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PHYSICAL FITNESS OF 12-YEAR-OLD GIRLS FROM CAPITALS OF SERBIA AND SLOVENIA

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SUMMARY

Geographic variability of children fatness and fitness is important for understanding the effects of various distinct lifestyles of young people. The purpose of this study is to compare the physical fitness of girls in capitals of two western Balkan countries: Serbia and Slovenia. The cluster sample of 138 subjects consists of 12-year-old primary school girls from Belgrade and Ljubljana. All subjects were measured in the 2006/2007 academic year. Data from the Eurofit system were used in the analysis. A multivariate analysis of variance has shown that there are statistically significant ($p < 0.001$) differences between the countries for the entire set of tested motor and morphological variables. The girls from Ljubljana are more physically fit in comparison to girls from Belgrade despite there are negligible differences in body weight and BMI among them. Yet girls from both capitals have above-average cardiorespiratory fitness (20 m endurance shuttle-run) and lower-limb explosive strength (standing broad jump) compared to their counterparts from elsewhere in Europe (Ortega et al., 2011). Girls from Ljubljana scored around the 85th percentile of tests performance values, while Belgrade girls were in the 75th percentile in cardiorespiratory fitness and the 55th percentile in lower-limb explosive strength.

Key words: motor skills, body mass index, Eurofit, former Yugoslavia, geographic factor

INTRODUCTION

Depending on geographical, cultural and socio-economic origins, various distinctive lifestyles are being created. Nevertheless, the lives of young people in developed countries are today mostly characterized by the modern information era. In connection with the sheltering praxis of parents (restriction of children from access to public spaces, e.g. playing on city playgrounds, from walking alone in their own neighbourhood, from crossing the street by themselves), individualisation (children's incorrect impressions of their role in society) and permissive education, sedentary lifestyles are common among young people (Armstrong, 2007; Ferreira et al., 2006; Jurak, 2006; Strel, Kovač, & Jurak, 2007). According

to the findings of secular trend studies, it can be concluded that changes in the lifestyles of young people in developed countries are manifesting themselves in an increased skin fat (Olds, Ridley, & Tomkinson, 2007; Strel et al., 2007), a higher proportion of the overweight population (Currie et al., 2004; Lobstein & Frelut, 2003; Malina, 2007; Strauss & Pollack, 2001; Strel et al., 2007; Wedderkopp et al., 2004) and in the deterioration of their physical fitness, particularly endurance and strength (Beunen et al., 1992; Froberg & Andersen, 2010; Rychtecky, 2007; Strel et al., 2007; Tomkinson & Olds, 2007; Westerståhl, Barnekow-Bergkvist, & Jansson, 2005). Old et al. (2007) found out that increases in fatness alone explain less than half the observed decline in aerobic fitness performance.

Geographic variability of children fatness and fitness indicates a north-south gradient in the obesity levels (Livingstone, 2001; Lobstein & Frelut, 2003) and the aerobic performance of European children (Tomkinson, Olds, & Borms, 2007). The superior fitness of northern and central European children has been found in a few studies (Tomkinson et al., 2007; Shephard, 1966). Most interpretations of fitness differentials focus on climate, genetic and embedded socio-cultural differences.

There have been no recent studies to compare the physical fitness test performance of young people from different countries of the former Yugoslavia (western Balkans). Little is therefore known about the geographic variability of young people's physical fitness performances since the disintegration of the federation. In some other countries, which also have experienced significant social upheaval as a result of the collapse of communist regimes, research has conducted on geographic variability, even secular trends (i.e. Baltic states; Jürimäe & Jürimäe, 2000; Jürimäe, Volbekiene, Jürimäe, & Tomkinson, 2007). In Slovenia, there is a long tradition of monitoring paediatric physical fitness (data have been collected systematically on national representative samples since 1970; see Strel et al., 2007); in Serbia, such studies are performed occasionally (see Ivanić, 1996). Therefore, such comparison studies are needed.

PURPOSE

The former Yugoslavian countries have similar climate conditions, somewhat different socio-cultural backgrounds (Luthar & Pušnik, 2010) and economic standards (IMF, 2010), similar school systems, similar models of sport (Sever, Bednarik, & Šugman, 2000), with a diverse range of options for after school sports (especially sport clubs), and common genetic roots. The purpose of this study is therefore the first attempt since the disintegration in 1991 to identify some differences in physical fitness between children from Slovenia and Serbia.

PROCEDURES

Subjects

The cluster sample of 138 subjects (students from the same school grade) consists of 12-year-old girls from capitals of Serbia (Belgrade) and Slovenia (Ljubljana) from 10 different primary schools. Only healthy students who were not exempt from physical

education (PE) for health reasons were tested. All subjects participated in 3 × 45 min compulsory PE classes per week.

Testing procedures

Having fully informed the children and their parents about the aims of the study, its protocol and the possible hazards and discomforts related to the procedures used, written consent was obtained from the parents of all participants. Also, the children gave their verbal assent and were free to withdraw from the study at any time. The study protocols were approved by the Ethics Committees of the Faculty of Sport of the University of Ljubljana and Faculty of Sport and Physical Education of the University of Belgrade.

The tests were performed and scored using Eurofit protocols (Council of Europe, 1993). The data included two morphological and five motor tests (see Table 1). In addition to Eurofit, the backwards obstacle course test (described in Strel et al., 1997) was added to motor tests and BMI were calculated. The qualified personnel conducted the testing sessions, with testing held in the morning in primary schools as part of compulsory physical education classes. All students were measured in the 2006/2007 academic year. Testing in Serbia was conducted in the October–November period, while in Slovenia they were done in the May–June period. Testing procedures were standardized by running sessions for testing personnel prior to data collection, and routinely calibrating all testing equipment throughout the testing period. All subjects were familiar with the testing equipment.

The testing sessions were structured so that following a brief (≈10 min) warm-up tasks were randomly performed. The 20 m endurance shuttle run test was performed on a different day. Subjects were weighed barefoot in their shorts and T-shirts to the nearest 0.1 kg, with a medical balance scale; height was measured using a Martin metal anthropometer to the nearest 0.1 cm. In addition to the described tests, the subjects performed some other tests that are not presented in this work.

Data Entry and Treatment

All hard copy data were manually entered into a spreadsheet and checked for transcription errors, with corrections made where appropriate. The cut-off points for BMI were calculated from body height and weight according to the Cole classification (Cole, Bellizzi, Flegal, & Dietz, 2000). All endurance shuttle run scores were converted from the number of completed minutes to the speed at last completed minute by using the procedures of Tomkinson et al. (2003). Seven students with more than four missing test values were excluded from the analysis, while for 21 students, the missing values were computed using an EM algorithm. The data were complete for the remaining 127 students.

Data analysis

Basic parameters of the distribution of variables were calculated (mean, standard deviation). Multivariate analysis of variance (MANOVA) was used to test the differences

according to the country. The power of the concurrent influence of the country on the entire set of dependent variables was assessed with Wilks' lambda; its statistical significance was tested with Bartlett's V transformation. The amount of explained variance of the entire system of dependent variables was estimated with an adjusted R2 for the entire system of predictors (main effect – country) and with a partial η2 for individual predictors. Univariate tests were also carried out for each dependent variable separately: F-tests for the entire model, for its main effects and its interaction were applied. All analyses were performed using PASW Statistics 18 for Windows (SPSS Inc., Chicago, IL, USA).

RESULTS

Table 1. Test means and standard deviations.

	Country	
	Slovenia (N = 51)	Serbia (N = 87)
Age, year	12.85 ± 0.34	12.98 ± 0.22
Body height, cm	161.0 ± 5.94	163.7 ± 6.29
Body weight, kg	52.7 ± 12.52	54.9 ± 10.58
BMI, kg/m^2	20.3 ± 4.42	20.4 ± 3.43
Standing broad jump, cm (power)	170.4 ± 19.73	142.4 ± 21.77
Sit and reach, cm (flexibility)	25.1 ± 8.15	22.0 ± 5.93
Sit-ups in 30-second, n in 30 s (abdominal muscular endurance)	21.5 ± 4.78	20.9 ± 3.68
Obstacle course backwards, s (co-ordination of the whole body movement)	11.8 ± 2.81	13.8 ± 3.68
20 m endurance shuttle-run, km/h (cardio-respiratory endurance)	13.9 ± 1.47	13.2 ± 1.79

The basic parameters of the distribution of results (Table 1) display differences between the countries.

Girls from Serbia are taller and heavier than their counterparts from Slovenia; consequently, there are very small differences in BMI. 80.4% of girls in Slovenia and 74.7% of girls in Serbia have normal body weight, 15.7% of girls in Slovenia and 20.7% of girls in Serbia are overweight and 3.9% of girls in Slovenia and 4.6% of girls in Serbia are obese. Slovenian girls performed better than Serbian girls on all motor tests. Particularly large differences in test results are obtained in the standing broad jump and backwards obstacle course. The differences between the countries are statistically significant for the entire set of motor and morphological variables (Wilks' $\lambda = .614$, $F = 10.156$, $df = 8$, $p < 0.001$). The girls' country explains 38.6% of variance between the groups.

Table 2. Univariate ANOVA F-test for the full model and the proportion of explained variance.

	Mean Square	F	p	adj. R2
Body height	237.392	6.248	.014	.044
Body weight	151.474	1.180	.279	.009
BMI	.602	.041	.840	.000
Standing broad jump	25,188.068	56.893	< .001	.295
Sit and reach	309.751	6.642	.011	.047
Sit-ups in 30-second	9.644	.568	.452	.004
Obstacle course backwards	135.094	11.791	.001	.080
20 m endurance shuttle-run	17.780	6.283	.013	.044

Given the significance of the overall test, the univariate main effects were examined. Significant main effects for country are obtained (see the rightmost columns of Table 2) for body height, standing broad jump, sit and reach, obstacle course backwards and 20 m endurance shuttle-run. The most considerable effect is on standing broad jump, as it reaches almost 30% of the explained variance. Negligible interactions are in body weight, BMI and sit-ups.

DISCUSSION

The data of the present study demonstrated the differences in physical fitness of 12-year-old girls from Belgrade and Ljubljana. We have seen that girls from Ljubljana are more physically fit in comparison to girls from Belgrade despite similar body build and fatness, yet girls from both countries performed better then their counterparts from elswere in Europe.

The overview of physical fitness of European children from Tomkinson et al. (2007) confirmed the higher performance levels of young people from northern and central Europe. Data from Slovenia (classified in central Europe) and Serbia (classified in south-eastern Europe) were not included in this overview. A comparison of test results from our study with recent HELENA study (Ortega et al., 2011) indicates that girls from Ljubljana have cardiorespiratory fitness (20 m endurance shuttle-run) and lower-limb explosive strength (standing long jump) around the 85th percentile of tests performance values (P85) of their counterparts from Europe. Such good results were found also in other studies on Slovenian samples (Jurak, Kovač, & Strel, 2006; Kovač, Jurak, Strel, & Bednarik, 2003). In a few European countries, it has been noticed that performance of standing broad jump is decreasing (Bös, 2003; Rychtecký, 2007; Telama, Naul, Nupponen, Rychtecký, & Vuolle, 2002). Girls from Belgrade have cardiorespiratory fitness around the 75th percentile of tests performance values (P75), while lower-limb explosive strength around the 55th percentile of tests performance values (P55).

The differences among girls from Belgrade and Ljubljana in motor fitness cannot be explained with tested morphological characteristics since Belgrade girls are taller than Ljubljana girls and there are negligible differences in body weight and BMI. This is not so

unusual since the data about the influence of those characteristics on the performance of motor tests are contradictory. Body mass was found to be negatively connected with body movement (especially running capacity) in several studies (Cureton et al., 1991; Strel et al., 2007; Tomkinson & Olds, 2007; Wedderkopp et al., 2004), yet the data about the influence of body height on motor tests performance are contradictory (Jürimäe & Jürimäe, 2000; Mota et al., 2002).

Some other factors therefore influence on differences in physical fitness of selected age group of girls from capitals of Serbia and Slovenia. Olds, Tomkinson, Leger, & Cazorla (2006) found a relationship between climate and children's fitness performance but Slovenia and Serbia have similar climates. Furthermore, they have same genetic roots (Slavic); therefore, it seems likely that socio-cultural factors are important.

Limitations

There are limitations to our study and care should be taken in generalisation, since study was not performed on national representative samples, had limited number of morphological and motor variables and did not control for many important environmental and social factors influencing the physical fitness of children. We are aware that the differences between children physical fitness among countries could be result of different maturation level of children, but we were not able to determine the biological age of children from our data. Another uncontrolled factor could be conditions for PE in schools. We were also unable to gather the information on out-of-school physical activity of children. Also, we gathered no information on other social factor that could influence on physical activity. Slovenians have almost three times greater purchasing power than the Serbians (IMF, 2010). Overall wealth of the country could be an important factor, which ensures resources in schools and in the broader community in order to engage children in active lifestyles. Slovenia has a GDP per capita level of USD 24,417 while Serbia's is USD 5,809 (IMF, 2010). However, wealthy countries may offer more opportunities for sedentary pastimes and passive lifestyles. Therefore, no firm relationship between children's physical performance and gross indicators of economic status was found (Tomkinson et al., 2007).

CONCLUSIONS

This study is first attempt to gain knowledge about the variability of physical fitness performance of young people on the territory of former Yugoslavia (western Balkan region). We assume that this variability could be determined mostly by socio-cultural factors. To confirm this hypothesis, studies on different age and gender groups on national representative samples should be performed. Such studies could indicate similarities and differences of the physical fitness of young people from this region. Further investigations should also focus on comparisons of secular trend studies of children fitness and fatness in different countries of the former Yugoslavia, since it can be assumed that with disintegration, the socio-cultural differences between countries of former Yugoslavia territory have become larger.

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TĚLESNÁ ZDATNOST 12LETÝCH DÍVEK V HLAVNÍCH MĚSTECH SRBSKA A SLOVINSKA

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SOUHRN

Variabilita geografického rozložení tělesné zdatnosti a tělesného tuku u dětí je důležitá pro pochopení vlivu různých odlišných životních stylů mladých lidí. Cílem studie je srovnání tělesné zdatnosti dívek v hlavních městech Srbska – Bělehradu a Slovinska – Lublani. Vzorek 138 probandek byl složen z 12letých dívek základních škol z těchto měst. K analýze a srovnání byly použity motorické testy z Eurofit baterie. Všechna data byla získána ve školním roce 2006/2007. Vícerozměrná analýza rozptylu prokázala, že mezi soubory testovaných dívek existují v motorických a morfologických proměnných statisticky významné ($p < 0,001$) rozdíly. Dívky z Lublaně jsou ve srovnání s jejich vrstevnicemi z Bělehradu tělesně zdatnější, navzdory skutečnosti, že v tělesné hmotnosti a BMI byly rozdíly mezi nimi zanedbatelné. Děvčata z obou hlavních měst však mají nadprůměrnou kardiorespirační

zdatnost (20m vytrvalostní člunkový běh) i výbušnou sílu dolních končetin (skok do dálky z místa) ve srovnání s jejich protějšky z jiných evropských zemí (Ortega et al., 2011). Dívky z Lublaně dosahují 85. percentilu hodnot v testech výkonnosti, zatímco dívky z Bělehradu byly na úrovni 75. percentilu v kardiorespirační zdatnosti a na 55. percentilu ve výbušné síle dolních končetin.

Klíčová slova: pohybové dovednosti, BMI, Eurofit test, bývalá Jugoslávie, geografické faktory

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