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FITNESS

Differences in the Fitness Levels of Urban and Rural Middle School Students in Croatia

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Abstract

Background: *It is known that suburban youth are more fit than urban youth in Croatia.* ***Method:*** *Differences ($p < .05$) in fitness levels and motor abilities of 9,164 (F = 4,671, M = 4,493) Croatian children (age range: 11–14 years) from urban (F = 1,380, M = 1,268), mixed rural–urban (F = 274, M = 289), and rural (F = 3017, M = 2936) areas were assessed to determine the health status and fitness levels of middle school Croatian students from urban and rural areas.* ***Results:*** *Urban children were taller and leaner compared to their rural–urban and rural peers. Male and female students living in urban areas demonstrated better agility, flexibility, explosive strength, and repetitive strength with respect to their rural–urban and rural counterparts.* ***Conclusion:*** *Contrary to previous research, this study shows that urban students show greater fitness characteristics than their suburban counterparts. This may be due to the induction of mechanization and the lower need for physical work on farms, while maintaining the nutritional habits, including traditional high calorie meals, which have brought about a decline in the level of basic fitness characteristics in the rural*

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environment. As there is a greater opportunity for organized sports events and programs in cities, the availability of these benefits should be examined.

During the past 15 years, Croatia has emerged from wartime destruction to a high level of industrialization and today strives to become a member of the European Union. This period of quick urbanization has yielded a 12%–14% growth in the urban population (Croatian Bureau of Statistics [CBS], 2011). Today, Croatia's urban population is at 58%, with a 0.4% annual growth (Central Intelligence Agency, 2011). Four cities have more than 100,000 inhabitants, and the largest is the capital city Zagreb, with about 900,000 inhabitants (CBS, 2011). Residents of rural community live a traditional lifestyle and rely on small-scale farming. The lack of work opportunities and infrastructure has led to the migration of rural populations to urban areas. Urbanization and industrialization tend to determine a reduction of spontaneous physical activity, with a consequent increase of sedentary-related diseases. In particular, youth are less exposed to daily exercise activities (Findak, 1991; Heimer et al., 2004; Hrabal, 1989), resulting in decreased motor abilities (Findak, Metikoš, Mraković, Neljak, & Prot, 1996; Tokmakidis & Kasambalis, 2006).

The study of environment and the effects on motor ability and development of a healthy lifestyle remain unclear (Felton et al., 2002; Ozdirenç, Ozcan, Akin, & Gelecek, 2005; Peña Reyes, Tan, & Mallina, 2003; Tognarelli et al., 2004; Tsimeas, Tsiokanos, Koutedakis, Tsigilis, & Kellis, 2005). Living in an urban environment has been associated with inactivity of school children. In fact, students in urban areas tend to spend most of their free time at home, adopting sedentary behaviors such as reading, playing computer games, or watching television (Ruel et al.,1998). Conversely, students living in rural areas tend to engage in active playing in open environments, outside the house. The assumption may be that rural students are more fit compared to their urban peers (Felton et al., 2002; Ozdirenç et al., 2005; Peña Reyes et al., 2003; Tognarelli et al., 2004; Tsimeas et al., 2005). However, the induction of agricultural mechanization, maintenance of traditional high calorie nutritional habits, and the limited introduction of organized sports facilities and programs with respect to urban areas may put rural children at a disadvantage (Sheehan, 2005). Beneficial changes in public health and nutrition have been associated with early physical growth and development of children living in urban areas with respect to their rural peers (Bielicki, 1986; Peña Reyes et al., 2003). The urbanization phenomenon of Western countries developed over the past century could represent a tremendous opportunity to study health-related differences, if any, between children living in rural and urban areas.

As health-related physical fitness is crucial for day-to-day functioning and health maintenance, the emphasis in physical fitness has shifted from performance- to health-related indicators in Croatia (Pate & Shephard, 1989) as operationalized by a compound of cardiorespiratory endurance, musculoskeletal function of the lower trunk (abdominal muscular strength and endurance and lower back/upper thigh flexibility), and body composition (American Alliance for Health, Physical Education, Recreation, and Dance, 1980; Bouchard & Shephard, 1994). In this study, we compare the health-related fitness of middle school–age students (11–14 years old) living in urban, mixed rural–urban, and rural areas, to determine if there is a difference in fitness levels.

Method

Study Subjects

The Institutional Review Board of the Faculty of Kinesiology, University of Zagreb, Croatia, approved this cross-sectional study, which was performed in accordance with the ethical standards in sports and exercise science research. To operationalize rural, mixed rural–urban, and urban characteristics of Croatian children, the groups were defined by geographical, demographic, and economical aspects (Pokos, 2002). Thus, three subgroups were identified: (1) rural, settlements ≤ 5,000 inhabitants; (2) rural–urban, settlements between 5,000 and 10,000 inhabitants; and (3) urban, settlements ≥ 10,000 inhabitants.

A written informed consent was obtained from 9,164 (F = 4,671, M = 4,493) children (11–14 years), their parents, and principals of 51 schools from all Croatian regions (rural = 14, rural–urban = 10, urban = 27). The sample consisted of Croatian students from urban (F = 1,380, M = 1,268), mixed rural–urban (F = 274, M = 289), and rural (F = 3,017, M = 2,936) areas during one school year (fifth, sixth, seventh, and eighth grade), with the students attending twice-a-week, 45-min compulsory physical education lessons (70 hr total).

Instruments

Fitness levels measurements. Fitness levels depend on several attributes, including BMI, strength, flexibility, coordination, speed, and aerobic capacity. According to health-related epidemiological studies (Jureša et al., 2011; Oja, 2011), BMI has been used to distinguish between normal-weight and overweight or obese children (BMI > 20.55 kg/m^2 for boys and BMI > 20.74 kg/m^2 for girls; Cole, Bellizzi, Flegal, & Dietz, 2010). Furthermore, to monitor the individual percentage of body fat, a bioelectrical impedance analysis was used, which proved to be highly related to dual-energy X-ray absorptiometry and magnetic resonance imaging measurements. Evaluation of physical performance included assessment of coordination, agility, flexibility, explosive strength, and repetitive strength by means of the CROFIT BATTERY, which included 15 tests. Tests are described in the Physical Fitness Tests section, and their validity and reliability as tests relevant for health of children and adolescents have been discussed elsewhere (Marković, Dizdar, Jukic, & Cardinale, 2004; Metikoš, Hofman, Prot, Pintar, & Oreb, 1989; Novak, 2010; Novak, Neljak, & Prot, 2012).

Standing height (HT) was measured to the nearest 0.5 cm with the Martin-type anthropometer for the standing posture, with shoes removed, feet together, and head in the Frankfort horizontal plane. Body mass (BM) and body fat (BF) percentage were measured to the nearest 0.1 kg by applying a bio-impedance analysis test and using portable digital scales (BF500, Omron, Medizintechnik, Mannheim, Germany). BMI was calculated as weight in kilograms divided by the square of height in meters (BMI = kg/m^2). The measurements were made during school days, with children wearing light clothes and no shoes. Measurements were taken three times, and mean values were used for further analysis.

Physical Fitness Tests

Coordination. For assessment of coordination, the polygon reverse (PR), ball rolling with nondominant hand (ROLLING), and polygon turn (PT) were used. Tests were measured as the time elapsed to the nearest 0.01 s from the starting signal to crossing the finish line. While performing polygon reverse, the respondent was moving backwards on all fours on a 10-m-long flat surface by overcoming two placed obstacles. During the ball roll with the nondominant hand, the time was not stopped until the student did not complete four circles of ball rolling with the nondominant hand around three placed skittles on a 6-m-long flat surface. The respondent performed the polygon turn on a 9-m-long flat surface, overcoming one obstacle after turning round for 180°.

Agility. Agility was assessed using the tests side step (SIDE STEP), figure eight with bending (F8), and shuttle-run (SR). The first two tests were conducted in a space of 4 m. During side steps, the time was not stopped until the child did not complete six lengths by performing the change of direction, with stopping in the moment when the outer foot fitted on the line. In the figure eight test with bending, the child should have made four lengths with stopping under 90-cm-high elastic bands and running around stands in a figure eight. In the test shuttle-run, time was measured for the time it took for the child to transfer (move) two school sponges from one side of the 9-m length to the opposite side. Students were only allowed to carry one sponge across at a time.

Flexibility. The tests bending forward with legs extension (BFLE), forward bend on a bench (BFB), and forward bend in narrow legs extension (BFNLE) were performed to assess flexibility. The children removed their shoes and sat or stood near the test apparatus with legs fully extended. The children were instructed to lean forward, with palms facing downward along the ruler, and reach as far as possible without jerking or bouncing. In the test bending forward with legs extension, the child would sit; in the forward bend test, the child would stand on a bench. The distance of the stretch was recorded to the nearest centimeter. The children were permitted to warm up with slow stretching movements before the test.

Explosive strength. The explosive strength of lower extremities was assessed by the tests standing long jump (SLJ) and 20-m run (20 m), whereas the explosive strength of the upper extremities was measured by throwing a medicine ball (1 kg) from lying position (BTLP). Standing long jump was measured to the nearest centimeter as the distance from the takeoff line to the point where the heels touched the ground. In the 20-m run test, time was measured as the time elapsed to the nearest 0.1 s from the starting signal to crossing the finish line. The distance of the thrown medicine ball in the test throwing a medicine ball (1 kg) from lying position was measured to the nearest centimeter as the distance from the center of throwing to the point where the medicine ball touched the ground. The children were instructed to throw the medicine ball as strongly as they could, while keeping their head on the ground. For each test, three trials were administered, and the best of the three was retained for analysis, except for throwing the medicine ball (1 kg) from lying position, for which four trials were allowed. The children were permitted to rest between trials for as long as they deemed necessary.

Repetitive strength. Lifting body from lying position (LBLP) and lifting body-short (LBS) were carried out to estimate the repetitive strength of the front part of the body. The repetitive strength of the lower extremities was estimated using test squats (SQ). Lifting the body from lying position was measured with the child in a supine position on a mat with the knees bent at 90° angles, the feet approximately hip width apart, and the hands placed at the side of the head with the fingers over the ears and elbows pointed toward the knees. The hands and elbows were maintained in this position for the duration of the test. The tester held the child's ankles to ensure that the heels were in constant contact with the mat. The child was required to sit up, touch the knees with the elbows, and return to the starting position. Raising body-short test was conducted in the same way with the exception of the palms leaning on the thighs. Children were told to raise their body, as the middle of their palms slid on the upper thighs without touching the top of the knee. Squats were derived from an upright standing position, with feet spread hip width apart, heels leaning on the edge of the mat, and arms relaxed along the body. The children performed the squat repeatedly, as fast as they could to a starting signal. While performing every squat, the children went down to the level that allowed the fingertips to touch the ground at the same time and then rose to an upright position, which was determined by the full stretching of the legs. In all tests for assessment of repetitive strength, the children were instructed to perform as many repetitions as possible in 60 s. They were permitted to pause for rest if necessary. One trial was given.

Data Analysis

Data were analyzed using Statistica for Windows 8.0 (StatSoft, Inc., 2008). Data are presented as $M \pm SD$, and statistical significance was set at $p = 0.05$. Prior to the study, the Kolmogorov–Smirnov test was applied to evaluate the normal distribution of data. Levene's test for homogeneity of variance and Mauchly's test for sphericity were applied to control for statistical assumptions. An ANOVA was used to assess differences among groups (i.e., urban, mixed rural–urban, and rural). When multiple comparisons were performed, a post hoc analysis with Bonferroni corrections was used.

Results

The ANOVA (Table 1) showed significant differences among the three tested groups of male students in body height (HT, p = 0.000), body fat percentage (BF, p = 0.002), and BMI (BMI, p = 0.023). Follow-up tests (Table 2) confirmed that urban male students were taller than their peers from rural areas (p = 0.000) by more than 1.5 cm and had a lower percentage of body fat (p = 0.002). The highest value of BMI was noticed by rural–urban male students, with a statistically significant difference (Table 2). Statistical analysis (Table 1) did not show a significant difference in body mass among male students (p = 0.257).

Table 1

Descriptive Statistics of Anthropometric Measurements and ANOVA Results for Male Groups

	M* ± *SD				
Variables	**< 5,000 (rural)**	**5,000–10,000 (rural–urban)**	**> 10,000 (urban)**	***F***	***p***
Anthropometry					
HT	159.66 ± 11.21	159.59 ± 11.47	161.33 ± 10.77	9.171	**0.000**
BM	52.64 ± 13.18	53.99 ± 13.31	52.95 ± 12.93	1.359	0.257
BF	16.72 ± 8.61	15.80 ± 8.47	15.53 ± 8.06	6.205	**0.002**
BMI	21.40 ± 3.73	22.04 ± 3.72	21.28 ± 3.38	3.792	**0.023**

Note. HT = standing height; BM = body mass; BF = body fat percentage; BMI = body mass index.

Table 2
Results of Series of t Tests for Independent Samples for Male Groups

Variables	Population	< 5,000	5,000–10,000	> 10,000
Anthropometry				
HT	< 5,000	–	1.000	**0.000**
	5,000–10,000	1.000	–	0.055
	> 10,000	**0.000**	0.055	–
BM	< 5,000	–	0.327	1.000
	5,000–10,000	0.327	–	0.731
	> 10,000	1.000	0.731	–
BF	< 5,000	–	0.386	**0.002**
	5,000–10,000	0.386	–	1.000
	> 10,000	**0.002**	1.000	–
BMI	< 5,000	–	**0.040**	1.000
	5,000–10,000	**0.040**	–	**0.019**
	> 10,000	1.000	**0.019**	–

Note. HT = standing height; BM = body mass; BF = body fat percentage; BMI = body mass index.

The ANOVA (Table 3) showed significant differences among the three tested groups of female students in body height (HT, $p = 0.000$), body fat percentage (BF, $p = 0.011$), and body mass index (BMI, $p = 0.020$). The results of a series of *t* tests (Table 4) showed that urban female students were significantly taller compared to their counterparts from rural–urban ($p = 0.000$) and rural areas ($p = 0.000$) by more than 2 cm and had a significantly lower percentage of body fat ($p = 0$ .010). BMI, although significantly different (Table 4) between rural–urban and urban female students ($p = 0.035$), showed almost equal values (Table 3). Statistical analysis (Table 3) did not show a statistically significant difference in body mass between urban and suburban female students ($p = 0.087$).

Table 3
Descriptive Statistics of Anthropometric Measurements and ANOVA Results for Female Groups

	M ± *SD*				
Variables	**< 5,000 (rural)**	**5,000–10,000 (rural–urban)**	**> 10,000 (urban)**	***F***	***p***
Anthropometry					
HT	158.84 ± 8.39	157.63 ± 7.97	161.19 ± 8.43	40.09	**0.000**
BM	51.83 ± 11.36	52.34 ± 11.95	52.70 ± 11.57	2.445	0.087
BF	25.40 ± 8.77	26.59 ± 8.84	24.87 ± 8.58	4.531	**0.011**
BMI	20.48 ± 3.57	20.83 ± 3.79	20.22 ± 3.48	3.922	**0.020**

Note. HT = standing height; BM = body mass; BF = body fat percentage; BMI = body mass index.

Table 4
Results of Series of t Tests for Independent Samples for Female Groups

Variables	**Population**	**< 5,000**	**5,000–10,000**	**> 10,000**
Anthropometry				
HT	< 5,000	–	0.069	**0.000**
	5,000–10,000	0.069	–	**0.000**
	> 10,000	**0.000**	**0.000**	–
BM	< 5,000	–	1.000	0.086
	5,000–10,000	1.000	–	1.000
	> 10,000	0.086	1.000	–
BF	< 5,000	–	0.097	0.255
	5,000–10,000	0.097	–	**0.010**
	> 10,000	0.255	**0.010**	–
BMI	< 5,000	–	0.377	0.120
	5,000–10,000	0.377	–	**0.035**
	> 10,000	0.120	**0.035**	–

Note. HT = standing height; BM = body mass; BF = body fat percentage; BMI = body mass index.

The ANOVA (Table 5) showed significant differences among the three tested groups of male students in all physical fitness tests, except in medicine ball throwing from lying position (BTLP, $p = 0.966$), which was used to assess explosive strength. In the tests for assessment of coordination, the rural male students achieved significantly faster time in the polygon reverse (PR) compared to the urban male students ($p = 0.002$). In the test ball rolling with nondominant hand (ROLLING), the male students from the urban areas were significantly better compared to their counterparts from the rural areas ($p = 0.000$) by more than 1.5 s and compared to counterparts from the rural–urban areas ($p = 0.000$) by more than 2 s. Polygon turn results showed no significant difference (Table 6).

Table 5
Descriptive Statistics of Physical Fitness Tests and ANOVA Results for Male Groups

	M* ± *SD				
Variables	**< 5,000 (rural)**	**5,000–10,000 (rural–urban)**	**> 10,000 (urban)**	***F***	***p***
Coordination					
PR	13.20 ± 3.62	13.18 ± 3.57	13.61 ± 3.73	5.918	**0.003**
ROLLING	18.51 ± 3.49	18.03 ± 2.94	16.99 ± 3.81	80.715	**0.000**
PT	8.76 ± 2.24	8.61 ± 2.08	8.94 ± 2.44	3.611	**0.027**
Agility					
SIDE STEP	10.58 ± 1.54	10.90 ± 1.59	10.24 ± 1.29	34.38	**0.000**
F8	9.46 ± 1.42	9.60 ± 1.02	9.37 ± 1.16	3.973	**0.019**
SR	11.33 ± 1.23	11.47 ± 2.90	11.04 ± 1.12	23.226	**0.000**
Flexibility					
BFLE	48.99 ± 12.97	50.96 ± 12.51	53.34 ± 13.08	46.365	**0.000**
BFB	38.94 ± 8.03	42.80 ± 6.68	40.74 ± 7.72	43.702	**0.000**
BFNLE	40.76 ± 9.38	40.27 ± 8.66	44.35 ± 12.62	51.581	**0.000**
Explosive strength					
SLJ	173.46 ± 27.06	170.62 ± 28.56	175.31 ± 24.81	3.058	**0.047**
20 m	3.86 ± 0.43	4.25 ± 0.42	3.82 ± 0.43	61.8	**0.000**
BTLP	72.33 ± 19.84	71.90 ± 17.54	72.37 ± 19.55	0.034	0.966

Table 5 (cont.)

Variables	$M \pm SD$ < 5,000 (rural)	5,000–10,000 (rural–urban)	> 10,000 (urban)	F	p
Repetitive strength					
LBLP	42.43 ± 9.75	39.24 ± 9.67	43.07 ± 9.86	9.416	**0.000**
LBS	52.48 ± 13.98	49.01 ± 13.55	52.84 ± 12.68	4.744	**0.009**
SQ	46.93 ± 11.30	44.19 ± 9.07	47.26 ± 10.90	4.561	**0.011**

Note. PR = polygon reverse; ROLLING = ball rolling by a nondominant hand; PT = polygon turn; SIDE STEP = side step agility; F8 = figure 8 with bending; SR = shuttle-run; BFLE = bending forward with legs extension; BFB = forward bend on a bench; BFNLE = forward bend in narrow legs extension; SLJ = standing long jump; 20 m = 20-m run test; BTLP = medicine ball throwing from lying position; LBLP = lifting body from lying position; LBS = lifting body-short; SQ = squats.

Table 6
Results of Series of t Tests for Independent Samples for Male Groups

Variables	Population	< 5,000	5,000–10,000	> 10,000
Coordination				
PR	< 5,000	–	1.000	**0.002**
	5,000–10,000	1.000	–	0.216
	> 10,000	**0.002**	0.216	–
ROLLING	< 5,000	–	0.082	**0.000**
	5,000–10,000	0.082	–	**0.000**
	> 10,000	**0.000**	**0.000**	–
PT	< 5,000	–	0.830	0.075
	5,000–10,000	0.830	–	0.086
	> 10,000	0.075	0.086	–
Agility				
SIDE STEP	< 5,000	–	**0.001**	**0.000**
	5,000–10,000	**0.001**	–	**0.000**
	> 10,000	**0.000**	**0.000**	–

Table 6 (cont.)

Variables	Population	< 5,000	5,000–10,000	> 10,000
F8	< 5,000	–	0.307	0.137
	5,000–10,000	0.307	–	**0.030**
	> 10,000	0.137	**0.030**	–
SR	< 5,000	–	0.261	**0.000**
	5,000–10,000	0.261	–	**0.000**
	> 10,000	**0.000**	**0.000**	–
Flexibility				
BFLE	< 5,000	–	**0.049**	**0.000**
	5,000–10,000	**0.049**	–	**0.017**
	> 10,000	**0.000**	**0.017**	–
BFB	< 5,000	–	**0.000**	**0.000**
	5,000–10,000	**0.000**	–	**0.000**
	> 10,000	**0.000**	**0.000**	–
BFNLE	< 5,000	–	1.000	**0.000**
	5,000–10,000	1.000	–	**0.000**
	> 10,000	**0.000**	**0.000**	–
Explosive strength				
SLJ	< 5,000	–	0.686	0.143
	5,000–10,000	0.686	–	0.158
	> 10,000	0.143	0.158	–
20 m	< 5,000	–	**0.000**	**0.008**
	5,000–10,000	**0.000**	–	**0.000**
	> 10,000	**0.008**	**0.000**	–
BTLP	< 5,000	–	1.000	1.000
	5,000–10,000	1.000	–	1.000
	> 10,000	1.000	1.000	–
Repetitive strength				
LBLP	< 5,000	–	**0.001**	0.184
	5,000–10,000	**0.001**	–	**0.000**
	> 10,000	0.184	**0.000**	–
LBS	< 5,000	–	**0.013**	1.000
	5,000–10,000	**0.013**	–	**0.006**
	> 10,000	1.000	**0.006**	–

Table 6 (cont.)

Variables	Population	< 5,000	5,000–10,000	> 10,000
SQ	< 5,000	–	**0.018**	1.000
	5,000–10,000	**0.018**	–	**0.008**
	> 10,000	1.000	**0.008**	–

Note. PR = polygon reverse; ROLLING = ball rolling by a nondominant hand; PT = polygon turn; SIDE STEP = side step agility; F8 = figure 8 with bending; SR = shuttle-run; BFLE = bending forward with legs extension; BFB = forward bend on a bench; BFNLE = forward bend in narrow legs extension; SLJ = standing long jump; 20 m = 20-m run test; BTLP = medicine ball throwing from lying position; LBLP = lifting body from lying position; LBS = lifting body-short; SQ = squats.

Table 7
Descriptive Statistics of Physical Fitness Tests and ANOVA Results for Female Groups

	M ± *SD*				
Variables	**< 5,000 (rural)**	**5,000–10,000 (rural–urban)**	**> 10,000 (urban)**	***F***	***p***
Coordination					
PR	14.67 ± 3.91	16.17 ± 4.13	15.38 ± 3.92	28.743	**0.000**
ROLLING	21.28 ± 3.63	21.45 ± 3.31	20.54 ± 3.89	20.553	**0.000**
PT	10.03 ± 2.44	11.05 ± 2.69	10.50 ± 2.61	31.91	**0.000**
Agility					
SIDE STEP	11.29 ± 1.50	11.74 ± 1.81	10.98 ± 1.20	40.485	**0.000**
F8	10.24 ± 1.50	10.56 ± 1.10	10.24 ± 1.28	6.502	**0.002**
SR	12.01 ± 1.19	13.48 ± 2.16	11.85 ± 1.01	206.41	**0.000**
Flexibility					
BFLE	60.22 ± 13.14	57.93 ± 12.43	62.15 ± 12.73	16.317	**0.000**
BFB	44.79 ± 8.35	45.70 ± 7.36	44.60 ± 8.29	2.001	0.135
BFNLE	48.61 ± 9.82	47.15 ± 8.50	50.76 ± 10.56	26.624	**0.000**
Explosive strength					
SLJ	157.86 ± 23.04	152.18 ± 23.02	161.87 ± 22.04	19.432	**0.000**
20 m	4.10 ± 0.44	4.53 ± 0.46	4.06 ± 0.44	64.354	**0.000**
BTLP	59.50 ± 13.36	58.17 ± 11.90	62.17 ± 14.12	17.692	**0.000**

Table 7 (cont.)

Variables	*M* ± *SD*			*F*	*p*
	< 5,000 (rural)	**5,000–10,000 (rural–urban)**	**> 10,000 (urban)**		
Repetitive strength					
LBLP	38.62 ± 9.11	33.71 ± 8.77	37.68 ± 8.68	20.855	**0.000**
LBS	49.08 ± 12.07	43.58 ± 12.83	48.15 ± 11.38	14.381	**0.000**
SQ	44.28 ± 9.00	41.82 ± 7.49	43.00 ± 8.55	12.527	**0.000**

Note. PR = polygon reverse; ROLLING = ball rolling by a nondominant hand; PT = polygon turn; SIDE STEP = side step agility; F8 = figure 8 with bending; SR = shuttle-run; BFLE = bending forward with legs extension; BFB = forward bend on a bench; BFNLE = forward bend in narrow legs extension; SLJ = standing long jump; 20 m = 20-m run test; BTLP = medicine ball throwing from lying position; LBLP = lifting body from lying position; LBS = lifting body-short; SQ = squats.

Table 8
Results of Series of t Tests for Independent Samples for Female Groups

Variables	Population	< 5,000	5,000–10,000	> 10,000
Coordination				
PR	< 5,000	–	**0.000**	**0.000**
	5,000–10,000	**0.000**	–	**0.007**
	> 10,000	**0.000**	**0.007**	–
ROLLING	< 5,000	–	1.000	**0.000**
	5,000–10,000	1.000	–	**0.001**
	> 10,000	**0.000**	**0.001**	–
PT	< 5,000	–	**0.000**	**0.000**
	5,000–10,000	**0.000**	–	**0.003**
	> 10,000	**0.000**	**0.003**	–
Agility				
SIDE STEP	< 5,000	–	**0.000**	**0.000**
	5,000–10,000	**0.000**	–	**0.000**
	> 10,000	**0.000**	**0.000**	–

Table 8 (cont.)

Variables	Population	< 5,000	5,000–10,000	> 10,000
F8	< 5,000	–	**0.001**	1.000
	5,000–10,000	**0.001**	–	**0.002**
	> 10,000	1.000	**0.002**	–
SR	< 5,000	–	**0.000**	**0.000**
	5,000–10,000	**0.000**	–	**0.000**
	> 10,000	**0.000**	**0.000**	–
Flexibility				
BFLE	< 5,000	–	**0.017**	**0.000**
	5,000–10,000	**0.017**	–	**0.000**
	> 10,000	**0.000**	**0.000**	–
BFB	< 5,000	–	0.246	1.000
	5,000–10,000	0.246	–	0.136
	> 10,000	1.000	0.136	–
BFNLE	< 5,000	–	0.066	**0.000**
	5,000–10,000	0.066	–	**0.000**
	> 10,000	**0.000**	**0.000**	–
Explosive strength				
SLJ	< 5,000	–	**0.019**	**0.000**
	5,000–10,000	**0.019**	–	**0.000**
	> 10,000	**0.000**	**0.000**	–
20 m	< 5,000	–	**0.000**	**0.031**
	5,000–10,000	**0.000**	–	**0.000**
	> 10,000	**0.031**	**0.000**	–
BTLP	< 5,000	–	0.852	**0.000**
	5,000–10,000	0.852	–	**0.000**
	> 10,000	**0.000**	**0.000**	–
Repetitive strength				
LBLP	< 5,000	–	**0.000**	**0.006**
	5,000–10,000	**0.000**	–	**0.000**
	> 10,000	**0.006**	**0.000**	–

Table 8 (cont.)

Variables	Population	< 5,000	5,000–10,000	> 10,000
LBS	< 5,000	–	**0.000**	0.060
	5,000–10,000	**0.000**	–	**0.000**
	> 10,000	0.060	**0.000**	–
SQ	< 5,000	–	**0.006**	**0.000**
	5,000–10,000	**0.006**	–	0.448
	> 10,000	**0.000**	0.448	–

Note. PR = polygon reverse; ROLLING = ball rolling by a nondominant hand; PT = polygon turn; SIDE STEP = side step agility; F8 = figure 8 with bending; SR = shuttle-run; BFLE = bending forward with legs extension; BFB = forward bend on a bench; BFNLE = forward bend in narrow legs extension; SLJ = standing long jump; 20 m = 20-m run test; BTLP = medicine ball throwing from lying position; LBLP = lifting body from lying position; LBS = lifting body-short; SQ = squats.

The results of the agility tests showed very small, but significant superiority of urban male students (Table 6). The mean differences in results of the three tested groups were not great (Table 5). In the test side steps (SIDE STEP), the range of results was about 0.6 s, and in the figure eight with bending (F8) and shuttle-run (SR), the differences were less than 0.5 s.

Urban male students were significantly more flexible (Table 6) in the lower back and back thigh (in two out of three tests) than their peers in rural (BFLE, $p = 0.000$; BFNLE, $p = 0.000$) and rural–urban areas (BFLE, $p = 0.017$; BFNLE, $p = 0.000$). Rural–urban male students performed better in forward bend on a bench (BFB, $p = 0.000$)

The explosive strength of lower extremities sprint-type (20 m) was significantly better (Table 6) for urban male students than for their peers from rural ($p = 0.008$) and rural–urban areas ($p = 0.000$), whereas in other types of explosive strength, no significant differences were observed. Urban male students had better repetitive strength (Table 6) of front body (LBLP, LBS) and lower extremities (SQ) than rural–urban male students (LBLP, $p = 0.000$; LBS, $p = 0.006$; SQ, $p = 0.008$). Significantly, the worst results were from students in rural–urban areas, in the lifting body from lying position

(LBLP) and lifting body-short (LBS) test. They had achieved about 3 fewer repetitions and about 4 fewer squats (SQ) than their peers from rural (LBLP, $p = 0.001$; LBS, $p = 0.013$; SQ, $p = 0.018$) and urban areas (LBLP, $p = 0.000$; LBS, $p = 0.006$; SQ, $p = 0.008$).

The ANOVA (Table 7) showed significant differences among the three tested groups of female students in all physical fitness tests, except in forward bend on a bench (BFB, $p = 0.135$) used for assessment of flexibility. In addition, rural female students achieved slightly better results in coordination tests (Table 8), polygon reverse (PR) and polygon turn (PT), compared to their peers from rural–urban (PR, $p = 0 .000$; PT, $p = 0.000$) and urban areas (PR, $p = 0.000$; PT, $p = 0.000$). Female urban students performed better in ball rolling with nondominant hand (ROLLING), with a difference of less than 1 s compared to rural ($p = 0.000$) and rural–urban ($p = 0.001$) female students.

The results of the agility tests showed very small, but significant superiority of urban female students (Table 8). The mean difference in results of the three tested groups was not significant (Table 7). Results ranged in all tests of agility from an equal value in the figure eight with bending test (F8) to 0.3 s in the side steps test (SIDE STEP). Female students from rural–urban areas achieved the weakest results in all tests (Table 8).

Urban female students are significantly more flexible (Table 8) in the lower back and back thigh (in two out of three tests) than their peers in rural (BFLE, $p = 0.000$; BFNLE, $p = 0.000$) and rural–urban areas (BFLE, $p = 0.000$; BFNLE, $p = 0.000$). Urban female students were significantly better in all three tests of explosive strength than their peers in rural (SLJ, $p = 0.000$; 20 m, $p = 0.031$; BTLP, $p = 0.000$) and rural–urban areas (SLJ, $p = 0.000$; 20 m, $p = 0.000$; BTLP, $p = 0.000$).

Female students from rural–urban areas had the poorest results in tests of repetitive strength of the front body and lower extremities compared to their peers from rural (LBLP, $p = 0.000$; LBS, $p = 0.000$; SQ, $p = .006$) and urban areas (LBLP, $p = 0.000$; LBS, $p = 0.000$). Although a significant advantage is on the side of the rural female students compared to the urban female students in the tests lifting body from lying position and squats (LBLP, $p = 0.006$; SQ, $p = 0.000$), the presented descriptive indicators (Table 8) provide evidence that those differences are small. In both tests, the female students reached in 1 min only, 1 repetition more.

Discussion and Conclusion

Research shows that children's motor performance tends to lag behind their physical development (Findak et al., 1996; Kuznjecova, 1985; Tokmakidis & Kasambalis, 2006). This information highlights that children are born with relatively large motor potential. However, the potential diminishes because of a number of exogenous factors (Findak et al., 1996; Jureša et al., 2000; Kuznjecova, 1985) and is primarily due to hypokinesis as a synonym of the modern way of living (Jureša et al., 2000; Katić, Jozefina, & Mirjana, 2012; Uthman & Aremu, 2008). This is evidenced in the results of research showing a generational trend in the increase of subcutaneous adipose tissue, real muscle mass reduction, a decrease of functional and motor abilities, and an increase of various psychological disorders, which are the direct indicators of disrupted health in early childhood due to lack of movement (Findak et al., 1996; Hrabal, 1989; Mraković, 1994; Uthman & Aremu, 2008). This research indicates that urban female and male students in the Republic of Croatia are taller than their peers from rural–urban and rural areas, and the differences in body weight were not significant.

The results of monitoring nutritional conditions of school children aged 7–15 indicated that 69.5% of children had normal weight, 11% were overweight, 5.5% were obese, and only about 1% were underweight (Antonić Degač, Kaić-Rak, Mesaroš-Kanjski, Petrović, & Capak, 2004). As it is in the adult population, an upward trend of obesity prevalence was observed, particularly in urban areas where the number of obese children during the last 5–10 years has almost doubled (Croatian Institute for Public Health, 2003, 2004, 2005). Data indicate that besides improper nutrition, the lack of physical activity of children in certain urban areas contributes to the rise in obesity. This is due to not only bad habits but also the limited space for outdoor playing, such as the lack of playgrounds and sports equipment to which children have access after school hours. Researchers have found that only 33% of 11–12-year-old children attain the recommended levels of physical activity per day (Kuzman, Pejnović, Franelić, & Pavić-Šimetin, 2004).

Data from this research indicate that male and female students from highly urban areas have the lowest values of body fat percentage (15.53% and 24.87%), which are different from data in similar research (Felton et al., 2002; Ozdirenç et al., 2005; Peña Reyes et al., 2003; Tsimeas et al., 2005; Tognarelli et al., 2004). These values may determine how lifestyle and nutrition in rural areas have changed. Namely, the introduction of mechanization and lower need for physical work on farms, while retaining nutritional habits, including high calorie meals, is a possible reason of the observed state.

Furthermore, in the results of this research, male and female students from highly urban areas generally achieved better results than their peers from rural–urban or rural areas. Similar research indicates that students from rural areas have an improved motor potential (Felton et al., 2002; Medved, Mišigoj-Duraković, Matković, & Pavičić, 1989; Ozdirenç et al., 2005; Peña Reyes et al., 2003; Tognarelli et al., 2004; Tsimeas et al., 2005). This study, however, showed weaker results of rural students in tests for assessing the motor skills compared to their peers from mixed rural–urban or urban Croatian regions.

Physical inactivity causes numerous problems in the health status of individuals. In general, students' health and fitness level characteristics are highly related to quality of life (Seefeldt, Malina, & Clark, 2002). Recent data are becoming more alarming. Considering today's sedentary way of life (Seefeldt et al., 2002), urban students spend more time in front of the television compared to their peers from rural areas (Ruel et al., 1998). Rural areas offer greater available outdoor spaces, offer an opportunity for children to stay outdoors longer, and provide them freedom to move and play. However, a consequence of modernization and urbanization is increasingly affecting the rural areas, and it should not be surprising that students from rural areas are spending more and more time at home, watching TV and playing computer games. All this leads to a reduced level of physical exercise and thus to falling results of their fitness level characteristics.

The results of this study suggest that there are differences in children's health-related physical fitness profiles depending on the rural–urban characteristics. Urban male students had better results in tests for the assessment of agility, flexibility, explosive strength, and repetitive strength than rural male students. The urban female students were more successful in tests of agility, flexibility, and explosive strength than their peers from rural areas, who performed better in coordination and repetitive strength tests. The proficiency of urban children in most areas of health-related physical fitness may be due to the availability of school physical education and sports programs.

Collected information about the level of fitness level characteristics of male and female students of the middle school age in the Republic of Croatia represents a first step in designing intervention measures aimed to improve the health and availability of health options for rural and urban students. Researching the differences in fitness level characteristics according to the size of settlements can inform instruction in physical education and programs, physical activity choices, and curricular decisions for this student population. These changes in curriculum and designed interventions may have positive effects and increase student motivation and health outcomes. There is a need to further research the differences in the settlements in Croatia and motor differences that may occur.

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