43–47.
8. Paarup HM, Baelum J, Holm JW, Manniche C, Wedderkopp N. Prevalence and consequences of musculoskeletal symptoms in symphony orchestra musicians vary by gender: a cross-sectional study. *BMC Musculoskelet Disord* 2011; 12: 223.
9. Rickert DL, Barrett MS, Halaki M, Driscoll T, Ackermann BJ. A study of right shoulder injury in collegiate and professional orchestral cellists: an investigation using questionnaires and physical assessment. *Med Probl Perform Art* 2012; 27(2): 65–73.
10. Rickert DL, Barrett MS, Ackermann BJ. Are music students fit to play? A case study of health awareness and injury attitudes amongst tertiary student cellists. *Int J Music Educ* 2015; 33(4): 426–441.
11. Pichardo JD. Musculoskeletal problems in pianists and their influence on professional activity. *Med Probl Perform Art* 2017; 32(2): 118–122.
12. Hagberg M, Thiringer G, Brandstrom L. Incidence of tinnitus, impaired hearing and musculoskeletal disorders among students enrolled in academic music education: a retrospective cohort study. *Int Arch Occup Environ Health* 2005; 78: 575–583.
13. Nawrocka A, Mynarski W, Powerska-Didkowska A, Grabara M, Garbaciak W. Musculoskeletal pain among Polish music school students. *Med Probl Perform Art* 2014; 29(2): 64–69.
14. Jamison RN, Gracely RH, Raymond SA, Levine JG, Marino B, Herrmann TJ, et al. Comparative study of electronic vs. paper VAS ratings: a randomized, crossover trial using healthy volunteers. *Pain* 2002; 99(1-2): 341–347.
15. Leaver R, Harris EC, Palmer KT. Musculoskeletal pain in elite professional musicians from British symphony orchestras. *Occup Med* 2011; 61(8):549–555.
16. Steinmetz A, Scheffer I, Esmer E, Delank KS, Peroz I. Frequency, severity and predictors of playing-related musculoskeletal pain in professional orchestral musicians in Germany. *Clin Rheumatol* 2014; 34: 965–973.
17. Kok LM, Huistede BMA, Voorn WMA, Schoones JW, Nelissen RGHH. The occurrence of musculoskeletal complaints among professional musicians: a systematic review. *Int Arch Occup Environ Health* 2016; 89: 373–396.
18. Rodriguez-Romero B, Pérez-Valiño C, Ageitos-Alonso B, Pértega-Díaz S. Prevalence and associated factors for musculoskeletal pain and disability among Spanish music conservatory students. *Med Probl Perform Art* 2016; 31(4): 193–200.
19. Kochem FB, Silva JG. Prevalence and associated factors of playing-related musculoskeletal disorders in Brazilian violin players. *Med Probl Perform Art* 2017; 32(1): 27–32.
20. Jaskólski A, Jaskólska A. Podstawy fizjologii wysiłku fizycznego z zarysem fizjologii człowieka. Wrocław: Wydawnictwo AWF Wrocław; 2006. (In Polish).
21. Kubo K, Kanehisa H, Fukunaga T. Gender differences in the viscoelastic properties of tendon structures. *Eur J Appl Physiol* 2003; 88: 520–526.
22. Kaufman-Cohen Y, Ratzon N.Z. Correlation between risk factors and musculoskeletal disorders among classical musicians. *Occup Med* 2011; 61(2): 90–95.
23. Raymond DM, Romeo JH, Kumke KV. A pilot study of occupational injury and illness experienced by classical musicians. *Workplace Health Saf* 2012; 60(1):19–24.

Word count: 2136

• Tables: 5

• Figures: 0

• References: 23

Sources of funding:

The research was funded by the authors.

Conflicts of interests:

The authors report that there were no conflicts of interest.

Cite this article as:

Kaczorowska A, Mroczek A, Lepsy E, Kornek M, Kaczorowska A, Kaczorowska M, Lepsy K. Musculoskeletal pain in professional symphony orchestra musicians. *Med Sci Pulse* 2021; 15 (3): 38–43. DOI: 10.5604/01.3001.0015.0633.

Correspondence address:

Agata Mroczek
University of Opole, Institute of Health Sciences
pl. M. Kopernika 11a
45-040 Opole
E-mail: agata.mroczek@uni.opole.pl

Received: 08.06.2021

Reviewed: 18.07.2021

Accepted: 20.07.2021