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The Site of Musculoskeletal Pain in School Children with Excessive Body Weight and Obesity in Bosnia and Herzegovina

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ABSTRACT

Introduction: The number of school age children with excessive body weight and perception of musculoskeletal pain is on the rise. **Aim:** The aim of this study is to identify the most common sites of acute and chronic musculoskeletal pain in school children with excessive body weight and obesity. **Methods:** A survey included 1315 children aged 9-14 years from September 2016 to January 2017 in the Primary schools of Canton Tuzla. The weight and height were measured for each subject based on which a body mass index was determined and two groups were categorized: a group of children with excessive BMI and obesity (N = 406), and the remaining respondents were part of the control group. The Nordic questionnaire was utilized to examine places of perception of musculoskeletal pain experienced by children in the preceding 7 days (acute) or preceding 1 year (chronic pain). **Results**: Prevalence of overweight and obesity in school children is 31% (significantly higher in boys than in girls, 38%: 25%). The incidence of acute and chronic pain in children with normal BMI 49% is significantly higher than in excessive BMI 45% or in children with overweight 39.1%. Obesity and overweight are risk factors for the development of nonspecific musculoskeletal pain (OR = 1.161, 95% CI, 1.020-1.322). The most common places for chronic pain associated with overweight and obesity are neck (OR = 1.212, 95% CI, 0.893-1.644) and knee (OR = 1.103, 95% CI, 0.690-1.760). While the most common place of acute pain is knee (OR = 1.127 , 95% CI, 0.673-1.890). **Conclusion:** The relationship between excessive body weight and chronic musculoskeletal pain (MSP) in the neck and knees indicates the cumulative effect of exposure to excessive body weight and obesity in BiH school children.

Keywords: BMI, overweight, obesity, musculoskeletal pain, schoolchildren.

1. INTRODUCTION

Over the past 30 years, obesity in school children has increased by 50% across the world. Obesity is a major public health problem because it represents a potential risk factor for the health and quality of life of a child (1, 2). Chronic pain, obesity, and reduced body function /activity can contribute to the weight gain cycle that affects the quality of life of a child (3). According to a number of previous studies, the BMI (Body Mass Index), which indicates excessive body weight and obesity, is a risk factor for MSP (4-7). There seems to be links between MSP, physical activity and quality of life, and these links could be the key to resolve the problem of musculoskeletal pain in this group of children. Some literary results warn that schoolchildren complaining of chronic MSP have an increased risk for chronic MSP in adulthood (2, 8, 9).

The sites of MSPs in school children with excessive body weight and obesity differ in the research of other authors. In a recent, scientific effort to estimate MSP sites for children and adolescents aged 2 to 19, more frequent MSPs were found in extremely obese children in lower extremities compared to children with normal BMI (10). The chronic MSP of the lower extrinsics was located in the lower part of the back, ankle joints and knees (3, 5-7). Krul found a chronic MSP in the neck in schoolchildren with excessive body weight and obesity (4). Some authors reported on unspecific MSP without pointing to the pain spots (11-13).

2. AIM

The aim of the research is to establish the correlation between overweight and obesity in school children in Bosnia and Herzegovina (BiH), and if overweight BMIs are a risk factor

of developing specific MSP locations in different parts of the body.

3. METHODS

The longitudinal study included cohort school children aged 9-14 years, randomly selected in 13 primary schools from all 13 municipalities in the Tuzla Canton (the most populous canton in BiH with 500,000 inhabitants) in the period from September 2016 to January 2017. The initial sample consisted of 1,500 respondents, out of a total of 24,027 school children aged 9-14 years (16%). Factor for excluding subjects was that they have been diagnosed in their innate or acquired physical deformities and disorders (children using a wheelchair, some children's musculo- and bone disorders have been diagnosed, dysfunctions between the lower extremities, foot problems and the like). The research was approved by the Ethics Committee of the Public Health Institute of Canton Tuzla, Ministry of Education, Science, Culture and Sport of Tuzla Canton and director of all schools.

When designing a final sample of respondents, the principle of voluntaryism and anonymity was fully respected, and the desire to resign from participation in research was acknowledged. The parents of each child involved in the study have signed informational consent. The final sample included 1315 students (652 boys vs. 663 girls = 49.6% vs. 54.4%). During the organization of surveys and anthropometric measurements, a "sample cluster" method was used or random selection of 2-5 single grade students, repeated during 1 school hour (45 minutes, average number of hours 4-5). Of each grade, 20 respondents (> 100 from each primary school x13) were selected.

Before accessing the survey, relevant information was provided to the respondents, explaining the purpose, objectives and importance of the research. The survey was conducted using Nordic questionnaire on symptoms of musculoskeletal pain (translated into Bosnian by two experts) and anthropometric measurement. The Nordic questionnaire on musculoskeletal pain symptoms (NMQ) contains questions about disorders in the musculoskeletal system conceived in 9 bodily regions (14,15). In this study, we selected the questions in 6 locations of pain (neck, shoulders, upper back, lower back, knees, feet / ankles) for 7 days (acute pain) or 1 year (chronic). Responses to be conceived as affirmative - yes or negative - no (14). The validity of the questionnaire relating to 13 MSP-related questions was very satisfactory on our sample (Alpha-Cronbach, $\alpha = 0.854$).

Anthropometric measurements were performed by two trained examiners in all schools each day between 10 AM and 12 PM (after breakfast and before lunch). The body weight was measured using the "GIMA model 27310 Astra" scale, with a precision of 0.001 kg, and the body height with the portable stadiometer "SECA 213". The subjects were lightly sport-dressed during the measurement. The scale was calibrated before each measurement. Body Mass Index (BMI) was calculated as ratio of body weight (kg) and square of body height (m). In order to evaluate the nutritional status of subjects, BMI values were expressed as a percentile value for the appropriate age and sex. The BMI groups are divided according to the US Center for Disease Control and prevention (CDC) according to age and sex by categories: malnutrition (<5%), normal body mass (5% <85%), excessive body mass (85% <95% and obesity = 95%) (16).

Statistical analysis

The standard Statistical Package for Social Research (SPSS) version 19.0, IBM Corp., Armonk New York, was used for the analysis of results. For multivariate correlation analysis between MSPs in defined sites and excessive BMI and obesity non-parametric Spearman correlation tests were used. To estimate the correlation of dependent MSP variables of different physical locations (outcomes) and independent variables of excessive BMI with obesity, we calculated the attributive risk (OR), the absolute difference between the two morbidity measures. The attributive risk, OR refers to the strength of the relationship between exposure risk (excessive body weight and obesity) and symptoms of musculoskeletal pain in different parts of the body. The category of overweight BMI and obesity is combined into one of the most probable risk factors when determining OR. For this statistical assessment to be reliable with OR, a confidence interval of 95% (95% CI) was determined. If RR> 1.0, there is a higher risk of MSP in people with excessive weight and obesity. The value of $p < 0.05$ was considered significant.

4. RESULTS

Table 1 shows average respondent values for: age 11.31 (± SD 1.48) years (± SD 1.48), body weight 41.57 (± SD 11.71) kg and body height 146.18 (± SD 10.61) cm.

Characteristics of subjects	Mean	SD*	Minimum	Maximum
Age (years)	11.3	1.48	7.00	14.00
Body Weight (kg)	41.57	11.71	20.00	93.00
Body Height	146.18	10.61		

Table 1. Individual characteristics of respondents with perception of musculoskeletal pain (n=1315). *SD, Standard Deviation

The number of subjects with excessive body weight were 243 (18.5%) and obese were 166 (12.6%) - a total of 407 (31.1%) out of 1315 total respondents. Most subjects with excessive BMI by age ten (20.4%), twelve (20.7%) and thirteen (22.7%), and obesity by age nine (18.5%). The lowest incidence of overweight was 17.8% in the age of 14 and school children at age fourteen were not overweight. There is a decrease in the frequency of obesity with age (years, 9: 10: 11: 12: 13: 14 vs. obesity, 18.5%: 15.3%: 14.4%: 11.8%: 8.7%: 0%). Of the total sample 47.5% of school children have MSP. We observed that the prevalence of MSPs is in inverse relationship with BMI. MSP accounts for a total of 624 (47.5%) of respondents, most of whom are in the category of children with normal BMI, 416 out of 842 (49.4%). Only, 45.2% of students with overweight reported having a MP. In the category of obese pain, the prevalence was 39.1% (Table 2). It is also shown in Table 2, that the highest prevalence of muscle pain was found in subjects with normal BMI (healthy body weight). The highest incidence of chronic pain was reported in: right shoulder 13.4%, upper back 10.5% and neck 10.1%. The highest prevalence of acute pain in the neck is 11.3%. The highest prevalence of

Characteristics	No (%)		No (%)	
	Underweight 64 (4.9%)	**Normal** 842 (64.0%)	**Overweight** 243 (18.5%)	**Obesity** 166 (12.6%)
Age (years)				
9	8 (4.8)	114 (67.8)	15 (8.9)	31(18.5)
10	19 (6.8)	161(57.5)	57 (20.4)	43 (15.3)
11	5 (1.8)	182 (66.9)	46 (16.9)	39 (14.4)
12	11 (4.5)	155 (63.0)	51 (20.7)	29 (11.8)
13	15 (5.5)	176 (63.7)	61 (22.1)	24 (8.7)
14	6 (8.3)	54 (73.9)	13 (17.8)	0 (0.0)
Gender				
Male	23 (3.5)	388 (59.5)	127 (19.5)	114(17.5)
Female	41 (6.2)	454 (68.5)	116 (17.5)	52 (7.8)
MSP				
no	31	426 (50.6)	133 (54.8)	101 (60.9)
yes	33	416 (49.4)	110 (45.2)	65 (39.1)
Acute and chronic MSP in different part of the body	Underweight	Normal	Overweight	Obesity
Acute neck pain	0 (0.0)	148 (11.3)	41(3.1)	21(1.6)
Chronic neck pain	12 (0.9)	133 (10.1)	49 (3.7)	27 (2.1)
Acute right shoulder pain	17 (1.3)	176 (13.4)	38 (2.9)	16 (1.2)
Chronic right shoulder pain	0 (0.0)	28 (2.1)	9 (0.7)	5 (0.4)
Acute upper back pain	8 (0.6)	96 (7.3)	19 (1.4)	15 (1.0)
Chronic upper back pain	8 (0.6)	109 (8.3)	20 (1.5)	21(1.6)
Acute low back pain	9 (0.7)	91 (6.9)	21 (1.6)	13(1.0)
Chronic low back pain	12 (0.9)	138 (10.5)	34 (2.6)	30 (2.3)
Acute knees pain	3 (0.2)	42 (3.2)	15 (1.2)	8 (0.6)
Chronic knees pain	3 (0.2)	53 (4.0)	18 (1.4)	10 (0.8)
Acute ankles pain	4 (0.3)	52 (4.0)	17 (1.3)	7 (0.5)
Chronic ankles pain	3 (0.2)	51 (3.9)	15 (1.1)	9 (0.7)

Table 2. The differences between individual characteristics and perception of MSP of all respondents per BMI categories (n=1315)

MSP in the category of excessive BMI is chronic pain of 3.7% and chronic lower back pain 2.6%, acute neck pain 3.1% and acute pain in right shoulder 2.9%. Obese patients have the highest prevalence of chronic pain in the lower back 2.3% and chronic pain in the neck of 2.1%. Students with excess body weight with obesity suffer from chronic neck pain of 5.8% and chronic pain in the lower back 4.9%. There is a statistically significant difference between BMI and BMI subgroup (χ2-test = 6.769, p = 0.011), and when it comes to pain-only differentiation for acute pain in the right shoulder and BMI subgroup (χ2-test = 15.667, p = 0.001) (Table 2). A significant correlation was found between body weight and chronic MSP pain in the right arm (Spearman correlation factor, f = 0.084), chronic pain in the upper part of the chest (f = 0.061), chronic pain in the knee (f = 0.063) and chronic pain in the feet. The acute MSP neck (p <0.001), the upper back (p <0.001), the lower back (p <0.001), the knee (p <0.05) and the feet (p <0.001) statistically correlate significantly with the body weight of schoolchildren (shown in Table 3). Table 4 shows that excessive BMI with obesity is a risk for developing musculoskeletal pain (OR = 1.161, 95% CI, 1.020-1.322), chronic neck pain (OR = 1.212, 95% CI, 0.893-1.644), chronic pain in knee (OR = 1,103, 95% CI, 0.690-1.760) and acute knee pain (OR = 1.127, 95% CI, 0.673-1.890).

Spearman correlation beetween body weight (20.0-36.8kg) and MSP	Correlation factor
Chronic neck pain	0.053
Chronic right shoulder pain	0.084**
Chronic right wrist pain	0.033
Chronic upper back pain	0.061**
Chronic lower back pain	0.024
Chronic knees pain	0.097*
Chronic ankles pain	0.087**
Acute neck pain	0.069**
Acute right shoulder pain	0.053
Acute right wrist pain	0.023
Acute upper back pain	0.063**
Acute lower back pain	0.072**
Acute knees pain	0.094*
Acute ankles pain	0.087**

Table 3. Correlation between body height and MSP and body weight and MSP in different part of the body in all respondents (n=1315). * Correlation is significant at the 0.05 level (2 tailed). ** Correlation is significant at the 0.001 level (2 tailed)

Nonspecific musculoskeletal pain in different part of the body	Relative Risk OR*	95% Confidence interval (95% CI)
Musculosceletal pain	1.161	1.020-1.322
Chronic neck pain	1.212	0.893-1.644
Acute neck pain	0.838	0.610-1.152
Chronic right shoulder pain	0.913	0.486-1.715
Acute right shoulder pain	0.571	0.412-0.790
Chronic upper back pain	0.770	0.530-1.119
Acute upper back pain	0.691	0.460-1037
Chronic low back pain	0.923	0.671-1.270
Acute low back pain	0.722	0.480-1.086
Chronic knees pain	1.103	0.690-1.760
Acute knees pain	1.127	0.673-1.890
Chronic ankles pain	0.973	0.520-1.596
Acute ankles pain	0.936	0.571-1.532

Table 4. Relative Risk- assessment of exposure to overweight and obesity (undependent variable) for acute and chronic musculoskeletal pain in different part of the body (n=409). *OR>1 significant risk

5. DISCUSSION

The obesity epidemic in children spreads with alarming rates of prevalence. Numerous studies indicate that excessive body weight and obesity contribute to permanent health problems such as MSP and musculoskeletal disorders in schoolchildren (6, 11, 17). Smith and his associates have been trying to provide a current examination of musculo-

skeletal pain in children with excessive body weight and obesity in their systematic auditory analysis. They concluded that obesity and subsequent chronic MSP, reduced body function and activity may contribute to an additional weight gain cycle that affects the health and quality of life of a child (6). Chronic pain is a cumulative exposure effect to your body weight and obesity (5). Obesity in childhood is a good indicator of obesity in adulthood, and school age is the best time to take preventive programs (17, 18).

Krul and his associates found in 2459 Dutch school children that subjects with excessive body weight had an increased MSP risk in lower extremities (OR = 1.62, 95% CI, 1.09-2.41) and especially in ankle joints and feet (OR = 1.92, 95% CI, 1.15-3.20) than those who were in the normal BMI category (4). The meta analysis conducted in Finland in adult subjects showed that obesity was also associated with chronic pain in the lower back (OR = 1.43, 95% CI: 1.28, 1.60) compared to persons without excessive body weight (9). Other authors have found that obesity is the risk of chronic MSP in adult knees (10). Obesity and overweight BMI with obesity is a probable risk for development of musculoskeletal pain (OR = 1.161, 95% CI, 1.020-1.322), chronic neck pain (OR = 1.212, 95% CI, 0.893-1.644) and chronic knee pain = 1.103, 95% CI, 0.690-1.760). Recently, a study that sought to evaluate the overall and age-specific relationship between obesity and musculoskeletal pain in children has shown a significant increase in pain in the lower extremities of extremely obese children in three ages including children ages 2 to 19 compared to children of normal weight (19). Finally, by searching literature, the pain spots in school children with excessive body weight and obesity differ in each study (5). Sedentary lifestyle results in insufficient development of muscle and tendon, and young bones suffer from non-physiological pressures leading to the deformity of the foot and spinal column. This is especially important in obese children who suffer from pain in their hips, knees and feet in children (20).

6. CONCLUSION

The hypothesis is that overweight BMI with obesity is not an independent MSP factor that occurs in different body locations in children. MSP is probably multifactorial. Hypothetically it is possible that various environmental factors (school furniture, chairs), ergonomic movements and attitude in activities, carrying a school bag, over-sitting at school, at home with TV or computer, stress contribute to the risk of MSP in overweight and obese students (21-24). The relationship between increasing BMI, weight and pain indicates a risk factor for damage to the musculoskeletal structure, and that child often perceives pain (25). Reducing the physical function of children with excessive weight and obesity can be seen through the child's pain, which further affects their self-esteem, resulting in poorer quality of life. The way pain is reported can require future research from the perspective of both parent and child.

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REFERENCES

1. World Health Organization. Obesity and Overweight Fact Sheet, WHO: No. 311, 2011. http://www.who.int/mediacentre/factsheets/fs311/en/.
2. Tsiros MD, Coates AM, Howe PRC, Grimshaw PN, Buckley JD. Obesity: the new childhood disability? Obes Rev. 2011; 12: 26-36.
3. Smith SM, Sumar B, Dixon KA. Musculoskeletal pain in overweight and obese children. International Journal of Obesity. 2014; 38: 11-15.
4. Krul M, Van Der Wouden JC, Schellevis FG, Van Suijlekom-Smit LWA, Koes BW. Musculoskeletal problems in overweight and obese children. Ann Fam Med. 2009; 7: 352-356.
5. Taylor ED, Theim KR, Mirch MC, Ghorbani S. Orthopedic complications of overweight in children and adolescents. Pediatrics. 2006; 117: 2167-2174.
6. de Sá Pinto AL, de Barros Holanda PM, Radu AS, Villares SMF, Lima FR. Musculoskeletal findings in obese children. J Paediatr Child Health. 2006; 42: 341-344.
7. Bell LM, Curran JA, Byrne S, Roby H, Suriano K, Jones TW. et al. High incidence of obesity co-morbidities in young children: a cross-sectional study. J Paediatr Child Health. 2011; 47: 911-917.
8. Nilsen TI, Holtermann A, Mork PJ. Physical exercise, body mass index, and risk of chronic pain in the low back and neck/shoulders: longitudinal data from the Nord-Trondelag Health Study. Am J Epidemiol. 2011; 174(3): 267-273.
9. Shiri R, Karppinen J, Leino-Arjas P, Solovieva S, Viikari-Juntura E. The association between obesity and low back pain: a meta-analysis. Am J Epidemiol. 2010; 171(2): 135-154.
10. MacFarlane GJ, de Silva V, Jones GT. The relationship between body mass index across the life course and knee pain in adulthood: results from the 1958 birth cohort study. Rheumatology. 2011; 50: 2251-2256.
11. Hainsworth KR, Davies WH, Khan KA, Weisman SJ. Co-occurring chronic pain and obesity in children and adolescents: the impact on health-related quality of life. Clin J Pain. 2009; 25: 715-721.
12. Podeszwa DA, Stanko KJ, Mooney JF 3rd, Cramer KE, Mendelow MJ. An analysis of the functional health of obese children and adolescents utilizing the PODC instrument. J Pediatr Orthop. 2006; 26: 140-143.
13. Bell LM, Byrne S, Thompson A, Ratnam N, Blair E, Bulsara M. et al. Increasing body mass index z-score is continuously associated with complications of overweight in children, even in the healthy weight range. J Clin Endocrinol Metab. 2007; 92: 517-522.
14. Kuorinka I. Jonsson B, Kilbom A, Vitenberg H, Biering- Sørensen F, Andersson G, Jørgensen K. Standardized Nordic questionnaire for the analysis of musculosceletal symptoms. Appl Ergon. 1987; 18: 233-237.
15. Crawford JO. The Nordic Musculoskeletal Questionnaire. Occup Med. 2007; 57: 300-301.

16. Centres for Disease Control and Prevention [homepage on the Internet]. Clinical Growth Charts [accessed 18 March 2018]. Available from: https://www.cdc.gov/growthcharts/clinical_charts.htm
17. Adeyemi AJ, Rohani JM, Rani MR. Interaction of body mass index and age in muscular activities among backpack carrying male schoolchildren. Work. 2015; 52(3): 677-686. doi: 10.3233/WOR-152102.
18. Viester L, Verhagen EA, Oude Hengel KM, Koppes LL, van der Beek AJ, Bongers PM. The relation between body mass index and musculoskeletal symptoms in the working population. BMC Musculoskelet Disord. 2013; 14: 238.
19. MacFarlane GJ, de Silva V, Jones GT. The relationship between body mass index across the life course and knee pain in adulthood: results from the 1958 birth cohort study. Rheumatology. 2011; 50: 2251-2256.
20. Sperotto F, Brachi S, Vittadello F, Zulian F. Musculoskeletal pain in schoolchildren across puberty: a 3-year follow-up study. Pediatr Rheumatol Online J. 2015; 13: 16.
21. Rhee H. Relationships between physical symptoms and pubertal development. J Pediatr Health Care. 2005; 19(2): 95-103.
22. McEvoy MP, Grimmer K. Reliability of upright posture measurements in primary school children. BMC Musculoskelet Disord. 2005; 6(35): 1-10.
23. Grimmer K, Dansie B, Milanese S, Pirunsan U, Trott P. Adolescent standing postural response to backpack loads: a randomised controlled experimental study. BMC Musculoskeletal Disorders. 2002; 17: 3:1.
24. Lafond D, Descarreaux M, Normand MC, Harrison DE. Postural development in school children: a cross-sectional study. Chiropr Osteopat. 2007; 4: 15-21.
25. Shultz SP, Browning RC, Schutz Y, Maffeis C, Hills AP. Childhood obesity and walking: guidelines and challenges. Int J Pediatr Obes. 2011; 6: 332-341.