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Differences between Health-Related Physical Fitness Profiles of Croatian Children in Urban and Rural Areas

Tihana Ujević[1], Goran Sporiš[1], Zoran Milanović[2], Saša Pantelić[2] and Boris Neljak[1]

[1] University of Zagreb, Faculty of Kinesiology, Zagreb, Croatia
[2] University of Niš, Faculty of Sport and Physical Education, Niš, Serbia

A B S T R A C T

Information about the regional distribution of health-related physical fitness status is necessary in order to tailor public health interventions, and due to a number of behavioral health risks caused by the increasing sedentary lifestyle. This study aimed to find differences between Croatian children's health-related physical fitness profiles in urban and rural areas. The sample for this study consisted of 2431 fifth-grade students (1248 boys and 1183 girls) from urban und rural areas of Croatia. The mean age of participants was 11.3±6.1 years. The differences between the health-related physical fitness of school children from urban and rural areas was computed using series of univariant analysis of variance and canonical discriminant analysis. The reliability of the tests was determined by Cronbach's alpha coefficients. Urban boys and girls significantly differ in body height from rural boys and girls. Body mass index and body fat percentage are slightly higher in the urban boys and girls but they do not differ significantly. Urban children perform significantly better in the 20 m dash, standing long jump and timed sit-ups. Urban and rural boys and girls do not differ significantly in the flexibility. This study determined if selected levels of urbanization affected the physical fitness status of children in Croatia. The results suggest that the differences in children's health-related physical fitness profiles are due to the level of urbanization.

Key words: *physical fitness, health-related, urban* versus *rural, school children*

Introduction

Physical inactivity is a serious, growing health problem. A lot of research[1] has been carried out in an effort to emphasize the importance of physical fitness, physical activity and health indices. Nevertheless, there is an increasing prevalence of sedentary lifestyle in spite of the known benefits of physical activity for the health status. A lifestyle of regular physical activity presumably contributes to a more efficient functioning of various systems, weight maintenance, reduced risk of mortality[2] and overall improvement of quality of life[3]. An environment that limits physical activity has been implicated as a major contributing factor in the obesity epidemic[1,4–6]. The modern attitude in public health considers physical activity and physical fitness as factors that influence on one's health during childhood and adolescence. This continues into and throughout adulthood affecting the well-being of the individuals and populations[7].

Bouchard and Shepard[3] proposed a conceptual approach to the complex relationship between physical activity, fitness and health. Their health-related fitness refers to the state of physical and physiological characteristics that define the risk levels for the premature development of diseases presenting a relationship with a sedentary mode of life. The current emphasis in physical fitness has shifted from performance-related to health-related indicators. Health-related physical fitness has been viewed as a narrower concept focusing on the aspects of fitness that are related to day-to-day functioning and health maintenance[8]. The concept of health-related fitness is operationalized as a composite of cardiorespiratory endurance, musculoskeletal function of the lower trunk (abdominal muscular strenght and endurance and lower-back/upper thigh flexibility) and body composition, specifically adiposity[9]. Also, besides this muscular, motor

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and cardiorespitatory component, the health-related fitness includes a morphological (body mass for height, body composition, subcutaneous fat distribution, abdominal visceral fat, and bone density) and metabolic (glucose tolerance, insulin sensitivity, lipid and lipoprotein metabolism, substrate oxidation characteristics) component[3]. Although BMI and body fat percentage are not measures of physical fitness *per se*, they significantly affect the physical fitness of children[10] and constitute a component of physical fitness, which is why they are included in this study as health-related physical fitness variables.

Many factors are associated with adopting and maintaining a physically active lifestyle, such as socioeconomic status, cultural influences, environmental factors and health status[11,12]. Information about the regional distribution of health physical fitness status is necessary in order to tailor public health interventions, because a number of behavioral health risks are established in late childhood and early adolesence, including sedentary behavior and lack of strenuous exercise[13,14]. This study aims to find differences between children's health physical fitness profiles in urban and rural areas, if there are any.

Methods

Participants

The sample for this study consisted of 2431 fifth-grade pupils (boys=1248, girls=1183) from urban and rural areas of Croatia. 43 schools from rural and 30 schools from urban area participated in the present study. The schools were selected from various geographical areas and depending on their level of urbanization. The data were collected in period from February until the end of April of year 2009. The mean age of participants was 11.3±6.1 years. Prior to the participation in the study, a written informed consent was obtained from every participant's parent and a permission to conduct the study from the school principals. This paper states the results of a larger study with the aim of validating tests and measurements for assesing kinanthropometric characteristics of school children in Croatia.

Procedures

Anthropometric measurements

Standing height 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 fat percentage (Body fat %) and body mass index (BMI) were used as indicators of children's body composition. Weight and body fat percentage were measured to the nearest 0.1 kg by applying a bio-impedance analysis test and using portable digital scales (Omron BF500 Body composition monitor). The measurements were made while the children were wearing light clothes and no shoes. BMI was calculated as weight in kilograms divided by the square of height in meters (BMI=kg/m^2).

Physical fitness tests

The AAHPERD[9] test battery designed for the assessment of health-related physical fitness in children was used as a guidance in determining our test battery with slight modifications in consolidation with the Eurofit test battery[14,15]. Five components of physical fitness were tested (four motor and one cardiovascular health-related fitness test). These included: movement speed – 20-meter dash; explosive power – standing long jump; lower back/upper thigh flexibility – sit and reach; abdominal strength and endurance – dynamic sit-ups (number completed in 60 seconds); and cardiorespiratory endurance – distance run.

The 20-meter dash was performed from the standing start position. The test measured the time elapsed to the nearest 0.1 second from the starting signal to crossing the finish line. Three trials were administrated alternating with the resting pause. The mean value was calculated and included in the analysis. This test measured the explosive power of the lower extremities, which indicates the ability of maximum movement speed.

The standing long jump (SLJ), as a measurement of explosive power, was measured to the nearest cm as the distance from the standing start to the point of landing heels. A preparatory crouch before take-off was permitted. Three trials were administered and the mean value was included in the analysis.

The sit and reach (SAR) measured the distance of the performed stretch to the nearest cm. Before the test, the shoes were removed and the subjects were instructed to slowly reach forward with their knees fully extended as far as possible with palms facing downward. This test measures flexibility in the lower back and upper thighs. Three trials were administrated and the mean value was taken in the analysis.

For the sit-ups the maximum number of sit-ups achieved in 60 seconds was recorded. The subjects were instructed to keep their arms across the chest while curling up to a sitting position until their elbows touched their thighs. This test measures abdominal strength and endurance. One trial was given.

A distance run (800 meters for the boys and 600 meters for the girls) as the time elapsed to the nearest second from the starting signal to crossing the finish line. This test is for the asessesment of the cardiorespiratory endurance. The time necessary to cover the proposed distance was recorded in minutes and seconds. One trial was administrated.

Statistical Analysis

A data analysis was conducted using the Statistical Package for Social Sciences (v18.0, SPSS Inc., Chicago, IL). The descriptive statistics were computed for all the experimental data and separately for the rural and urban subgroups and gender, for all the morphological and motor variables (mean, standard deviation, range, skewness and kurtosis). In addition, the Kolmogorov-Smirnov test was used for testing the normality of distribution before

further analysis. Cronbach's alpha reliability coefficients (α) were used to determine the between-subjects reliability of the tests. The differences between the children's physical fitness profiles from urban and rural areas, as well as the gender differences, were determined using the univariate analyses of variance and canonical discriminant analysis. The statistical significance was estimated at the level of $p<0.05$.

The reliability coefficients indicated an acceptable internal consistency for the tests: Height (α=0.99), Body mass (α=0.99), BMI (α=0.98), body fat % (α=0.98), Dash (α=0.95), SLJ (α=0.96), SAR (α=0.99).

Results

In Table 1 the descriptive statistics for urban and rural children is presented; arithmetic means (X), standard deviations (SD), range, the minimum (MIN) and the maximum (MAX) score, as well as the asymmetry (skewness) and the curvature (kurtosis) of the distribution of the results.

The results of the 20 m dash show small differences between urban and rural children. The contrasts in the results are more apparent in the standing long jump and timed sit-ups where urban children of both sexes performed better. The data from the sit and reach test show greater flexibility

TABLE 1
DESCRIPTIVE STATISTICS FOR BODY SIZE AND PHYSICAL FITNESS OF URBAN AND RURAL CHILDREN

Variable	Urban				Rural			
	$\overline{X}$±SD	Min	Max	Range	$\overline{X}$±SD	Min	Max	Range
Height (cm)	151.71±7.83	127.00	176.33	49.33	150.16±7.47	128.00	173.50	45.50
Body mass (kg)	45.26±10.91	24.10	95.83	71.73	44.34±11.13	26.73	91.03	64.30
BMI (kg/m^2)	20.36±3.61	7.00	33.40	26.40	20.13±3.88	11.00	33.70	22.70
Body fat (%)	20.62±9.53	4.00	50.57	46.57	20.00±9.74	5.00	52.00	47.00
Dash (sec)	4.10±0.43	2.93	5.95	3.02	4.20±0.47	3.12	6.19	3.07
SLJ (cm)	157.43±22.03	83.33	232.33	149.00	151.82±20.84	77.33	218.67	141.33
SAR (cm)	41.49±7.64	16.33	70.33	54.00	41.53±8.04	19.00	68.33	49.33
Sit-up (n/60sec)	37.30±9.40	5.50	71.00	65.50	35.54±8.52	11.00	72.00	61.00
800 m (sec)	255.32±3.95	144.00	544.00	400.00	267.38±3.92	159.00	555.00	396.00
600 m (sec)	208.24±51.32	114.00	437.00	323.00	218.47±64.88	117.00	434.00	317.00

BMI – Body mass index, Dash – 20-meter dash, SLJ – standing long jump, SAR – sit and reach, Sit-up – number of sit-ups completed in 60 seconds, 800 m – distance run, 600 m – distance run

TABLE 2
MEANS AND STANDARD DEVIATIONS FOR BODY SIZE AND PHYSICAL FITNESS OF URBAN AND RURAL CHILDREN WITHIN THE GENDER

Variable	Males		Females	
	Urban	Rural	Urban	Rural
	$\overline{X}$±SD	$\overline{X}$±SD	$\overline{X}$±SD	$\overline{X}$±SD
Height (cm)	150.93±7.51	152.46±8.06	149.14±7.22	151.29±7.59
Body mass (kg)	44.78±10.75	45.73±11.04	43.72±10.56	44.98±11.66
BMI (kg/m^2)	21.21±3.43	19.81±3.61	20.82±3.57	19.65±4.02
Body fat (%)	16.68±8.29	23.18±9.4	15.77±7.81	23.01±9.88
Dash (sec)	4.03±0.39	4.17±0.45	4.07±0.40	4.33±0.50
SLJ (cm)	161.84±21.33	153.38±21.91	155.99±19.40	147.52±21.42
SAR (cm)	39.81±6.99	43.04±7.89	40.02±7.74	43.09±8.06
Sit-up (n/60sec)	38.82±9.57	35.91±9.02	37.69±8.63	33.36±7.83
800 m (sec)	248.41±51.02	265.61±69.25	–	–
600 m (sec)	–	–	207.69±46.93	220.31±69.51

BMI – Body mass index, Dash – 20-meter dash, SLJ – standing long jump, SAR – sit and reach, Sit-up – number of sit-ups completed in 60 seconds, 800 m – distance run, 600 m – distance run

in the lower back and upper thigh for the urban boys and girls. The rural boys and girls showed better results in the distance run. Table 2 presents the mean values and standard deviations within the gender category.

The results of the univariate analysis of variance (ANOVA) of the anthropometric and health-related physical fitness variables of urban and rural children are summarized in Table 3. Urban boys and girls significantly differ in body height. BMI and body fat percentage are slightly higher in the urban boys and girls but they do not differ significantly. The urban children performed significantly better in the 20 m dash, standing long jump and timed sit-ups. The urban and rural boys and girls do not differ significantly in the flexibility.

TABLE 3
RESULTS OF THE ANALYSES OF VARIANCE OF THE ANTHROPOMETRIC AND HEALTH-RELATED PHYSICAL FITNESS VARIABLES OF URBAN AND RURAL CHILDREN

Variable	Urban-Rural Difference	
	F	p
Total		
Height	16.78	0
Body mass	2.91	0.09
BMI	1.25	0.26
Body fat	1.40	0.24
Dash	16.46	0.00
SLJ	26.94	0.00
SAR	0.02	0.90
Sit-up	16.18	0.00
Males		
Height	12.45	0.00
Body mass	2.03	0.16
BMI	1.65	0.20
Body fat	1.69	0.19
Dash	2.09	0.15
SLJ	15.93	0.00
SAR	0.18	0.67
Sit-up	3.21	0.07
800 m	10.50	0.00
Females		
Height	13.12	0.00
Body mass	3.11	0.11
BMI	1.321	0.10
Body fat	1.45	0.21
Dash	2.33	0.34
SLJ	14.57	0.00
SAR	0.23	0.44
Sit-up	3.15	0.03
600 m	11.49	0.00

BMI – Body mass index, Dash – 20-meter dash, SLJ – standing long jump, SAR – sit and reach, Sit-up – number of sit-ups completed in 60 seconds, 800 m – distance run, 600 m – distance run, F – F-test value, p – level of significance

A canonical discriminant analysis determined one canonical discriminant function between the urban and rural children (χ^2=59.996, df=8, p<0.00). The variables that influenced the differences on this discriminant function are Height (0.70), SLJ (0.63), Sit upps (0.37), Body mass (0.35), Dash (–0.35), SAR (0.32), body fat percentage (0.16), BMI (0.08).

Discussion

The data from Europe consistently indicate that children in urban areas have greater size and mature earlier than their peers in rural areas, and in many countries the urban–rural differences persist in adults[17]. The size advantage is attributed to the beneficial changes in public health and nutrition and, in general, to the living conditions associated with urbanization[18]. Hence, the size advantage commonly observed in urban children might also be reflected in the better levels of physical fitness.

It would be interesting to compare the obtained results with the available information from other parts of the world. However, this should be carried out with considerable caution as the information may differ due to the differences in the test design, environmental conditions and motivation. Plus, this may also be caused by the differences in the samples' body size, secular trends, maturity, general health and socioeconomic status[8].

The evidence from Oxaca, Mexico study suggests that urban children performed better in the explosive power (standing long jump) and abdominal strength and endurance (timed sit-ups). The younger rural children and older urban girls performed better in the endurance task (distance run- 8 minutes grades 1–3, 12 minutes grades 4–6), whereas older rural and urban boys did not differ[18].

In contrast, a Turkish study reports, among other things, that no significant differences were found in the cardiopulmonary and motor fitness between the urban and rural group, but the flexibility (SAR and side bending) and muscle endurance (dynamic sit-ups) were significantly higher in the rural group[19].

This study has several limitations. An individual's level of health-related fitness is a consequence of the natural process of growth and maturation, in addition to her/his lifetime exposure to physical activity and current physical activity. The general pattern of results from the correlational studies of physical activity and health-related physical fitness, using a variety of indicators within each domain, indicates a significant but weak to moderate relationship[20]. This suggests that factors other than physical activity exert a significant influence on the health-related physical fitness of children and youth. These factors are probably rooted in the biological and behavioral domains of changes associated with normal growth, maturation, and development from childhood through adolescence.

Conclusion

This study determined if the selected levels of urbanization characterized by geographic differences affect the physical fitness status of children in Croatia. The results

suggest that there are differences in children's health-related physical fitness profiles depending on the level of urbanization. Namely, the children from urban areas had better results in the 20 m dash, standing long jump and timed sit-ups than the rural children, although the differences were small to moderate. In the distance run the rural cildren showed better results. This can be attributed to the greater levels of habitual physical activity among rural children, specifically walking relatively longer distances than urban children, who have access to all kinds of public transport. Also, the proficiency of urban children in all other areas of health-related physical fitness is due to the availability of the school physical education and sport programs.

Therefore, there is a need for further longitudinal study of health-related physical fitness that includes indicators of growth (body size and composition), biological maturation (timing of the growth spurt and/or sexual maturation), and development (behavioral parameters).

This study was conducted in association with 158 physical education teachers from elementary and high schools, who were engaged in research protocol. It produced a great amount of practical benefits for physical education teachers who participated because of their direct involvement in the first two of three stages of the study (staff education and field measuring).

Now we would like to attract larger audience and emphasize the importance of physical fitness and health indices on school health practitioners who can utilize this information and influence on children's health during childhood and adolescence.

The presented data can inform about the different regional distribution of health physical fitness status in Croatia and encourage other researches for similar studies in order to tailor public health interventions, if they are needed.

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REFERENCES

1. PARIZKOVA J, Coll Antropol, 36 (2012) 23. — 2. ERIKSSEN G, LIESTÖL K, BJÖRNHOLT J, THAULOW E, SANDVIK L, ERIKSSEN J, Lancet, 352 (1998) 759. — 3. BOUCHARD C, SHEPHARD RJ, Physical activity, fitness and health: The model and key concepts. In: BOUCHARD C, SHEPHARD RJ, STEPHENS T (Eds) Physical activity, fitness and health (Human Kinetics, IL, 1994). — 4. HILL JO, MELANSON FL, Med Sci Sports Exerc, 31 (1999) 515. — 5. JEFFERY RW, UTTER J, Obes Res, 11 (2003) 12. — 6. JOENS- MATRE RR, WELK GJ, CALABRO MA, RUSSEL DW, NICKLAY E, HENSLEY LD, J Rural Health, 24 (2008) 49. DOI: 10.1111/j.1748-0361.2008.00136.x. — 7. MALINA RM, Am J Hum Biol, 13 (2001) 162. — 8. PATE R, SHEPHARD R, Characteristics of physical fitness in youth. In: GISOLFI CV, LAMB DR (Eds) Perspectives in exercise science and sports medicine. Youth, exercise and sport (Benchmark Press, Indianapolis, 1989). — 9. AMERICAN ALLIANCE FOR HEALTH, PHYSICAL EDUCATION, RECREATION AND DANCE (AAHPERD), Technical Manual: Health Related Physical Fitness Reston (VA: AAHPERD, 1984). — 10. HUANG, YC, MALINA RM, Med Sci Sports Exerc, 39 (2007) 701. DOI: 10.1249/mss.0b013e31802f0512. — 11. SEEFELDT V, MALINA RM, CLARCK MA, Sports Med, 32 (2002) 143. — 12. PATE RR, DOWDA M, RESS JG, Am J Dis Child, 144 (1990) 1123. — 13. TELAMA R, YANG X, LAAKSO L, VIIKARI J, Am J Prev Med, 13 (1997) 317. — 14. KRISTJANSDOTTIR G, VILHJALMSSON R, Acta Paediatr, 90 (2001) 429. DOI: 10.1111/j.1651-2227.2001.tb00445.x. — 15. ADAM C, KLISSOURAS V, RAVASSOLO M, Eurofit. Handbook for the Eurofit test of physical fitness (Council of Europe: Committee for the Development of Sport, Rome, 1988). — 16. OJA P, TUXWORTH B, Eurofit for adults. Assessment of health-related fitness (Council of Europe-UKK Institute, Tampere, 1995). — 17. BIELICKI T, Physical growth as a measure of economic well-being of populations: the twentieth century. In: FALKNER F, TANNER JM (Eds) Human growth. A comprehensive treatise (Plenum Press, New York, 1986). — 18. PENA REYES ME, KHENG TAN S, MALINA RM, Am J Hum Biol, 15 (2003) 800. DOI: 10.1080/03014460310001612792. — 19. ÖZDIRENÇ M, ÖZCAN A, AKIN F, GELECEK N, Pediatr Int, 47 (2005) 26. — 20. KATZMARZYK PT, MALINA RM, SONG TMK, BOUCHARD C, Med Sci Sports Exerc, 47 (1998) 709.

G. Sporiš

University of Zagreb, Faculty of Kinesiology, Horvaćanski zavoj 15, 10000 Zagreb, Croatia
e-mail: gsporis@kif.hr

RAZLIKE IZMEĐU FITNES PROFILA HRVATSKE DJECE URBANIH I RURALNIH SREDINA

S A Ž E T A K

Informacije o regionalnoj distribuciji fitnes profila je nužno za stvaranje adekvatnih intervencija u javno zdravlje, zbog činjenice da postoji vrlo veliki niz zdravstvenih rizika koji rastu zbog sedentarnog načina življenja. Cilj ovog istraživanja bio je utvrditi razlike između fitnes profila Hrvatske djece urbanih i ruralnih sredina. Uzorak se sastojao od 2431 učenika (1248) i učenica (1183) petih razreda osnovne škole iz urbanih i ruralnih sredina Republike Hrvatske. Prosječna dob učenika bila je 11,3±6,1 godinu. Razlike između fitnes profila školske djece urbanih i ruralnih sredina utvrđene su primjenom univarijantnih analiza varijanci i diskriminacijske analize. Pouzdanost mjernih instrumenata je utvrđena Cronbachovim koeficijentima. Učenici i učenice urbanih sredina značajno se razlikuju u visini od učenika i učenica ruralnih sredina. U mjerama indeksa tjelesne mase i postotka tjelesne masti, učenici i učenice urbanih sredina imaju nešto više, ali ne i statistički značajne vrijednosti od učenika i učenica ruralnih sredina. Učenici urbanih sredina postižu bolje rezultate u testovima sprint na 20 metara, skoku u dalj s mjesta i podizanja trupa. Ne postoje statistički značajne razlike u fleksibilnosti između djeca urbanih i ruralnih sredina. Ovim istraživanjem utvrđivalo se je li postoji utjecaj stupnja urbanizacije na fitnes profile učenika i učenica u Hrvatskoj. Rezultati su pokazali kako postoje razlike između fitnes profila učenika i učenica s obzirom na stupanj urbanizacije.