PHYSICAL FITNESS LEVELS OF BULGARIAN PRIMARY SCHOOL CHILDREN IN RELATIONSHIP TO OVERWEIGHT AND OBESITY

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INTRODUCTION

- The health-related physical fitness in children has been shown to be of great importance for children's development, and has been widely discussed in the field of physical education and sport. Physical fitness is considered as a key factor in childhood (Ruiz et al., 2006, Ortega et al., 2008), and can be used to monitor and predict the health status of children (Ruiz et al., 2009). Measuring anthropometric parameters, as well as testing physical fitness components, is crucial in order to make a comprehensive assessment of the health-related physical fitness of children. A comprehensive review in many longitudinal studies concluded that a higher level of cardiorespiratory fitness, muscular strength and body composition is associated with a healthier cardiovascular profile and with a lower risk of developing cardiovascular diseases, and a healthier body composition in childhood is also associated with a lower risk of death in adulthood (Ruiz et al., 2009). Those health-related components are the core of the Alpha-fit test battery, which was designed to provide instruments for assessing physical fitness in a comparable way within the European Union (ALPHA, 2009). Based on a substantial number of studies, the Alpha-fit battery provides a full set of valid, reliable, feasible and safe field-based fitness tests to be applied for health monitoring purposes in children.

Aim and objectives of the study

- The aim of this cross-sectional study was to assess the health-related physical fitness levels in boys and girls between the ages of 7 and 11, in addition to providing estimates for overweight and obesity in a sample of primary school children from Sofia, Bulgaria. The realisation of this aim implies the following objectives: measurement and assessment of anthropometric parameters, testing and evaluating musculoskeletal fitness, motor fitness and cardiorespiratory fitness.

METHODS

SubjectsThis study consisted of 118 primary school children between the ages of 7 and 11, who were divided by their gender into two groups: 64 girls with a mean age of 9.1 ± 1.0 years, and 54 boys with a mean age of 9.1 ± 1.0, from Sofia, Bulgaria. In addition, the sample was also divided based on their BMI assessment (children with BMI percentile score (PRs) within the norms vs overweight or obese children), in order to investigate whether levels of physical fitness are associated with overweight and obesity in the primary school children.

The participants of this study completed the Alpha-Fit health-related physical fitness test battery (ALPHA, 2009), which includes different anthropometric measurements (height, weight, waist circumference, triceps and subscapular skinfolds), as well as a variety of different fitness tests (handgrip strength, standing long jump, 4x10m shuttle run test, and 20m multistage fitness test).

Anthropometric parameters, with their corresponding percentile scores, of the primary school children divided by their gender (mean ± SD).

	Girls (n=64)	**Boys** (n=54)	p
Age (years)	**9.09** ± 1.02	**9.14** ± 1.01	p > 0.05*
Height (cm)	**136.77** ± 10.51	**137.98** ± 9.98	p > 0.05 x
Height – percentile score	**61.72** ± 27.97	**68.39** ± 25.36	p > 0.05 x
Weight (kg)	**32.60** ± 8.86	**32.75** ± 6.94	p > 0.05 x
Weight – percentile score	**59.06** ± 30.82++	**66.03** ± 31.22++	p > 0.05 x
BMI (kg/cm^2)	**17.19** ± 2.78	**17.03** ± 2.14	p > 0.05 x
BMI – percentile score	**56.43** ± 31.38	**59.84** ± 30.24	p > 0.05*
Arm circumference (cm)	**20.23** ± 2.59	**20.27** ± 2.77	p > 0.05 x
Waist circumference (cm)	**58.54** ± 7.36	**60.27** ± 6.63	p > 0.05 x
Waist-to-height ratio	**0.43** ± 0.05	**0.44** ± 0.04	p > 0.05 x
% Fat	**18.39** ± 6.72	**16.72** ± 7.19	p > 0.05 x
% Fat - percentile score	**29.35** ± 36.66	**35.74** ± 35.48	p > 0.05 x
UAMA (cm^2)	**21.42** ± 4.57	**22.63** ± 5.07	p > 0.05 x
UAMA – percentile score	**50.53** ± 25.48	**48.95** ± 34.12	p > 0.05 x

Results from the Alpha-Fit health-related physical fitness tests, and the corresponding percentile scores of the primary school children, divided according to gender (mean ± SD)

	Girls (n=64)	**Boys** (n=54)	p
Musculoskeletal Fitness: Upper body strength			
Handgrip strength test† (kg)	**12.81** ± 3.46	**14.14** ± 3.15	**p < 0.05** [x]
Handgrip strength test (percentile score)	**44.32** ± 26.89	**44.26** ± 28.51	p > 0.05*
Musculoskeletal Fitness: Lower body strength			
Standing long jump (cm)	**126.36** ± 20.30	**138.66** ± 21.81	**p < 0.01***
Standing long jump (percentile score)	**61.24** ± 24.40	**61.72** ± 29.48	p > 0.05 [x]
Motor Fitness			
4x10 m shuttle run test (sec)	**14.24** ± 1.18	**13.48** ± 1.82	**p < 0.001** [x]
4x10 m shuttle run test (percentile score)	**44.75** ± 22.58	**48.92** ± 29.43	p > 0.05 [x]
Cardiorespiratory Fitness			
VO_2max (ml/kg/min)	**47.24** ± 2.40[+]	**48.45** ± 3.22[++]	**p < 0.05***
VO_2max (percentile score)	**62.57 ±** 21.44[+]	**58.36** ± 22.68[++]	p > 0.05*

ANALYSIS

ANTROPOMETRIC ANALYSIS

- The individual PRs of BMI in the girls showed that 9 of the 64 females were assessed as 'overweight', and 8 as 'obese'. Additionally, 15 of the 54 boys were assessed as 'overweight' and 2 as 'obese'. On the whole, the individual BMI assessment showed that 20.3 % (24 children) of all primary school children were 'overweight' (BMI > 85th PRs), 8.5 % (10 children) were 'obese' (BMI > 97th PRs), and 13.5 % (16 children) were assessed as 'thin' (BMI < 15th PRs).

Alpha-Fit health-related physical fitness tests ANALYSIS

- Overall, the boys had significantly better results in all fitness tests (Table 2), but the PRs were similar to those of the girls. The mean PRs of handgrip strength and 4x10 m shuttle run tests for both groups did not differ significantly from the 50^{th} percentile of the international norms for European children ($p > 0.05$). However, both groups showed significantly higher mean PRs in the standing long jump and VO_2max, in contrast with the 50^{th} percentile of the international norms ($p < 0.05$).

DISCUSSION

- In this study, 24 children were assessed as 'overweight' and 10 as 'obese' according to their BMI percentile scores, which made a total of 34 pupils (29% of all participants). The findings of our study were slightly lower than the observed values by other authors, which range from 30% to 45% of overweight/obesity frequency in children (Guinhouya et al., 2009, Sanchez-Vaznaugh et al., 2015, Kolimechkov et al., 2017).
- The results from the health-related fitness tests showed that boys performed significantly better than girls, but the percentile scores in each fitness component were similar (Table 2). The children from our study showed significantly higher results in lower body strength and cardiorespiratory fitness than the 50^{th} percentile ($p < 0.05$) of the international norms for children. As shown on Table 2, the mean PRs for those tests in the boys and girls were around the 60^{th} percentile, which is above the average. In the other two tests, which assessed upper body strength and motor fitness, the participants from our study showed results which were sufficiently close to the 50^{th} percentile of the international norms, and did not differ significantly from it.

CONCLUSIONS

- The children with normal weight from our study showed a healthier profile in terms of their anthropometric parameters, and performed significantly better in the standing long jump, 4x10m shuttle run, and the 20m multistage fitness tests, in comparison with those who were assessed as ‘overweight’ or ‘obese’ (Table 3).
- The results of this study showed that overweight and obese primary school children are associated with lower levels of health-related physical fitness. Excessive weight, above the WHO norms, limited fitness performance, and therefore tracking and assessing physical fitness, in addition to promoting physical activity, should start from an early primary school age.

THANK YOU FOR YOUR ATENTION