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Physical Fitness of Rural Children Compared With Urban Children in North Cyprus: A Normative Study

Tinazci, Cevdet tinazcic@neu.edu.tr

Emiroglu, Osman osmanemir@yahoo.com

Run. Head: Physical Fitness of children in rural and urban areas

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Background: The aim of this study is to investigate the effects of environmental factors on physical fitness of rural and urban children. Methods: To reveal the differences between physical fitness of children living in urban and rural districts of Turkish Cypriot population, 3939 of 9-11 years old, male primary school children from 90 schools of North Cyprus were tested. Testing procedures were similar to the Eurofit tests. Results: The results showed that body mass index and skinfold thicknesses were higher in the urban children ($p<0.05$). Differences in cardiopulmonary and motor fitness were also found between groups. In addition, flexibility and muscle endurance were significantly higher in the rural children. Conclusion: The significantly lower flexibility, muscle endurance and strength of urban children may indicate lower habitual physical activity level.

Physical Fitness levels of children in rural and urban areas

Physical fitness is generally considered to be "the ability to perform daily tasks without fatigue". It includes several components: cardio respiratory fitness, muscular endurance, muscular strength, flexibility, coordination, and speed[3, 15].

Differences in mean height, weight and physical fitness levels of children belonging to different socio-economic strata and/or towns or villages occur in almost all developed as well as in developing countries, and also in North Cyprus.

Studies state that participation in physical activity during childhood can aid the development of motor abilities and lay the foundation for good health, especially cardiovascular health[16, 18]. Although some studies have shown that the physical fitness levels of children, in general, are not sufficient to promote optimal health, the health related benefits of physical activity are well known[16]. For example, regular physical activity decreases the risk of health problems, such as coronary heart disease, hypertension, and obesity. Participation in physical activity and sport can also promote social well-being, as well as mental health, among children and adolescents[6].

The results from fitness assessments can serve a variety of purposes. For example some studies revealed that, results from fitness tests can be utilized by teachers to increase the effectiveness of fitness activities that have been incorporated into the physical education program over a period of time. These fitness test scores are often reported as group means and may even be compared with the scores of students from other schools[10, 12].

Living in areas distinguished by population size can be associated with differences in inter alia, eating habits, access to sport facilities, and opportunities for

physical fitness activities. However, it is not entirely clear whether such factors can affect aspects of body composition and therefore, physical fitness[11]. Contradictory reports have also been published as to physical fitness parameters of children living in urban and rural settings. In some cases, no difference has been identified in a range of fitness and motor skill measures between children from urban and rural areas[9,11]. While some data indicate that urban children have more body fat than their rural counterparts, other data are in strong disagreement[11].

In literature it has been suggested that the distribution of children's physical fitness across geographic boundaries, such as rural-urban districts needs to be studied in different climate, economic and cultural context[19]. To our knowledge, there is a dearth of such data, especially on reference value, on Turkish Cypriot childrens. Also, in North Cyprus children's health complications of over-weight or low levels of physical fitness are delayed for many years. Therefore, comparisons are more interesting. There is no reference data on physical fitness of Turkish Cypriot children available as for regional or nationwide samples. Physicians, physical education teachers and sport coaches are groups potentially interested in such reference data.

Therefore, the aim of this study was to evaluate physical fitness levels of Turkish Cypriot children in relation to urban and rural districts.

METHODS

In 2005, a total of 4233 male 3rd, 4th and 5th grade children from all the schools of Ministry of Education and Culture in North Cyprus were invited to participate in the study. As a result, 3939 boys volunteered from 90 schools. Reasons for others not participating were illness, no parental permission or other causes. This sample represented 93.05% of all 3rd, 4th and 5th grade male students living in North Cyprus. 63 schools (n=3223) were situated in urban living areas and 27 schools (n=716) in rural living areas. The districts that students contributed to test were Lefkoşa, Güzelyurt, Girne, Magosa and İskele. Lefkoşa, Magosa and Girne represent urban living areas, while Güzelyurt and İskele represents rural living areas.

The mean age of the subjects was 9.02, 10.06 and 11.04 years for grades 3rd, 4th and 5th, respectively. They are hereafter referred to as 9, 10 and 11 years old, respectively. Those who contributed continued to receive their usual physical education during the study. Measurements took place at four specially arranged test centers, with the same trained staff performing the tests. Before the data collection, parents of each participating child gave a written consent. The study was completed within three months (1 March- 15 July 2005).

Anthropometric measurements

Height (HG) and body weight (BW) of subjects dressed in light clothes, without shoes were recorded, using a calibrated standard scale (Tanita TBF-350, Japan) and stadiometer (Holtain, UK). Height was recorded in centimeters while body mass was recorded in kilograms, with one decimal. Body mass index (BMI) was calculated as body

mass in kilograms divided by height in meters square (kg x m $^{-2}$). Sum of skinfold thickness (SKF) was measured using Holtain calipers (UK) at four sites: biceps, triceps, suprailiac and subscapula on the dominant side of the body.

Physical Fitness Tests

Physical fitness was assessed using the European physical fitness test battery (EUROFIT) [13] containing 8 tests that measure different components of fitness: Flamingo balance (general balance), plate tapping (coordination and speed of limb movement), sit and reach (flexibility), standing-broad jump (explosive strength), handgrip strength (static strength), sit-ups (trunk strength and endurance), 10*5m shuttle run (speed and agility), and 20m endurance shuttle run (cardiorespiratory endurance). This test battery is a reliable and valid instrument to measure physical fitness in children and is a commonly used test battery in Europe[13].

All the tests were conducted in this order;

* Flamingo balance Test (FLB): Balancing for 60s on one leg as long as possible while standing on the preferred foot. If the subject lost his balance, the clock was stopped and started again when the subject did the next ascent. The number of ascents was recorded.

* Plate Tapping Test (PLT): Rapid tapping of two plates alternately with the preferred hand. He performed 25 cycles for two times and better result is the score.

* Sit and Reach (SAR): Reaching as far as possible from a sitting position. Research assistants recorded farthest reach to the nearest cm.

* Standing Broad Jump (SBJ): Jumping for distance from a standing start. Three attempts were allowed. The longest distance jumped was recorded.

* Hand-Grip (HGR): Squeezing a calibrated hand dynamometer as forcefully as possible with the dominant hand. Grip size was adjusted to fit the subjects' hand size. Three attempts were given and results were recorded in kilograms (kg) with one decimal. The best trial was recorded.

* Sit-ups (SUP): Maximum number of sit ups achivied in 30 seconds.

*10 x 5 m Shuttle Run (ST): Subject performed 10 shuttles over 5 metres in a lane that is 1m wide. He performed 10x5m run test for two times and best result is recorded in second.

* 20m Shuttle Run (SRT): This was assessed by the 20 m shuttle run test[14]. Subjects start running up and down a 20 m track at an initial speed of 8 km/h which gets progressively faster (0.5 km/h every minute), in accordance with a pace dictated by a sound signal on an audio tape. Subjects are instructed to keep pace with signals as long as possible. The score of test was recorded as a lap or shuttle was completed.

Data analysis: Descriptive statistics were performed for all parameters. All data were not assessed to be normally distributed (Z: 6.35, $p<0.05$). Differences between rural and urban areas were identified by Mann-Whitney U test. The SPSS 12.0 statistical package was used, and significance was set at $p<0.05$.

RESULTS

Mean (X) and Z values of anthropometric measurements and physical fitness of 3rd , 4th, and 5th grade male students was shown in table 1,2 and 3, accordingly.

Although body fat (BMI and SKF) was found to be higher than in urban children when compared with those living in rural, areas which is universally regarded as acceptable for boys of this age, no statistical difference was found between our urban and rural children ($p>0.05$).

Z scores revealed that SBJ ($p<0.05$) was significantly higher in boys living in urban settings compared to their rural counterparts. PLT was found to be significantly better ($p<0.05$) in the urban children while ST was found to be better in rural boys ($p<0.05$). Unlike urban subjects HGR was significantly higher ($p<0.05$) in the rural subjects (Table 1).

As is shown in table 2, there were significant differences between urban and rural boys.Tukey tests revealed that SRT ($p<0.05$) was significantly higher in boys living in rural settings compared to their urban counterparts and SUP was found to be significantly better ($p<0.05$) in the urban children, whereas HGR was significantly higher ($p<0.05$) in the rural subjects.

For 11 year old boys, BMI was significantly higher for those living in urban settings ($p<0.05$). Z scores revealed that SKF and FIB ($p<0.05$) was significantly higher in boys living in urban settings compared to their rural counterparts, whereas SRT was found to be significantly better ($p<0.05$) and HGR, SBJ and SUP was significantly higher ($p<0.05$) in the rural subjects (Table 3).

Conclusion

The main aim of the study was to examine potential differences in physical fitness of Turkish Cypriot children living in both urban and rural settings. This study gives reference values on body mass, body weight, BMI and some physical performance tests of Turkish Cypriot children. Recent study stated that physical activity is correlated with a number of factors including demography, psychology, society and environment[17]. In this study only the environmental factor was analysed.

Anthropometric characteristics increase with age in both living areas. As for FLB, SAR, PLT and ST performance improved with age, but no difference was identified between living areas except SKF. In the SBJ, SUP, SRT and HGR performance improved with age in both groups and differences were noted between living areas.

To our knowledge, this is the first study which examined selected physical fitness components in urban and rural children using nationwide approach to 3rd-5th grade school boys. Nevertheless, the present data do not agree with published reports advocating that the place of residence indeed affects children's fitness.

Reference data from this study is in agrement with evidence from a study conducted in Poland as it claims that rural children are fitter than their urban counterparts[19]. However, it is in disagreement with evidence from a study conducted in US, which state that US urban children have superior fitness levels compared to those living in rural areas[20]. Methodological differences, such as the criterion used to define rural versus urban areas, variability in tests used to assess fitness levels, and statistical analysis may account for the discrepancies in the literature [1,7,8]. In another study

conducted in Mexico it has been found that children living in urban parts were significantly taller and heavier than rural children[2], however in this study there was no significant difference between rural and urban children as for height and weight. In the study conducted in Mexico, absolute grip strength did not consistently differ between rural and urban children, whereas in this study HGR was found to be better in rural children[2] . Explosive power (standing long jump), abdominal strength and endurance were better in urban than rural children in study conducted in Mexico, while HGR, SBJ and SUP were better in rural than in urban children in our study.

A number of studies stated that there were major increase in most of the fitness parameters of 9-11 years and 11-12 years respectively during their maximum spurt in height and weight[3]. Similar observations were revealed in this study.

One potentially important factor behind the lack of statistical differences in physical fitness of boys living in urban and rural environments may be the National Turkish Cypriot physical education (PE) programmes. Irrespective of schools' size or location, State Secondary School PE programmes are common and compulsory throughout North Cyprus. However, it has recently been found that these programmes are insufficient to bring about expected beneficial adaptations in selected health related fitness parameters, such as maximal oxygen intake. These findings are also in line with existing data from other countries questioning the validity of school PE classes and partly contradict with the assertion that school PE lessons should fulfill most of the fitness needs of children[16]. The emerging trend towards urbanization of North Cyprus rural life may be an additional explanation for the present findings.

Physical Fitness levels of children in rural and urban areas

The lack of statistical differences between children living in urban and rural environments may be supported by the well established genetic basis of certain fitness components. Recent study stated that aerobic fitness in children serves just as a proxy indicator of physical activity participation[5]. However, low aerobic fitness reduces muscular fat oxidation capacity, which may decrease tolerance of dietary fat and increase adiposity[4, 10]. For the shuttle run, performance improved with age, and significant differences were found between living areas except 3rd grade children. Also BMI values of rural children were lower than those of urban children.

The main findings were that only five out of the 12 of the 3rd grade children (9 years old), three out of the 12 of the 4th grade children (10 yeras old) and seven out of the 12 of the 5th grade children (11 years old) variables were significantly different between urban and rural children and that in some cases these differences were not uniformly distributed to children living in either urban or rural environments. It is, therefore reasonable to suggest that for Turkish Cypriot children change in age and the place of residence has no clear impact on physical fitness as studied herein, although urban versus rural and age differences are present.

The few variables that were found significantly different between rural and urban children could also be due to the fact that in North Cyprus the rural living standards have reached to the urban living style. The emerging trend towards urbanisation of North Cyprus rural life may be an additional explanation for the

present findings. A major positive aspect of the present study is the ability to assess all the male children who live in rural and urban districts because all the geographical locations and ethnic distribution of the sample strengthen the study. Although the assessment of some of the measures is questionable about health (flamingo balance and plate tapping test), studying a widely used battery enhances generalability of the findings.

One major weakness may be the lack of other similar assessments in North Cyprus in order to compare the results. However, with this study we could reveal the norms of physical fitness levels of 9, 10 and 11 years old boys who live in rural and urban districts. Another weakness is, this study was limited to male children in North Cyprus, female children were excluded because of lack of time (maturation effect), experienced people and financial support. Another limitation is, unequal number of subjects between districts. As in all ages the number of urban subjects was higher than the rural ones.

In conclusion and within the study's limitations, it is suggested that the place of residence has no clear impact on physical fitness of 9-11 year old Turkish Cypriot male school children and also the significantly lower flexibility, muscle endurance and strength of urban children may indicate lower habitual physical activity level in urban children.

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Table 1) Mean and Z values for anthropometric and physical fitness in 3rd grade (9 years old) students according to living areas

	R		U		Z		R		U		Z		R		U		Z
	X	SD	X	SD			X	SD	X	SD			X	SD	X	SD	
HG (cm)	132	.05	132	.05	.59	BW(kg)	30.6	6.5	30.9	6.7	.45	FIB(asc)	10.4	4.5	10.9	4.5	1.7
PLT(s)	18.7	2.8	18.2	3.4	3.6*	SAR(cm)	21.9	5.5	21.7	5.4	.88	SBJ(cm)	119.3	19.4	116	18.9	2.9*
SUP(r)	15	4.4	14.2	4.4	3.2*	ST(s)	23.4	1.7	23.9	1.9	3.4*	SRT(n)	30.3	14.2	29.9	14.1	.26
BMI(kg/m^2)	17.4	2.7	17.6	3	.34	SKF(mm)	32	17.3	32.3	18	.36	HGR(kg)	29.1	5.3	26.8	5.4	6.3*

U= Urban, n:1038 R= Rural, n: 258 asc: ascents r: number of repetition n: number of shuttle
SD:Standart Deviation

Height(HG), Body Weight(BW),Sum of Skinfold Thicknesses (SKF)hand grip (HGR), Flamingo balance test (FLB), standing broad jump (SBJ), Shuttle run test (SRT), sit ups (SUP), Sprint test (ST), plate tapping (PLT) sit and reach test (SAR)
*p<0.05

Physical Fitness levels of children in rural and urban areas

Table 2) Mean and Z values for anthropometric and physical fitness in 4th grade (10 years old) students according to living areas

	R		U		Z		R		U		Z		R		U		Z
	X	SD	X	SD			X	SD	X	SD			X	SD	X	SD	
HG (cm)	137.8	.05	137.4	.06	.85	BW(kg)	35.3	8	35.1	8.3	.30	FIB(asc)	9.9	4.8	10.2	4.7	.65
PLT(s)	17	2.8	16.7	2.7	1.5	SAR(cm)	21.2	5.7	21.3	5.8	.01	SBJ(cm)	124.3	21.9	123.3	19.5	.86
SUP(r)	16.2	4.4	15.7	4.5	2.3*	ST(s)	23.2	1.8	23.2	1.8	.78	SRT(n)	36.4	17.6	33.5	15.2	2*
BMI(kg/m^2)	18.4	3.5	18.4	3.2	.01	SKF(mm)	37.5	21.9	37	21.4	.23	HGR(kg)	32.8	6	31.1	6.1	4*

U= Urban, n:1086 R= Rural, n: 234 asc: ascents r: number of repetition n: number of shuttle SD: Standart Deviation
Height(HG), Body Weight(BW),Sum of Skinfold Thicknesses (SKF)hand grip (HGR), Flamingo balance test (FLB), standing broad jump (SBJ), Shuttle run test (SRT), sit ups (SUP), Sprint test (ST), plate tapping (PLT) sit and reach test (SAR)
*p<0.05

Table 3) Mean and Z values for anthropometric and physical fitness in 5th grade (11 years old) students according to living areas

	R		U		Z		R		U		Z		R		U		Z
	X	SD	X	SD			X	SD	X	SD			X	SD	X	SD	
HG (cm)	142.5	.07	142,3	.06	.11	BW(kg)	38.4	9.5	39.3	9.6	1.6	FIB(asc)	8.8	4.8	9.7	4.9	2.4*
PLT(s)	15.8	2.7	15.6	3.1	.87	SAR(cm)	21.3	5.5	21.4	5.8	.16	SBJ(cm)	135.7	24.7	131.5	20.1	3.7*
SUP(r)	17.9	3.9	16.6	4.6	4.1*	ST(s)	22.6	2.1	22.6	1.8	1.5	SRT(n)	41.1	17.2	38.1	17.6	2.6*
BMI(kg/m^2)	18.7	3.3	19.2	3.6	2.1*	SKF(mm)	37.5	24.3	40.1	23.8	2.6*	HGR(kg)	37.3	6.7	35.2	7.2	4.1*

U= Urban, n:1080 R= Rural, n: 243 asc: ascents r: number of repetition n: number of shuttle SD: Standart Deviation
Height(HG), Body Weight(BW),Sum of Skinfold Thicknesses (SKF)hand grip (HGR), Flamingo balance test (FLB), standing broad jump (SBJ), Shuttle run test (SRT), sit ups (SUP), Sprint test (ST), plate tapping (PLT) sit and reach test (SAR)
*p<0.05