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Original Article

Assessment of spine pain presence in children and young persons studying in ballet schools

Małgorzata Wójcik[1)*], Idzi Siatkowski[2)]

[1)] *Department of Physiotherapy, Stanislaw Staszic University of Applied Science in Pila: Podchorążych 10, 64-920 Piła, Poland*
[2)] *Department of Mathematical and Statistical Methods, Poznan University of Life Sciences, Poland*

Abstract. [Purpose] Spine disorders affect various sections of the spine and have a variety of causes. Most pain occurs in the lumbo-sacral and cervical regions. Dance is associated with exercise. High levels of physical activity predispose to back pain occurrence. [Subjects and Methods] The subjects were 237 ballet learners; 80 children (primary school level), mean age 11.24±0.77, mean of years of training ballet 2.14±0.74; 93 students (junior high school level), mean age 14.01±0.84, mean of years of learning ballet 4.64±1.24; 64 students (high school) mean age 17.01±0.77, mean of years of learning ballet 7.47±1.54. Numeric rating scale was used to determine spine pain. [Results] Feelings of pain were analyzed on the basis of "now" and "before" between levels education by using point statistics and statistical tests to compare groups. "Now" exhibited weaker back pain feelings than "before" at all the education levels. There were statistically significant differences in pain feeling for "before" (at any time of learning) and "now" (the day of survey). [Conclusion] All patients reported pain "before" and "now" in cervical, thoracic and lumbar spine. At all levels of education there were statistically significant differences in feelings of pain between "before" and "now".

Key words: Back pain, Ballet

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INTRODUCTION

Spine disorders affect various sections of the spine and have a variety of causes[1, 2)]. Most back pain occurs in the lumbo-sacral and cervical regions of the spine. Low back pain is defined as pain localized between the ribs and the gluteal folds, with or without symptoms in a lower limb. Pain in the upper part of the spine usually means pain in the cervical spine and upper thorax, with or without syndrome in an upper limb[3)]. Back pain is divided into two groups that differ in pathogenesis and in therapeutic procedure. The first group consists of specific pain in the spine. It is caused by a specific disease of the motor system or injury due to external causes. The second group consists of non-specific low back pain which does not have a specific cause and may be caused by musculoskeletal disorders or injury due to other reasons. Non-specific low back pain occurs in 90% of people who suffer from back pain[4)]. According to the duration of the pain, back pain is divided into acute—up to six weeks, subacute—from 6 to 12 weeks, and chronic—lasting more than 12 weeks[5)]. The International Association for the Study of Pain states that chronic pain is a condition lasting more than three months[6)]. The frequency of pain increases with age[7)]. The occurrence of pain in the cervical and lumbar spine in children and adolescents is influenced by: anthropometric, lifestyle, mechanical strain on the back, psychological, social and behavioral factors[7, 8)]. Dance learning is associated with physical effort. High levels of physical activity can lead to back pain[6–9)]. Pain in the lumbar spine is most frequently associated with sports activities such as judo, golf, rugby, basketball, baseball, soccer, athletics and volleyball[9)]. Pain also experienced by ballet learners[9)]. Pain warns the body from harmful activities and dysfunctions. Pain causes a change in the muscle tension of particular muscle groups, contributes to changes in body shape, disturbs motor control and causes abnormal motion patterns[10, 11)]. Taking into consideration the universality of the back pain problem in children and adolescents we decided to check if symptoms occur in children and young people studying in primary, junior high and high schools of ballet.

SUBJECTS AND METHODS

The predetermined objectives of this research were to assess in which segments of spine pain arises most frequently "before" and "now" and to investigate whether there was a statistically significant difference in the range of pain sensation between "before" and "now". Our hypothesis was that the feeling of back pain is weaker "now" than "before" at particular levels of education (primary school level, junior high school and high school).

The subjects were 237 children and young people learn-

*Corresponding author. Małgorzata Wójcik (E-mail: malgo_wojcik@interia.pl)

Table 1. Number of students reporting pain "before" and "now" in different sections of the spine at the primary, junior high, and high school levels

	C "before"	Th "before"	L "before"	C "now"	Th "now"	L "now"	Numer of pupils
Primary school level	14	6	15	12	2	10	80
Junior high school level	19	9	31	7	5	15	93
High school level	20	10	41	7	5	30	64
Number of people	53	25	87	26	12	55	237

C: cervical spine, Th: thoracic spine, L: lumbar spine

Table 2. The percentages of students at the primary, junior high, and high school levels reporting pain both "before" and "now"

	Primary school level			Junior high school level			High school level		
	C	Th	L	C	Th	L	C	Th	L
A	80.00%	33.33%	66.67%	40.00%	55.56%	59.38%	35.00%	45.45%	75.61%
B	20.00%	66.67%	33.33%	60.00%	44.44%	40.63%	65.00%	54.55%	24.39%

A: % of people declaring pain "now" to declaring pain "before", B: percentage % of people reporting fewer pain sensations "now" than "before", C: cervical spine, Th: thoracic spine, L: lumbar spine

ing in ballet schools in Gdańsk and Łódź in Poland. Eighty children were examined from two primary ballet schools. The average age of the respondents at this school level was 11.24±0.77 years (mean ± standard deviation), and their time of study in ballet school was 2.14 ± 0.74 years. Ninety-three junior high school students were included in this research. Their average age was 14.01± 0.84 years, and their mean time of study in ballet schools was 4.64±1.24 years. At the high school level 64 students were included in this research. Their average age was 17.01±0.77 years, and their mean time of study in ballet school was 7.47±1.54 years.

A numeric rating scale (NRS) was used to determine the sense of pain in the cervical, thoracic and lumbar spine[12]. Students were asked to point to the level of pain on the day of research "now" using a numerical scale for cervical, thoracic and lumbar spine pain, (mark in red), and then to mark the feeling of pain for each section of the spine at any time during school attendance, "before" (check in green). The assessment of pain using the NRS was performed once. For analyzing the result, the reported of pain feelings was only taken into account in terms of "before" and "now" for the various sections of the spine. The children and young people did not report the occurrence of musculoskeletal injuries and did not report pain as meningeal or radicular. The feelings of back pain were analyzed using, percentage assessment, point statistics and statistical tests to compare the groups. The results were statistically analyzed using the statistical package R[13]. This research was carried out with the permission of the Local Bioethics Committee of Poznan University of Medical Sciences, and after receiving the consent of the subjects' parents or guardians.

RESULTS

Among the 80 children at primary level, 14 students reported pain in the cervical spine, 6 in the thoracic spine and 15 in the lumbar part of the spine. Regarding pain "now", 12 children declared feelings of back pain in the cervical spine, and 10 declared pain in the thoracic and lumbar regions of the spine (Table 1). At the junior high level, among the 93 tested students, 19 reported "before" pain in the cervical spine, 9 in the thoracic spine and 31 in the lumbar section of spine. Regarding pain "now", 7 students reported pain in the cervical spine, 5 in thoracic spine and 15 in the lumbar part of the spine. At the high school level, among the students 64, 20 reported pain "before" in the cervical spine, 10 in thoracic spine, and 41 in the lumbar spine. Regarding pain "now" 7 students reported pain in the cervical spine, five in the thoracic segment, and 30 in the lumbar part of the spine.

The assessment of pain at the primary, junior high and high school levels showed that reported pain occurred in a smaller number of respondents "now" rather than "before" in each part of the spine. Considering the occurrence of pain in each section of spine for the whole group of students, it should be noted that 53 pupils reported pain "before" in the cervical spine but only 26 respondents "now". In the thoracic spine 25 students felt pain in the lumbar spine "before" but only 12 students reported pain "now". Eighty-seven pupils reported pain in the lumbar spine "before", but only 55 students reported pain "now" (Table 1). However, it should be pointed that the most reported location of feelings of pain was the lumbar spine both "before" and "now". It can be seen that for learners at the primary level, pain sensations were reduced in different sections of the spine. In the cervical spine pain, it was reduced by 20%, in the thoracic spine by 66.67%, and in the lumbar section of the spine by 33.33% (Table 2).

Reduced pain sensations were also reported among junior high school students. For the low-cervical spine segment, pain decreased by 60.00%, in the thoracic spine by 44.44%, and in the lumbar spine by 40.63% (Table 2).

Respondents at the high school level, students also reported a reduction in pain: in the cervical part by 65.00%, in the thoracic spine by 54.55%, and in the lumbar spine by

Table 3. Basic results of the primary, junior high, and high school level students

	PRIMARY		MIDDLE		HIGH	
	"before" pain	"now" pain	"before" pain	"now" pain	"before" pain	"now" pain
Min.	0.00	0.00	0.00	0.00	0.00	0.00
1st Qu	0.00	0.00	0.00	0.00	1.00	0.00
Median	0.00	0.00	1.00	0.00	1.00	1.00
Mean	0.45	0.30	0.66	0.34	1.13	0.67
3rd Qu	1.00	1.00	1.00	1.00	2.00	1.00
Max.	2.00	2.00	3.00	2.00	3.00	2.00

24.39% (Table 2).

The basic characteristics of the primary, junior high and high school students are shown in Table 3.

At the primary level all the results are the same for pain feeling "now", and "before" with the exception of the mean. The mean value for feeling pain "before" is 0.45 and that for "now" is 0.30 (Table 3).

For the junior high school level, the minimum, 1st and 3rd quartile values of pain are the same for "before" and "now". However, the median value for the feelings of pain "before" is 1.00 and that of "now" is 0.00. The values for the mean of "before" and "now" are different: the value of 0.66 for "before" is bigger than the mean of "now", 0.34 (Table 3). Also the maximum value for "before"=3.00, is bigger than the maximum value of "now"=2.00.

All values for "before" are bigger than "now", except for the minimum (0.00) and median (1.00). The 1st quartile value of "before" is 1.00, and that of "now" is 0.00. The mean value of "now" is 1.13, and that of "before" is 0.67. The 3rd quartile value of "before" is 2.00, and that of "now" is 1.00. The maximum value of "before" is 3.00 and that of "now" is 2.00 (Table 3). Subsequently whether there were significant differences between pains "before" and "now" among the tested groups at the three education levels was determined.

Since the p values of the paired t-test for the primary, junior high and high school levels are less than 0.05, there are a statistically significant differences in pain sensation between "before" and "now". Moreover, the p value of the t-test between the primary and junior high school ballet students is 0.5926, the p value of the t-test between the primary and high school ballet students is 0.0004, and the p value of t-test between the junior high ballet school and high ballet school is equal 0.0015.

DISCUSSION

Our research confirmed the hypothesis feelings of back pain "now" are weaker than "before" at the various levels of education (Table 1). perhaps the reason for was the time of the survey (it was conducted at the beginning of the school year—September 2012). the assessments of pain expressed as percentages for each of the levels of education and the various sections of the spinal column show a reduction of pain between "before" and "now" (Table 2). the values of the basic characteristics are different at primary level for the mean values (Table 3), at the secondary level for the median, mean and maximum values (Table 3), and at the high school level for the values for the mean, 3rd quartile and maximum (Table 3). in the comparison of the results for all levels of teaching only the mean is different between "before" and "now" (Table 2).

The p value of the t-test between the primary and junior high school ballet isn't significant different (0.5926), the p value of the t-test between the primary and high school ballet is significant different (0.0004), and the p value of the t-test between the junior high and high school ballet is also significantly different (0.0015).

Sports activities and, a high level of physical activity affects low back pain occurrence[7, 9, 14]. Wedderkopp and co-authors did not find a relationship between the level of physical activity and back pain presence[15]. Low back pain is more common among females than males[6, 9]. However, in ballet low back pain is more often seen in boys and men. It is related to their requirement to lift and hold female dancers of the ground[16]. Previously conducted studies indicate that ballet, as a form of physical activity, causes low back pain[9]. Poor core stability is, perhaps, a predisposing factor for injuries to the lower limbs and lumbar spine in dancers, due to poor stabilization of the lumbo-pelvic complex[17]. Studies show that segmental muscle stabilization training as part of a core stability program decreased low back pain[18]. Yang and co-authors point out that the main cause of pain in the lumbar spine is abnormal function of the core muscles in this segment[19]. Headache, stomach pain and sleeping trouble can have a strong influence on the occurrence of back pain in children[20–23]. The occurrence of low back pain may also be affected by the short height of a child. Shorter children report more psychosocial problems in group relationships, which may predispose them to pain occurrence[14]. Pain is also a factor that limits function. The musculoskeletal system is connected by a wide system of sensory nerves. Sensory receptors are associated with fast-conductive fibers, Aβ, which are stimulated by harmless stimuli. According to the results of research and observation, daily stimuli which stimulate sensitized nociceptive nerve paths are causes of pain. Nociceptors exhibit, like nerve cells, the phenomenon of adaptability, which is associated with peripheral sensitization in the formation of muscle-skeletal pain conditions. Peripheral and spinal mechanisms are responsible for formation of pain feeling[24]. However, it has been shown in the assessment of pain formation that psychological and social

factors are the most important elements that help to predict the presence of pain and the degree of its severity[24]. Pain in muscles caused by exercise is short and provoked by impaired blood flow to working muscles[25]. It is possible that pain felt in the cervical, thoracic and lumbar spine reported by the respondents was associated with a weakening of the stabilizing muscles[26–28]. Davarian and colleagues have shown that there is a correlation between the intensity of pain and disability[29].

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REFERENCES

1) Burton AK, Balagué F, Cardon G, et al. COST B13 Working Group on Guidelines for Prevention in Low Back Pain: Chapter 2. European guidelines for prevention in low back pain : November 2004. Eur Spine J, 2006, 15: S136–S168. [Medline] [CrossRef]
2) Walker BF: The prevalence of low back pain: a systematic review of the literature from 1966 to 1998. J Spinal Disord, 2000, 13: 205–217. [Medline] [CrossRef]
3) Skillgate E: Back and neck pain. Epidemiological studies on some risk factors and treatments, including Naprapathic manual therapy. Stockholm: Karolinska Institutet, 2007, pp 2–6.
4) Assendelft WJ, Morton SC, Yu EI, et al.: Spinal manipulative therapy for low back pain. A meta-analysis of effectiveness relative to other therapies. Ann Intern Med, 2003, 138: 871–881. [Medline] [CrossRef]
5) van Tulder M, Furlan A, Bombardier C, et al. Editorial Board of the Cochrane Collaboration Back Review Group: Updated method guidelines for systematic reviews in the cochrane collaboration back review group. Spine, 2003, 28: 1290–1299. [Medline] [CrossRef]
6) King S, Chambers CT, Huguet A, et al.: The epidemiology of chronic pain in children and adolescents revisited: a systematic review. Pain, 2011, 152: 2729–2738. [Medline] [CrossRef]
7) Jones GT, Macfarlane GJ: Epidemiology of low back pain in children and adolescents. Arch Dis Child, 2005, 90: 312–316. [Medline] [CrossRef]
8) Iqbal ZA, Rajan R, Khan SA, et al.: Effect of deep cervical flexor muscles training using pressure biofeedback on pain and disability of school teachers with neck pain. J Phys Ther Sci, 2013, 25: 657–661. [Medline] [CrossRef]
9) Sato T, Ito T, Hirano T, et al.: Low back pain in childhood and adolescence: assessment of sports activities. Eur Spine J, 2011, 20: 94–99. [Medline] [CrossRef]
10) Hodges PW, Richardson CA: Contraction of the abdominal muscles associated with movement of the lower limb. Phys Ther, 1997, 77: 132–142, discussion 142–144. [Medline]
11) Hodges PW: Changes in motor planning of feed forward postural responses of the trunk muscles in low back pain. Exp Brain Res, 2001, 141: 261–266. [CrossRef]
12) Cepuch G, Wordliczek J, Golec A: Selected scales for pain intensity examination in adolescents-assessment of their usefulness. Adv Palliat Med, 2006, 5: 108–113.
13) R Development Core Team: A language and environment for statistical computing. R Foundation for Statistical Computing. Vienna. Austria 2009. http://www. r-project.org (Accessed Sep. 11, 2014)
14) Jones GT, Macfarlane GJ: Predicting persistent low back pain in schoolchildren: a prospective cohort study. Arthritis Rheum, 2009, 61: 1359–1366. [Medline] [CrossRef]
15) Wedderkopp N, Leboeuf-Yde C, Bo Andersen L, et al.: Back pain in children: no association with objectively measured level of physical activity. Spine, 2003, 28: 2019–2024, discussion 2024. [Medline] [CrossRef]
16) Wightman SE: Lumbosacral injuries in classical ballet dancers: a review of the literature. University of Tennessee at Chattanooga, 2005, pp 1,2,5.
17) Rickman AM, Ambegaonkar JP, Cortes N: Core stability: implications for dance injuries. Med Probl Perform Art, 2012, 27: 159–164. [Medline]
18) Wójcik M, Siatkowski I: Application of core stability concept for reduction in weak connections of boikinetics chain in hockey players-preliminary report. Polish J Sport Med, 2012, 28: 75–82. [CrossRef]
19) Jang SH, Lee JH, Bang HS: The effect of trunk control exercises performed on unstable surfaces on the spinal stability of low back pain patients. J Phys Ther Sci, 2013, 25: 459–462. [CrossRef]
20) Balagué F, Skovron ML, Nordin M, et al.: Low back pain in schoolchildren. A study of familial and psychological factors. Spine, 1995, 20: 1265–1270. [Medline]
21) Jones GT, Watson KD, Silman AJ, et al.: Predictors of low back pain in British schoolchildren: a population-based prospective cohort study. Pediatrics, 2003, 111: 822–828. [Medline] [CrossRef]
22) Brattberg G: The incidence of back pain and headache among Swedish school children. Qual Life Res, 1994, 3: S27–S31. [Medline] [CrossRef]
23) Mikkelsson M, Sourander A, Piha J, et al.: Psychiatric symptoms in preadolescents with musculoskeletal pain and fibromyalgia. Pediatrics, 1997, 100: 220–227. [Medline] [CrossRef]
24) Bruce LK: Pain mechanisms in musculoskeletal disease. Pain, 2005, pp 349–354.
25) Arendt-Nielsen L, Graven-Nielsen T: Assessing muscle pain mechanisms in humans. Pain, 2005, pp 355–365.
26) Jull GA, O'Leary SP, Falla DL: Clinical assessment of the deep cervical flexor muscles: the craniocervical flexion test. J Manipulative Physiol Ther, 2008, 31: 525–533. [Medline] [CrossRef]
27) Panjabi M, Abumi K, Duranceau J, et al.: Spinal stability and intersegmental muscle forces. A biomechanical model. Spine, 1989, 14: 194–200. [Medline] [CrossRef]
28) Cresswell AG, Oddsson L, Thorstensson A: The influence of sudden perturbations on trunk muscle activity and intra-abdominal pressure while standing. Exp Brain Res, 1994, 98: 336–341. [Medline] [CrossRef]
29) Davarian S, Maroufi N, Ebrahimi I, et al.: Trunk muscles strength and endurance in chronic low back pain patients with and without clinical instability. J Back Musculoskeletal Rehabil, 2012, 25: 123–129. [Medline]