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Cardiorespiratory endurance in relation to body mass in Polish rural children: Preliminary report



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ABSTRACT

Physical fitness is generally viewed as having morphological, muscular, motor, cardiovascular and metabolic components. Cardiorespiratory fitness describes the capacity of the cardiovascular and respiratory systems to carry out prolonged strenuous exercise. It is often considered as the most important indicator of health status. The place of residence is seen as a factor that may influence the feasibility of physically active lifestyles, and thus shaping cardiorespiratory fitness. The study group consisted of 121 children aged 10–16 years, including 60 girls and 61 boys. All of the children lived in rural areas. The investigated group was divided according to age and sex; body height and weight were measured and body mass index (BMI) calculated. All children performed the Cooper's run test and the Ruffier's test. The analysis of BMI for the nutritional status of children in relation to the entire study group demonstrated that 81 children had normal weight, 20 children were overweight and 11 were obese, while 9 children were underweight. The studied group of children showed on average very good and good performance in the Cooper's test, regardless of body weight, whereas the results of the Ruffier's test showed merely weak or medium cardiorespiratory endurance, which was even worse in overweight or obese children.

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Introduction

Over the last few decades obesity has become increasingly prevalent in children in Poland, European countries and the United States, as described by [Ogden et al. \(2012\)](#). Being overweight is related to the increased risk of chronic diseases (civilization diseases) and psychosocial problems, as proposed by [American Academy of Pediatrics \(2003\)](#) ([Anderson and Butcher, 2006](#)). From the public health perspective, this is currently one of the most serious global challenges for social and health policies ([Currie et al., 2004](#)). In this context particular attention should be drawn to communities at risk of social inequality, such as the inhabitants of rural areas.

Some experts agree that the epidemic of obesity both in children and adults is mainly due to the positive energy balance resulting from the low level of physical activity and poor eating habits. Regular physical activity is considered to be one of the key factors in weight control and essential means of prevention of chronic diseases among children ([Currie et al., 2004](#)). The period of adolescence is particularly important in the context of the formation of physical activity habits. Their associations with the risk of being overweight and obesity are evident ([Hands et al., 2011](#)). Following the guidelines, children and adolescents should be physically active at least 60 min per day ([Currie et al., 2004](#)). Both moderate and intense physical efforts are needed to increase the energy expenditure, improve body composition, and to maximize the health effects for the cardiorespiratory system ([Dencker et al., 2006](#)).

Physical fitness is generally viewed as having morphological, muscular, motor, cardiovascular and metabolic components, as suggested by [Shephard and Bouchard \(1994\)](#). Cardiorespiratory fitness (CRF) or maximal aerobic power, the capacity of the cardiovascular and respiratory systems to carry out prolonged strenuous exercise, is often considered as the most important marker of the health status ([Ortega et al., 2008](#)).

CRF is one of the most important indicators of the efficiency of the cardiorespiratory system. According to the World Health Organization, the best indicator of cardiorespiratory fitness is the maximal oxygen consumption (VO_{2max}) – the greatest rate at which a person is able to consume oxygen during sustained, exhaustive exercise ([Shephard et al., 1968](#)). Shuttle tests and tests carried out using a treadmill and a cycloergometer seem to be the most reliable tests in terms of the CRV assessment ([Pate et al., 2012](#)). Examples of such tests are Cooper's run/walk test, and the Ruffier's test, popular in medical practice. Both are indicated as measures of the cardiopulmonary capacity in healthy children ([Edouarda et al., 2007](#)). The Ruffier's test is still used in the assessment of cardiorespiratory endurance in adolescents ([Bruneau et al., 2009](#)). Likewise, the walk/run Cooper's test is applied in the assessment of cardiorespiratory endurance in school children ([Barlow and Dietz, 2002](#); [Drinkard et al., 2001](#)).

A high level of physical fitness among children and adolescents is related to more favorable health effects, including reduced risks of obesity, cardiovascular diseases, skeletal disorders and mental illness, as studied by [Ruiz et al. \(2007a\)](#). A higher level of cardiorespiratory fitness is related to more favorable cardiovascular profiles and more favorable metabolic profiles in children and adolescents ([Hurtig-Wennlöf et al., 2007](#); [Ruiz et al., 2006, 2007a](#)). The level of cardiovascular fitness among young people is also inversely related to risk factors of cardiovascular diseases such as low levels of inflammatory markers and homocysteine ([Ruiz et al., 2007b](#)).

The correlation between cardiorespiratory endurance and health effects among adults is well known, and as far as children and the youth are concerned this is a fairly new area of research. The correlation with such risk factors as obesity and cardiometabolic risk factors is particularly well documented by [Farpour-Lambert et al. \(2009\)](#) and [Puder et al. \(2011\)](#). There is also an indication of potential correlations between CRV and risk factors related to the functioning of lungs, to depression, positive self-image and to bone health, as suggested by [Dunton et al. \(2007\)](#) and [Stella et al. \(2005\)](#).

The place of residence is seen as a factor that may influence the feasibility of physically active lifestyles, and thus shaping cardiorespiratory fitness ([Allender et al., 2008](#)). It has been believed that children from urban areas are more at risk of obesity than those from rural areas; it is due to easier access to the goods of civilization associated with a sedentary lifestyle and with the limited time for fun/outdoor activities. However, it seems that rural areas have ceased, in this respect, to give way to cities.

The cardiorespiratory endurance of Polish school children was previously studied by [Przewęda and Dobosz \(2003\)](#), but the study was limited to the Cooper's test. According to this study the fitness results

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