

# Characteristics of back pain in Polish youth depending on place of residence

Jacek Lewandowski<sup>1</sup>, Kornelia Łukaszewska<sup>2</sup>

<sup>1</sup> University School of Physical Education in Poznań, Chair of Motor System Rehabilitation, Department of Motor System Rehabilitation, Poznan, Poland

Lewandowski J, Łukaszewska K. Characteristics of back pain in Polish youth depending on place of residence. *Ann Agric Environ Med.* 2014; 21(3): 644–648. doi: 10.5604/12321966.1120618

## Abstract

**Introduction and objective.** Spinal pain (SP) has become a very common problem in contemporary societies and occurs in adults, youths, and even children. The aim of the study was to determine whether the prevalence and characteristics of SP, as well as the determinants leading to SP in Polish youths, vary depending on the place of residence. The determinants considered were out-of-school physical activity (PA) and physical work (PW), time spent at a computer and TV, and the level of psychosocial development expressed as the level of anxiety-trait. The restricting effect of the experienced SP on everyday functioning of youths was also analysed.

**Materials and method.** A cross-sectional, population-based study comprising 502 village residents (VR) and 1,593 city residents (CR) aged 13–19, residing in 3 random Polish provinces. The tools used were a custom-designed survey and the *State-Trait Anxiety Inventory* (STAI) filled by students during classes.

**Results.** The frequency and localisation of SP, the time and circumstances in which SP episodes occur, as well as the influence of the pain on everyday functioning, are the same in youths living in villages and youths living in cities. Slight differences in the correlation between the prevalence of SP and determinants of SP development related to lifestyle depending on the place of residence were observed. However, in both VR and CR the occurrence of SP is significantly correlated negatively with the level of psychosocial development.

**Conclusions.** At present, the conditions of living in a rural and in an urban environment in Poland pose no specific threat determining the occurrence of SP in youths, and increasing the negative effect of the pain on the functioning of youths.

## Key words

adolescent, spinal pain, back pain, epidemiology, anxiety, rural population

## INTRODUCTION

As suggested by numerous studies, spinal pain (SP) is a common and very expensive problem of contemporary societies [1, 2]. Epidemiological data indicate that as many as 84% of adults will experience low back pain (LBP) in their lives, 31% will experience upper back pain (UBP), and 71% will experience neck pain (NP) [3, 4, 5]. In children and youths, the estimated maximum values of the lifetime prevalence of LBP, UBP, and NP are 72%, 19%, and 28%, respectively [2, 4].

The 'SP epidemic' is explained as the effect of numerous physical and mental factors resulting from the civilisation changes of the environment we function in (e.g. wheeled transport, moving on even and hard surfaces, doing most activities in static positions, high level of stress and lifestyle) [4, 6]. Risk factors of SP in youths include: too frequent out-of-school physical activity (PA), doing physical work (PW), free time spent in the seated position in front of a computer or TV, and emotional disorders together with behavioural problems [6–10]. It must be noted, however, that the literature includes many reports, often contradictory, related to determining risk factors of SP in youths [2, 6].

To date, it has not been checked whether the demographic variable, i.e. place of residence and environmental conditions related with it, can affect the occurrence and characteristics

(localisation and frequency) of AP, as well as the level of negative functional consequences of SP in youths. It is not known either whether the environment of residence modifies the level of effect of mechanical and psychosocial factors on SP occurrence in youths. Thus, a plan evolved to check how these parameters in youths living in the country (village residents – VR) and youths living in urban agglomerations (city residents – CR). The aim of the research was comparing youths inhabiting villages and cities regarding:

1. lifetime prevalence of SP and 1-month prevalence of disabling SP;
2. most frequent localisation of SP;
3. frequency of SP (single episodes vs. recurring pain);
4. circumstances in which SP occurred;
5. age at which first episodes of SP occur most often;
6. consulting pain with specialists (physicians or physiotherapists);
7. functional consequences of SP, including abandoning school activities due to SP;
8. effect of factors related to lifestyle on the prevalence and frequency of SP:
  - mechanical strain of the locomotor system in free time (out-of-school PA and PW);
  - taking the seated position in free time (average time spent daily at a computer and in front of a TV);
9. influence of psychosocial development (expressed as the level of anxiety-trait) on the prevalence and frequency of SP [11].

Address for correspondence: Jacek Lewandowski, University School of Physical Education in Poznań, Chair of Motor System Rehabilitation, Department of Motor System Rehabilitation, Poznan, Poland  
e-mail: j.a.lewandowski@wp.pl

Received: 09 July 2013; accepted: 12 November 2013

## MATERIALS AND METHOD

The study was cross-sectional, population-based. The study group was chosen in multistage randomisation [12]. The first stage of randomisation was specifying 3 provinces in Poland (Kujawsko-Pomorskie, Wielkopolskie, and Świętokrzyskie) in which technical schools, high schools, and junior high schools were randomised in the second stage. In the next stage, classes of students directly participating in the study were randomised. The inclusion criteria were the age of 13–19, providing all personal data, and filling in the survey in a coherent way, which was met by 2,676 students (75% of all tested persons). Based on the information included in the personal data sheet, 502 village residents (VR) and 1,593 city residents, i.e. agglomerations of over 50,000 residents, (CR) were specified. The detailed structure of gender and age of the study subjects are presented in Table 1.

**Table 1.** Gender and age structure of subjects according to place of residence

	VR	CR	Total
N	502	1593	2676
Girls %	41%	48%	46%
Boys %	59%	52%	54%
Age range	13–19	13–19	13–19
Mean age	16.5 (SD=1.5)	16.5 (SD=1.5)	16.5 (SD=1.5)

The study used 2 research tools: a 2-part custom survey and the test *Inwentarz Stanu i Cechy Lęku* (ISCL) by C.D. Spielberger, J. Strelau, M. Tysarczyk, and K. Wrześniewski [13], which is a Polish adaptation of the American test *State-Trait Anxiety Inventory*<sup>1</sup> (STAI) [14].

The study was carried out by surveyors equipped with a standardised instruction. Each student filled in the ISCL and the first part of the survey individually and anonymously. The second part of the survey was filled in only by subjects experiencing SP. The reliability of the research procedure was verified by carrying out the test twice on the same group of 32 students, with an interval of one month. No statistically significant differences were found between the results obtained in the 2 tests.

The template of the custom survey is attached. On this basis the prevalence, characteristics, and circumstances of occurrence of SP were assessed, as well as the functional consequences of the occurrence of SP and the determinants related to lifestyle correlating with SP occurrence in the studied populations. In the ISCL tool, regarding anxiety-trait (the results of which were used for analysis in this study), the subjects assessed 20 statements about the usual condition of the subject. The point value given to answers were next summed-up according to the key [13]. A study subject can obtain 20–80 pts, with high point value representing a high level of anxiety-trait.

STATISTICA 9.0 software was used for statistical calculations; depending on the type of variables, Pearson's chi-squared test ( $\chi^2$ ), the Kruskal-Wallis test (KW) and the analysis of variance (ANOVA) were used for analysis. The value  $p \leq 0.05$  was assumed as the significance threshold.

1. Use of the ISCL in the study was thanks to the consent of the first author and to cooperation with the Department of Psychology at the Academy of Physical Education in Poznań, as its employees participated in setting the study methodology and interpretation of the results.

## RESULTS

The obtained data indicates that 61% ( $n=306$ ) of the studied youths living in the villages have experienced SP in their lives and only 39% ( $n=196$ ) have never experienced pain in this region (Tab. 3). 14% of VR ( $n=71$ ) have experienced only one episode of pain in the spine, while in 47% ( $n=235$ ) SP is a recurring problem. More precisely, 27% of VR experience SP several times a year, 13% experience it several times a month, and in 6% SP occurs several times a week. Similar values were also obtained in the CR group (differences were not statistically significant –  $\chi^2$ ).

In the VR group, 7% ( $n=34$ ) of subjects declared that during the month before the study they experienced a very onerous SP preventing the performance of everyday activities. This proportion was significantly lower than in the CR group (7% vs. 11%).

In the light of the results obtained, the most frequent localisation of SP in VR youth is the lumbosacral spine; low back pain (LBP) was reported by 39% ( $n=195$ ) of subjects. In 6% ( $n=28$ ) of VR, low back pain was accompanied by irradiation of pain to the lower limbs (LBP+). 16% ( $n=78$ ) of VR experienced pain in the thoracic spine (upper back pain – UBP), and 14% ( $n=69$ ) experienced neck pain (NP). In all cases, the place of residence did not affect the prevalence of pain in any segment of the spine (differences were not statistically significant –  $\chi^2$ ). Independently from the place of residence, 18% of subjects with SP (from both the VR and CR groups) decided to see a specialist, which means that considering the entire study group, 1 in 10 students had to consult medical staff due to SP.

The activities most often causing SP in youths were intensive physical effort and the sitting position; 14% and 16% of VR and 18% and 14% of CR, respectively, admitted that these were the basic generators of pain. The observed differences were not statistically significant ( $\chi^2$ ), hence the circumstances generating SP in youths do not vary depending on the place of residence. The time of occurrence of the first episodes of SP in youths is also not correlated with the place of residence (KW). The data indicate that for 50% of observations SP occurred for the first time between the ages of 13–15 (mean age = 14; SD=2.26).

In nearly all subjects with SP living in the country and in the city, the occurrence of SP caused a limitation in performing at least one of the everyday activities listed in the questionnaire. Such problems were reported by 302 VR and 1,019 CR, which constituted 60% of all VRs and 64% of all CRs. Analysis of the effect of SP on the performance of everyday activities is presented in Table 2, which indicates that the limitation of PA is the most problematic consequence of SP episodes in youths. 7% of VRs and 9% of CRs were completely unable to perform PA due to SP and for 1 in 4 VR and CR students performing PA it was more difficult than usual. Significant limitations caused by SP can be also observed in the ability to lift objects, remaining in the sitting position and, most importantly in this age group, the ability to concentrate and study. Independently from the place of residence, nearly 1 in 20 subjects reported they could not sit or study due to SP, and for 1 in 5 persons these activities were limited due to SP. Moreover, data also indicate that 3% ( $n=16$ ) of VRs and 6% ( $n=93$ ) of CRs had to skip classes due to SP. Both VR and CR youths reported more negative functional consequences when SP was more serious: more

**Table 2.** Impact of SP on daily life activities

	Lifting		Standing position		Sitting position		Walking		Dressing		Physical activity		Concentration and learning	
	Limited	Impossible	Limited	Impossible	Limited	Impossible	Limited	Impossible	Limited	Impossible	Limited	Impossible	Limited	Impossible
VR (n=502)	26% (130)	3% (17)	18% (89)	4% (20)	20% (100)	5% (27)	13% (65)	1% (6)	14% (70)	2% (10)	25% (125)	7% (35)	17% (86)	6% (32)
CR (n=1593)	24% (383)	5% (79)	21% (338)	4% (63)	21% (341)	4% (70)	17% (269)	2% (38)	12% (191)	3% (43)	26% (409)	9% (137)	19% (299)	5% (80)
Pearson's chi-square test	p=0.624		p=0.328		p=0.814		p=0.304		p=0.476		p=0.906		p=0.729	

frequent, occurring in several localisations at a time, and the first SP episode occurred at a younger age.

The study did not give a clear answer to the question about the significance of mechanical strain of the locomotor system during free time as a determinant of SP development in youths (Tab. 3). It was observed that in the VR group the proportion of youths with a single episode of SP increases, and the proportion of youths with recurring SP (several times a month or a year) decreases with the increase of taking up PA. A reverse tendency is seen in CR youths: in persons often taking up PA the proportion of subjects with SP recurring several times a week is significantly higher, while the proportion of subjects with a single SP episode is smaller. These observations were statistically significant only in the CR group ( $\chi^2$ ). At the same time, further analyses showed that in both VR and CR youths taking up PA more often, the proportion of youths who have experienced SP during intensive physical effort increased, and the proportion of youths who have experienced SP due to circumstances other than PA decreased. These relationships were statistically significant in both the VR and CR group ( $\chi^2$ ).

With increasing time spent on PA, the proportion of youths with no SP decreased. In the group of VRs often taking up PA, the proportion of youths with SP was significantly higher, both for a single episode and recurring SP, and in all localisations of SP: LBP, LBP+, UBP, and NP. In the case of CR youths, the proportion of persons experiencing recurring SP increased and the proportion of persons with a single episode of SP decreased with the increasing frequency of PW; unlike in the VR group, this involved mainly LBP. Analysis of the circumstances of SP occurring in youths independently from the frequency of PW indicated that frequent PW increased the proportion of youths in whom SP appeared during intensive physical effort or during lifting an object. These observations were statistically significant in the CR group, while in the VR group such relationships occurred but were not statistically significant ( $\chi^2$ ).

The study did not show a positive correlation between free time youths spent on activities carried out in the sitting position (watching TV, computer) and the frequency of SP (Tab. 4). In the case of CR youths, the more often subjects experienced AP, the less time a week they spent on watching

**Table 3.** Prevalence and occurrence of SP depending on taking up out-of-school PA and PW

		No SP	One SP episode in life	Several episodes of SP a year	Several episodes of SP a month	Several episodes of SP a week	p (Pearson's chi-square test)
Village residents	Total VRs	39% (196)	14% (71)	27% (138)	13% (67)	6% (30)	-
	No additional PA (n = 71)	39% (28)	7% (5)	27% (19)	18% (13)	8% (6)	0.567
	Additional PA above 4h/week (n = 111)	41% (45)	18% (20)	28% (31)	9% (10)	5% (5)	
	No PW (n = 56)	57% (32)	9% (5)	20% (11)	11% (6)	4% (2)	0.832
	PW done very frequently (n = 45)	27% (12)	22% (10)	27% (12)	18% (8)	7% (3)	
City residents	Total CRs	34% (541)	17% (273)	29% (457)	14% (225)	6% (97)	-
	No additional PA (n = 220)	35% (76)	20% (43)	26% (58)	16% (36)	3% (7)	0.021
	Additional PA above 4h/week (n = 393)	38% (149)	12% (49)	28% (110)	16% (62)	6% (23)	
	No PW (n = 286)	39% (111)	20% (57)	23% (65)	13% (38)	5% (15)	0.052
	PW done very frequently (n = 120)	33% (39)	17% (20)	23% (28)	14% (17)	13% (16)	

**Table 4.** Mean time spent watching TV or using a computer and mean level of anxiety-trait depending on prevalence and frequency of SP

		No SP	One SP episode in life	Several episodes of SP a year	Several episodes of SP a month	Several episodes of SP a week	ANOVA
Village residents	TV	1.9	1.5	1.4	1.5	2.0	0.016
	Computer	2.2	2.4	2.5	2.3	2.4	0.751
	Anxiety-trait	38	40	43	43	48	< 0.001
City residents	TV	1.9	1.9	1.6	1.6	1.5	0.006
	Computer	2.9	2.9	2.8	2.7	2.6	0.555
	Anxiety-trait	38	41	43	43	44	< 0.001

TV or activities with the use of a computer, on average. VR subjects with SP recurring several times a week, on average, spent a similar amount of time during the day watching TV or using a computer as subjects who have never experienced SP.

On the other hand, the prevalence and frequency of SP in youths is clearly correlated with the level of psychosocial development expressed as the level of anxiety-trait. More frequent SP is found in persons with a higher level of anxiety-trait. This tendency is particularly visible in the VR group.

## DISCUSSION

The presented study showed no effect of the place of residence (village/city) on the prevalence of SP in youths. The frequency and localisation of SP, the time and circumstances in which SP episodes occur, as well as the influence of the pain on everyday functioning, are the same in youths living in villages and youths living in cities. This can mean that presently in Poland the lifestyle of young village residents is comparable to the style observed in cities, and the living conditions pose no specific risks determining the prevalence of SP in youths. This can be related to the advances in technology used in agriculture and the respectively lesser physical load of 'country children'. At the same time, many rural areas have become suburban satellites with modern building and infrastructure, where residents commute to cities for work (often even several dozen kilometres away). These 2 phenomena diminish differences between the residents of villages and cities.

According to the presented study, in the CR group the proportion of youths with recurring SP increased with the increase in time spent on additional PA, while the proportion of subjects with a single SP episode decreased. In the case of VR youths, the relationships were reversed: in active persons the proportion of those who experienced a single episode of SP was higher, while the proportion of persons with recurring SP was lower. It may be that for VRs additional PA has better preventive effect against chronic SP in comparison with CRs. On the other hand, CR youths had better access to sports clubs and professional sports infrastructure; therefore, the PA they take up may be in the form of competitive sports more often, which leads to excessive strain of the locomotor system and generating chronic spinal pain. Meanwhile, the literature informs that taking up sports activities and participating in sports competitions increases the risk of NP, UBP, and LBP in youths [7].

The results of this study suggest that frequent PA can increase the risk of SP, but only SP occurring in the circumstances of intensive physical effort. At the same time, frequent PA should be treated as a preventive activity against SP in youths in circumstances other than sports activities [15]. It is worth noting that earlier study results indicate that a high level of PA in childhood was a preventive factor protecting against SP during adolescence [16]. However, if PA is to help youths instead of harming them, regular information campaigns on the topic should be organised, particularly in cities.

Both for VRs and CRs, frequent PW was related to a higher probability of recurring SP, and although this relationship was not statistically significant, this tendency seems especially clear (especially for VRs) and is confirmed in the literature [8, 17]. Frequent PW may generate physical strain in

youths, especially if they use incorrect movement stereotypes resulting from lacking knowledge on the ergonomics of work. On the other hand, the need to work after school can be a significant mental strain for youths which, in connection with insufficient rest, leads directly to recurring SP.

The common opinion is that one of the main factors directly causing SP in youths is time spent in the sitting position, especially at a computer and in front of a TV [9]. In fact, the presented study shows that, on average, youths with recurring SP do not spend more time in front of a TV or at a computer than subjects who have never experienced SP. Moreover, in some cases, youths with recurring SP spend even less time, on average, watching TV or using a computer than youths with no SP. This would confirm reports negating any effect of the time spent in front of a TV or at a computer on the prevalence of SP [8, 10, 17]. Hypothetically, it can be assumed that youths experiencing recurring SP consciously reduce watching TV to do other things not treated as a risk factor for the recurrence of spinal pain. On the other hand, with so many hours spent in the sitting position (during classes, commute, etc.) and the general hypokinesia of youths, the time spent in front of a TV or at a computer may be marginally significant in the process of SP development. This issue can be clarified only in prospective cohort studies.

Studies suggest that the level of psychosocial development expressed as the level of anxiety-trait can be a very significant determinant of AP development. Although such a relationship has never been proved, the presented results confirm earlier reports [8, 10, 18]. The literature indicates that youths with poor relations with peers and parents (which derives from incorrect psychosocial development) experience SP significantly more often: the domination of negative relations increases the risk of SP, while the domination of positive relations reduces this risk [7, 18]. It was also found that youths not living with both parents experience SP significantly more often than youths whose parents live together [10].

Unfortunately, the methodology of the study (cross-sectional) does not allow the drawing of clear conclusions regarding the direction and type of the relationship between the level of anxiety-trait and the prevalence and type of SP in youths, or whether it is constant or transient. An analysis of the literature provides more premises to conclude that most probably the increased level of psychosocial disorders causes the earlier occurrence of musculoskeletal problems, not vice versa. It was demonstrated in experimental conditions that an increased level of anxiety-trait and anxiety-state are directly related to low thresholds of perception and pain tolerance [19, 20]. Subjects with a higher level of anxiety-trait had much lower tolerance to pain even when their attention was diverted from the pain stimulus [20]. Moreover, in subjects with a high level of psychogenic stress, found also in patients with an increased level of anxiety-trait, the strain on the spine is increased and additional shearing forces appear [21]. The listed phenomena can reduce the mechanical strength of the locomotor system, which will increase the probability of SP development.

It should be noted that in the VR group, persons experiencing recurring SP, on average, had a higher level of anxiety-trait compared to CR youths. This is consistent with study results showing that the level of anxiety-trait is strongly related to environmental conditions and youths living in the country are much more likely to have an increased level of anxiety-trait compared to youths living in urban areas [22]. This

may be related to the fact that youths living in the country more often go to schools located in towns or cities, which causes many stresses and difficulties in achieving acceptance from their peers. It may be that these youths set idealised identification models, and due to constant comparison and uncertainty, the level of anxiety-trait increases [11]. This issue requires more detailed study.

## CONCLUSIONS

The prevalence and characteristics of SP (localisation, frequency, and circumstances of occurrence) and the functional consequences of SP in youths are not dependent on the place of residence. This may suggest that the contemporary society of urban and rural areas present no specific conditions determining the occurrence of spinal pain in youths.

The prevalence of spinal pain limits the ability of youths to take up everyday activities, including activities related to functioning in school and forces youths to seek the help of specialists. The village residents are no different in this regard from the city residents.

The coexistence of spinal pain and increased level of anxiety-trait may suggest that spinal pain in youths is psychogenic rather than strain-induced.

Although spinal pain often occurs during sitting, the amount of free time spent in this position (in front of a TV or at a computer) does not determine the occurrence and frequency of spinal pain in youths. Probably, in relation to a series of civilisation conditions (also those that affect the psyche), the amount of time spent in front of a TV or at a computer is marginally significant for the development of spinal pain in youths.

Frequent PA and PW increases the probability of spinal pain during physical effort. Therefore, a modification of the physical education programme are suggested, aimed at familiarising youths with the risk related to participating in sports and physical work, and teaching correct and ergonomic movement habits.

## REFERENCES

1. Meerding WJ, Bonneux L, Polder JJ, Koopmanschap MA, van der Maas PJ. Demographic and epidemiological determinants of healthcare costs in Netherlands: cost of illness study. *BMJ* 1998; 317(7151): 111–115.
2. Jeffries LJ, Milanese SF, Grimmer-Somers KA. Epidemiology of adolescent spinal pain: a systematic overview of the research literature. *Spine* 2007; 32(23): 2630–2637.
3. Loney PSP, Stratford PW. The prevalence of low back pain in adults: A methodological review of the literature. *Phys Ther*. 1999; 79: 384–396.
4. Briggs AM, Smith AJ, Straker LM, Bragge P. Thoracic spine pain in the general population: Prevalence, incidence and associated factors in children, adolescents and adults. A systematic review. *BMC Musculoskeletal Disorders* <http://www.biomedcentral.com/1471-2474/10/77> (access: 2013.07.09).
5. Hogg-Johnson S, Velde G van der, Carroll LJ, Holm LW, Cassidy JD, Guzman J, et al. The burden and determinants of neck pain in the general population. Results of the bone and joint decade 2000–2010 task force on neck pain and its associated disorders. *Spine* 2008; 33: S39–S51.
6. Murphy S, Buckle P, Stubbs D. A cross-sectional study of self-reported back and neck pain among English schoolchildren and associated physical and psychological risk factors. *Appl Ergon*. 2007; 38: 797–804.
7. Kristjansdottir G, Rhee H. Risk factors of back pain frequency in schoolchildren: a search for explanations to a public health problem. *Acta Paediatr*. 2002; 91: 849–854.
8. Watson KD, Papageorgiou AC, Jones GT, Taylor S, Symmons DPM, Silman AJ, Macfarlane GJ. Low back pain in schoolchildren: the role of mechanical and psychosocial factors. *Arch Dis Child*. 2003; 88: 12–17.
9. Sjoli.e. AN. Associations between activities and low back pain in adolescents. *Scand J Med Sci Sports*. 2004; 14: 352–359.
10. Diepenmaat ACM, van der Wal MF, de Vet HCW, Hirasings RA. Neck/Shoulder, Low Back, and Arm Pain in Relation to Computer Use, Physical Activity, Stress, and Depression Among Dutch Adolescents. *Pediatrics* 2006; 117: 412–416.
11. Spielberger CD. Theory and research on anxiety. In: Spielberger CD. *Anxiety and Behavior*. New York, Academic Press, 1966.p.16–17.
12. Jędrychowski W. *Epidemiologia. Wprowadzeni.e. i metody badań*. Wydawnictwo Lekarskie PZWL, Warszawa 1999.p.151–161 (in Polish).
13. Wrześniewski K, Sosnowski T. *Inwentarz Stanu i Cechy Lęku / ISCL/. Polska adaptacja STAI*. Polskie. Towarzystwo Psychologiczne, Warszawa 1987 (in Polish).
14. Spielberger CD, Gorsuch RL, Lushene RE. *Manual for the State-Trait Anxiety Inventory*. Palo Alto, Consulting Psychologists Press, California 1970.
15. Jones MA, Stratton G, Reilly T, Unnithan VB. Recurrent non-specific low-back pain in adolescents: the role of exercise. *Ergonomics* 2007; 50(10): 1680–1688.
16. Wedderkopp N, Kjaer P, Hestbaek L, Korsholm L, Leboeuf-Yde C. High-level physical activity in childhood seems to protect against low back pain in early adolescence. *Spine J*. 2009; 9(2): 134–141.
17. Harreby M, Nygaard B, Jessen T, Larsen E, Storr-Paulsen A, Lindahl A, Fisker I, Lægaard E. Risk factors for low back pain in a cohort of 1389 Danish school children: an epidemiologic study. *Eur Spine J*. 1999; 8: 444–450
18. Balague F, Troussier B, Salminen JJ. Non-specific low back pain in children and adolescents: risk factors. *Eur Spine J*. 1999; 8: 429–438.
19. Carter LE, McNeil DW, Vowles KE, Sorrell JT, Turk CL, Ries BJ, Hopko DR. Effects of emotion on pain reports, tolerance and physiology. *Pain Res Manag*. 2002; 7: 21–30.
20. James JE, Hardardottir D. Influence of attention focus and trait anxiety on tolerance of acute pain. *Brit J Health Psych*. 2002; 7: 149–162.
21. Marras WS, Davis KG, Heaney CA, Maronitis AB, Allread WG. The influence of psychosocial stress, gender, and personality on mechanical loading of the lumbar spine. *Spine* 2000; 25(23): 3045–3054.
22. Fenczyn J. Czynniki środowiskowy a obawy i lęki adolescentów. *Psychiatria Polska* 2003; 37(1): 71–85 (in Polish).