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6-Week Intervention Program and Posture Changes in Music Students

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Abstract

Introduction: Developing the musculoskeletal complaints in music students are common because of practice over an instrument. Little is known about the effectiveness of interventions; therefore, more research is necessary to better understand and manage the issues; therefore, the present study was aimed at evaluating the impact of 6-week intervention program on posture in music students.

Materials and Methods: 6-week intervention program was carried out six weeks, aiming for 30 female music students: (i) Experimental group (n = 15) (58.50 kg, 168.50 cm, 20.40 years); (ii) Control group (n = 15) (60.20 kg, 170.20 cm, 20.80 kg), attending the bachelor's degree in Performing Arts. Standardized measure to evaluate the posture was carried out; in particular, pre- (31-10, Week 1) and post-testing (9-12, Week 6). Evaluating the impact of 6-week intervention program was by Wilcoxon Signed-Rank Test, Wilcoxon Rank-Sum Test (rejection of normality of data distribution), Pearson's r (normality of data distribution).

Results. Significant differences (.01, .05) between the experimental and control group were in: (i) Pre-testing – (i-i) Head and neck; (i-ii) Curvature of spine; (ii) Post-testing – (ii-i) Head and neck; (ii-ii) Abdomen and pelvis; (ii-iii) Curvature of spine; (ii-iiii) Shoulders and scapulas. 6-week intervention program, targeting the posture in music students is important because of its impact on musculoskeletal health.

Discussions: 6-week intervention program in music students was effective at improving their postures; and therefore, implementing intervention program (at least 6 weeks) in music students and guidance on prevention of musculoskeletal complaints may influence, in a positive way, their quality of life and career.

Keywords: 6-week intervention, performing arts, posture, university students.

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1. Introduction

Musculoskeletal complaints in music students are common because of intense practice over an instrument, i.e., spending long hours of practicing may cause muscular imbalance, tension, and awkward posture (Cruder et al., 2021). Repetitive nature of practicing in music students may cause overuse and muscle fatigue, increasing the risk of acute pain of neck, arms, and shoulders (Cruder et al., 2018; Davies, 2020), affecting quality of life and performance (Ackermann et al., 2012; Rickert et al., 2014). ± 85 % of music students (1st year) at university experience acute pain and ± 34 % of them experience musculoskeletal complaints before the 1st year of bachelor's degree and/or earlier in education (Spahn et al., 2004; Dommerholt, 2010; Stanek et al., 2017). The 1st year of bachelor's degree at university is demanding because of transition, requiring intense practice over an instrument (Hildebrandt et al., 2012; Cruder et al., 2021); musculoskeletal complaints increase to 42 % in year 2, after which decline to 36 % in year 3 (Spahn et al., 2017). Decline by 6 % in year 3 is because of combination of factors; in particular, improving technique, increasing awareness of injury prevention, and developing self-care over time (Strenáčiková, 2020).

Promotion of health (e.g., musculoskeletal) at educational institutions (e.g., music school) may influence, in a positive way, health attitudes of music students (Árnason et al., 2018; Matei et al., 2018), reduce the incidence of musculoskeletal complaints (Chan et al., 2014; Davies, 2020), and support them during the demanding year 1 of bachelor's degree (Cruder et al., 2021).

Quality of posture in music students while performing (e.g., playing an instrument, singing) may affect the musculoskeletal health and quality of performance. Incorrect posture in music students is common (± 58 %), more in females (Ohlendorf et al., 2017; Gembris et al., 2018; Rousseau et al., 2021). Whether sitting and/or standing, music students should be aware of positioning, aligning the spine, and relaxing manner of shoulders (Blanco-Piñeiro et al., 2015). Maintaining correct posture is of utmost importance in promoting the well-being of music students, allowing to engage in music-making with greater comfort and ease; however, prevention of posture is not common in music students (Akbari-Chehrehbargh, Tavafian, 2022).

Responsibility of health (e.g., musculoskeletal) in music students is low; therefore, creating awareness and providing specific guidance on prevention of musculoskeletal complaints (e.g., discomfort, pain) during study may influence, in a positive way, careers of music students (Kreutz et al., 2009; Stanhope, Weinstein, 2021).

Educational institutions (e.g., music school) are in charge of teaching music students how to take care of musculoskeletal health; however, that teaching is absent (absence of data). Addressing that absence, educational institutions may incorporate musculoskeletal health education into curriculum by offering classes, practices, and/or seminars of various topics; in particular, music students' health, injury prevention, and self-care. Because many gaps remain in literature, in terms of Slovak scale (to the best of authors' knowledge), the present study was aimed at evaluating the impact of 6-week intervention program on posture in music students.

2. Materials and methods

Procedure Sample and Participant Selection

In accordance with study aim, the target population consisted of 30 (100 %, n = 30) female music students: (i) Experimental group (50 %, n = 15) (20.40 ± .50 years, 58.50 ± 4.50 kg, 168.50 ± 2.50 cm); (ii) Control group (50 %, n = 15) (20.80 ± .40 years, 60.20 ± 4.20 kg, 170.20 ± 3.40 cm) (Table 1, 2), attending the Bachelor's Degree (1st and 2nd year) in Performing Arts (Faculty of Performing Arts, Academy of Arts in Banská Bystrica, Slovakia). Target population (100 %, n = 30) consisted of convenience sample – music students (female), recruited through the subject – "Prevention of Musculoskeletal System 1 – 2" (Experimental group; 50 %, n = 15) and institutional e-mails (Control group; 50 %, n = 15) (Adamčák et al., 2022). 6-week intervention program was carried out six weeks (31-10 – 9-12-2023), 2x (Mon, Tue)/week/45 minutes, aiming for intentional sampling; regarding age, gender, and degree/year of study.

Evaluating the impact of 6-week intervention program in music students was carried out in accordance with the ethical standards as laid down in the 1964 Declaration of Helsinki and its later amendments and/or comparable ethical standards. All subjects provided written informed consent (Harriss et al., 2019).

Table 1. Anthropometric data of experimental (50 %, n = 15) and control (50 %, n = 15) group

	Experimental group	Control group
Age (years)	20.40 ± .50	20.80 ± .40
Body weight (kg)	58.50 ± 4.50	60.20 ± 4.20
Body height (cm)	168.50 ± 2.50	170.20 ± 3.40
Body mass index (i)	20.50 ± .60	20.80 ± .90

Table 2. Playing instruments of experimental (50 %, n = 15) and control (50 %, n = 15) group

	Experimental group	Control group
Wind	5 (33.33 %)	5 (33.33 %)
String	5 (33.33 %)	5 (33.33 %)
Keyboard	5 (33.33 %)	5 (33.33 %)

Assessments, Measures and Procedures

Evaluating the impact of 6-week intervention program in music students (female) (experimental vs. control group) was carried out six weeks (31-10 – 9-12-2023), 2x (Mon, Tue)/ week/45 minutes (True experimental design) consisting of random assignment (2 groups of music students (female), manipulation (6-week intervention program in experimental group (50 %, n = 15), and control (comparing with control group (50 %, n = 15). Experimental group (50 %, n = 15) size was 15 music students (female)/ lecturer (Prevention of Musculoskeletal System 1 – 2). Besides demonstrating (supervising) 6-week intervention program, the lecturer was informing the experimental group (50 %, n = 15) of purpose and principles of 6-week intervention program. 6-week intervention program was chosen because of supporting musculature of spine, neck, abdomen, and shoulders (Chan et al., 2014), allowing the experimental group (50, n = 15) to exercise with low-load activation of supporting musculature (early stage), advancing to more challenging (changing positioning) and movement patterns with resistance (Chan et al., 2013). 6-week intervention program consisted of warm-up, intervention (3 sets of 12 reps and/or 3 sets of 6 reps – 30/40 sec.), and cool-down. Experimental group (50 %, n = 15) was documenting the progress of 6-week intervention program (e.g., number of sets/reps, possible problems) and notifying the lecturer in case of musculoskeletal discomfort and/or pain who was monitoring the signs of fatigue (i.e., shaking, loss of control) (Kim et al., 2015).

Standardized measure (Klein and Thomas/ Mayer) to evaluate the posture in music students (n = 30) was carried out six weeks; in particular pre- (31-10, Week 1) and post-testing (9-12, Week 6). Standardized measure evaluates (visual) 5 segments (area) of body: (i) Head and neck; (ii) Shape of chest; (iii) Abdomen and pelvis; (iiii) Curvature of spine; (iiiii) Shoulders and scapulas. Positions of segments are given numerical values (1 – 4) in terms of quality and posture is expressed by postural score: (i) Correct posture, 5 points; (ii) Good posture, 6 – 10 points; (iii) Bad posture, 11 – 15 points; (iiii) Incorrect posture, 16 – 20 points (Marko, Bendíková, 2020).

Data Processing

Evaluating the impact of 6-week intervention program in music students (female) (experimental vs. control group) was by Wilcoxon Rank-Sum Test, Wilcoxon Signed-Rank Test (in case of rejection of normality of data distribution), Pearson's r (normality of data distribution is not rejected), and descriptive statistics (Ibm Spss Modeler). Significant difference (.01, .05) between the experimental (50 %, n = 15) and control (50 %, n = 15) group was evaluated by Wilcoxon Rank-Sum Test, of which the significance level (α) was .01 and .05 (Nahm, 2016). Significant difference (.01, .05) between the pre- (31-10, Week 1) and post-testing (9-12, Week 6) was evaluated by Wilcoxon Signed-Rank Test, of which the significance level (α) was .01 and .05 (Kim, 2014). Measuring of linear correlation between two sets of data (e.g., covariance and standard deviation) was evaluated by Pearson's r (Schober et al., 2018). Descriptive statistics (e.g., arithmetic mean, percentage frequency) described the basic features of music students (Adamčák et al., 2022).

3. Results

In accordance with study aim, Table 3 illustrates the differences (.01, .05) of posture in experimental (50 %, n = 15) and control (50 %, n = 15) group. Average values (1 – 4) in terms of

quality of posture (position of segments – i, ii, iii, iiii, iiiii) in experimental (50 %, n = 15) group were as follows: (i) Pre-; 1/ Post-; 6 – (i-i) Head and neck – 2.12 ± .64/1.34 ± .48; (i-ii) Shape of chest – 1.72 ± .70/ 1.34 ± .48; (i-iii) Abdomen and pelvis – 2.20 ± .68/1.40 ± 3). Average values in terms of quality of posture in control (50 %, n = 15) group were as follows: (ii) Pre-; 1/ Post-; 6 (no change) – (ii-i) Head and neck – 2.80 ± .68; (ii-ii) Shape of chest – 1.50 ± .64; (i-iii) Abdomen and pelvis – 2.20 ± .68; (i-iiii) Curvature of spine – 2.40 ± .52; (i-iiiii) Shoulders and scapulas – 2.14 ± .64. In accordance with results of repeated measures analysis of changes in quality of posture in experimental group (50 %, n = 15), significant (.01, .05) changes were in head and neck ($Z = 3.46$, $p < .01$, $r = .64$), shape of chest ($Z = 2.44$, $p < .05$, $r = .44^{*}$), abdomen and pelvis ($Z = 3.46$, $p < .01$, $r = .64$), curvature of spine ($Z = 3.32$, $p < .01$, $r = .60$), and shoulders and scapulas ($Z = 3.16$, $p < .01$, $r = .58$). In addition, there was significant (.01) decrease in measured values at week 6 (post-testing) as compared with baseline by post hoc analysis in experimental group (50 %, n = 15), which confirmed the decrease by 3.44 ± .60 in postural score (posture) in experimental group (50 %, n = 15) after the intervention of 6-week program ($Z = 3.60$, $p < .01$, $r = .64$). Repeated measures analysis of changes in quality of posture in control group (50 %, n = 15) were not statistically ($p > .05$) different (n/a); therefore, there was no significant (.01, .05) decrease in measured values at week 6 (post-testing) as compared with baseline (Pre-; 1) by post hoc analysis in control group (50 %, n = 15) after the intervention of 6-week program (n/a).

Table 3. Differences (.01, .05) of posture in experimental (50 %, n = 15) and control (50 %, n = 15) group

		Experimental group	
Testing; Week	**Pre-; 1**	**Post-; 6**	**Wilcoxon S-R Test**
Head and neck	2.12 ± .64	1.34 ± .48	$Z = 3.46$, $p < .01$, $r = .64^{**}$
Shape of chest	1.72 ± .70	1.34 ± .48	$Z = 2.44$, $p < .05$, $r = .44^{*}$
Abdomen and pelvis	2.20 ± .68	1.40 ± .50	$Z = 3.46$, $p < .01$, $r = .64^{**}$
Curvature of spine	1.86 ± .35	1.12 ± .35	$Z = 3.32$, $p < .01$, $r = .60^{**}$
Shoulders and scapulas	1.66 ± .48	1.02 ± .02	$Z = 3.16$, $p < .01$, $r = .58^{**}$
Postural score	9.94 ± 2.22	6.50 ± 1.62	$Z = 3.60$, $p < .01$, $r = .64^{**}$
		Control group	
Testing; Week	**Pre-; 1**	**Post-; 6**	**Wilcoxon S-R Test**
Head and neck	2.80 ± .68	2.80 ± .68	n/a
Shape of chest	1.50 ± .64	1.50 ± .64	n/a
Abdomen and pelvis	2.20 ± .68	2.20 ± .68	n/a
Curvature of spine	2.40 ± .52	2.40 ± .52	n/a
Shoulders and scapulas	2.14 ± .64	2.14 ± .64	n/a
Postural score	11.24 ± 2.20	11.24 ± 2.20	n/a

Notes: n/a – Not available; * – Significance (α) = .05; ** – Significance (α) = .01.

Differences (.01, .05) of posture in pre- (week 1) and post- (week 6) testing illustrates Table 4. According to repeated measures analysis of changes in quality of posture in pre- (week 1) testing of experimental (50 %, n = 15) and control (50 %, n = 15) group, significant (.01, .05) changes were in head and neck ($Z = 2.44$, $p < .05$, $r = .44$) and curvature of spine ($Z = 3.12$, $p < .01$, $r = .58$); however not in shape of chest ($Z = .80$, $p > .05$, $r = .14$), abdomen and pelvis (n/a), and shoulder and scapulas ($Z = 1.86$, $p > .05$, $r = .34$). In addition, there was significant (.05) difference in measured values at week 1 (pre-) as comparing, by post hoc analysis, experimental (50 %, n = 15) and control (50 %, n = 15) group, which confirmed the difference of 2.30 ± .02 in postural score, in favor of experimental (50 %, = 15) group ($Z = 1.96$, $p < .05$, $r = .36$). According to repeated

measures analysis of changes in quality of posture in post- (week 6) testing of experimental (50 %, n = 15) and control (50 %, n = 15) group, significant (.01) changes were in head and neck (Z = 4.36, p < .01, r = .80), abdomen and pelvis (Z = 3.04, p < .01, r = .56), curvature of spine (Z = 4.64, p < .01, r = .84), and shoulders and scapulas (Z = 4.26, p < .01, r = .68); however, not in shape of chest (Z = .8 4, p > .05, r = .16) (Table 4). In addition, there was significant (.01) difference in measured values at week 6 (post-) as comparing, by post hoc analysis, experimental (50 %, n = 15) and control (50 %, n = 15) group, which confirmed the difference of 4.74 ± .58 in postural score, in favor of experimental (50 %, = 15) after the intervention of 6-week program (Z = 4.60, p < .01, r = .84).

Table 4. Differences (.01, .05) of posture in pre- (week 1) and post- (week 6) testing

Testing; Week	Experimental group	Pre-testing; Week 1 Control group	Wilcoxon R-S Test
Head and neck	2.12 ± .64	2.80 ± .68	Z = 2.44, p < .05, r = .44*
Shape of chest	1.72 ± .70	1.50 ± .64	Z = .80, p > .05, r = .14
Abdomen and pelvis	2.20 ± .68	2.20 ± .68	n/a
Curvature of spine	1.86 ± .35	2.40 ± .52	Z = 3.12, p < .01, r = .58**
Shoulders and scapulas	1.66 ± .48	2.14 ± .64	Z = 1.86, p > .05, r = .34
Postural (total) score	9.94 ± 2.22	11.24 ± 2.20	Z = 1.96, p < .05, r = .36*
Testing; Week	**Experimental group**	**Post-testing; Week 6 Control group**	**Wilcoxon S-R Test**
Head and neck	1.34 ± .48	2.80 ± .68	Z = 4.36, p < .01, r = .80**
Shape of chest	1.34 ± .48	1.50 ± .64	Z = .84, p > .05, r = .16
Abdomen and pelvis	1.40 ± .50	2.20 ± .68	Z = 3.04, p < .01, r = .56**
Curvature of spine	1.12 ± .35	2.40 ± .52	Z = 4.64, p < .01, r = .84**
Shoulders and scapulas	1.02 ± .02	2.14 ± .64	Z = 4.26, p < .01, r = .68**
Postural (total) score	6.50 ± 1.62	11.24 ± 2.20	Z = 4.60, p < .01, r = .84**

Note: n/a – Not available; * – Significance (α) = .05; ** – Significance (α) = .01.

4. Discussion

When it comes to impact of intervention program (6-week) on posture in music students, the incidence rate is low (Blanco-Piñeiro et al., 2016) and because many gaps remain in the literature, in terms of Slovak scale (to the best of authors' knowledge), the present study was aimed at evaluating the impact of 6-week intervention program on posture in music students. 6-week intervention program targeting posture in music students is important because of significant impact it has on musculoskeletal health and performance (Chan et al., 2014). Research carried out by numerous authors underlines the prevalence of musculoskeletal complaints in music students and detrimental effects of poor posture (Steinmetz et al., 2012; Ackermann et al., 2012; Blanco-Piñeiro et al., 2015; Kok et al., 2016; Stanek et al., 2017; Cruder et al., 2020; Rotter et al., 2020). For instance, Ackermann et al. (2012) found that 84 % of music students surveyed musculoskeletal complaints, with the most affected areas being the neck, back, and upper limbs. According to repeated measures analysis of changes in quality of posture in pre- (week 1) testing of experimental (50 %, n = 15) and control (50 %, n = 15) group, significant (.01, .05) changes were in head and neck (Z = 2.44, p < .05, r = .44) and curvature of spine (Z = 3.12, p < .01, r = .58) (Table 3).

Prevalence of musculoskeletal complaints in music students may differ, depending on various factors, including the type of instrument, intensity of practice and performance, individual's technique and posture, and level of awareness and preventive measures taken. In terms of numbers, it ranges from 43 % to 63 %, sometimes in more than 80 % of professional musicians (Steinmetz et al., 2010; Paarup et al., 2011). Prevalence of musculoskeletal complaints related to music performance ranges from 80 % to 98 % among professional orchestral musicians, affecting at least one area of their body for at least one day (Leaver et al., 2011; Paarup et al., 2011; Spahn, Blum, 2011). Female music students have higher risk (significantly) for reporting the musculoskeletal complaints compared to males, while effects of these complaints last for more days. In a study conducted by Sousa et al., (2016), it was revealed that 94 % of orchestral musicians in North Portugal, who were part of research, expressed concerns regarding the musculoskeletal complaints. When involving 441 musicians from six Danish symphony orchestras, Paarup et al (2011) found that woodwind players had lower risks of musculoskeletal complaints compared to musicians who played other instruments.

6-week intervention program targeting posture may provide music students with knowledge necessary to maintain the correct body alignment during practice over an instrument and performance. Researchers like Mahmud et al. (2011) stressed the importance of ergonomics and optimal posture of reducing the possibility of musculoskeletal complaints. By educating music students about correct alignment and instrument-specific ergonomics, and teaching exercises and stretches to improve muscle flexibility and strength, 6-week intervention program may address, in a positive way, frequent demands placed on music students (Ackermann et al., 2002; Lee at al., 2012). Music students who receive individualized assessments and/ or guidance from qualified professional demonstrate improved postural awareness and were less likely to experience musculoskeletal complaints (Chan, Ackermann, 2014). This highlights the significant role of personalized guidance in promoting correct posture in music students; however, there is almost no research on implementing (evaluating) programs aimed at preventing correct posture in music students (Blanco-Piñeiro et al., 2015), as some deal with musicians' pain. As an illustration, Wolff et al. (2021) conducted the recent randomized controlled pilot study to assess the effectiveness of musicians' pain prevention workshop involving 57 music students. The results revealed that, at the 8-week follow-up, the intervention group experienced 32 % reduction in their pain scores, whereas the control group saw an 8 % increase in pain ($p < 0.01$). Davies (2020) was examining the impact of Alexander Technique classes on musicians' pain among music students and reported significant reductions in pain. In terms of 6-week intervention program, there was significant (.01) difference in measured values at week 6 (post-) as comparing by post hoc analysis experimental (50 %, n = 15) and control (50 %, n = 15) group, which confirmed the difference of 4.74 ± .58 in postural (total) score, in favor of experimental (50 %, = 15) after the intervention of 6-week program ($Z = 4.60$, $p < .01$, $r = .84$) (Table 4).

Researchers like Ohlendorf et al. (2017) demonstrated the positive correlation between correct posture and technical skills in music students. Correct alignment allows efficient muscle coordination and better control over an instrument, resulting in improved accuracy and precision during performance. Staes et al. (2010) found that music students with correct posture exhibited better sound production and tonal quality. This indicates that optimal body alignment facilitates proper breath control and enables musicians to produce the full, resonant sounds; therefore, 6-week intervention program that focuses on posture may enhance performance in music students. Scientific research supports the necessary of 6-week intervention program on posture in music students ($p < .01$, $.05$). It is obvious that incorrect posture contributes to musculoskeletal complaints and affects performance in music students (Blanco-Piñeiro et al., 2016; Ohlendorf et al., 2017). By implementing the comprehensive intervention program (at least 6 weeks) that includes education, personalized assessments, and guidance, music students may develop optimal posture habits. The integration of ergonomics and posture exercises into music curricula is essential for equipping music students with the necessary tools to maintain correct posture during their musical careers.

5. Conclusion

Musculoskeletal complaints in music students are common (see Introduction); and little is known about the effective prevention; therefore, the present study was aimed at evaluating the impact of 6-week intervention program on body posture (change) in music students. Using

evidence (available) of intervention program in cooperation with medical experience and current best practice (Bendíková et al., 2018; Kliziene et al., 2018), 6-week intervention program was effective at improving body posture (e.g., neck, abdomen, shoulders) in music students. Participation in such a program and/or any program is beneficial in music students if retaining for longer duration. Preventive education (i.e., Prevention of Musculoskeletal System 1 – 2) in music students influences attitudes towards musculoskeletal health; therefore, the intervention (preventive) programs, which target body postures (correct) with an adequate duration (at least 6 weeks) should be implemented.

Recommendation for future research: (i) Experimental groups (samples) should be larger, with control of variables, such as age, musical instrument; (ii) More research in music students and intervention (preventive) programs, with follow-up.

According to results of 6-week intervention program, we may recommend it for practical use of static load compensation system and prevention of functional disorders of musculoskeletal system; however, it is important to carry out 6-week intervention program on long-term and regular basis.

Conclusions of any experimental study require additional formulation in the light of existing limitations, therefore, we consider the inability to generalize the findings to the entire population, since non-probability sampling methods do not ensure the sample (representative), the results may not be applicable beyond the sample (experimental) group. While the 6-week intervention program may bring short-term improvements, sustaining these changes over the long term can be challenging. Music students may revert to their previous posture habits once the intervention ends, leading to a loss of benefits.

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7. Conflicts of interest

The author(s) declare that the research was carried out in the absence of any commercial, and/or financial relationships that could be construed as a potential conflict of interest.

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