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REVIEW PAPER

Effects of Aerobic Exercise on Children and Young Peoples' Body Composition

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Abstract

This study aimed to collect relevant data from current studies on the effects of aerobic exercise on Children and Young Peoples' body composition. The following databases were reviewed: Google Scholar, Mendeley, SCIndeks, and KOBSON. The criteria for the analysis of the papers were as follows: the period of publication of papers from 2008 to 2020, longitudinal studies conducted in English, a sample of respondents aged 7 to 20 and the type of results for the purposes of a systematic review. The final analysis included 15 studies, which were analysed and presented, and the analysis of the obtained results shows that the effects of aerobic exercise have a positive effect on the body composition of children and young people. The results of the research can be used by future research in order to find adequate literature on the effects of aerobic exercise on children and young peoples' body composition.

Keywords: *aerobic training, body composition, children and young people*

Introduction

The physical inactivity of young people and its increased relationship with diseases such as obesity and diabetes have become a leading health concerns at the global level (Garland et al., 2011). This has led to increased concern for children's health, their daily habits, and physical activity. How children spend their free time seems to be a factor that contributes to their increasing obesity (Stellino, Sinclair, Partridge, & King, 2010). Based on this fact, some authors believe that children spend most of their free time sitting in front of a television or computer (Bener et al., 2011; Hills, Obkely, & Baur, 2010). We have arrived at an absurd situation: new inventions and discoveries certainly help a person perform various tasks faster and easier, while energy consumption decreases. The "danger" can become greater if nothing is done during childhood.

Physically active people can maintain or reduce their body weight for a longer period much more easily than people who only rely on a reduced diet. However, maintaining body composition also depends on proper nutrition. Physical activity affects weight reduction by correcting body composition; in combination with a programmed diet, it can present an ideal formula in correcting body composition (D. C. Nieman, Brock, Butterworth, Utter, & C. C. Nieman, 2002). Excessive amounts of fat tissue pose a risk for various diseases: if the waist size increases by 1 cm, the risk of cardiovascular diseases increases by 10% (Milanović, Sporiš, Pantelić, Trajković, & Aleksandrović, 2012). Strategies for treating long-term obesity are largely ineffective in adults. Given the alarming increase in physical inactivity in children, primary measures to reduce obesity should be taken in early childhood, so that there would be no consequences later in life (Malina, 2007).

Children and adolescents can find a solution in a variety of aerobic activity programmes and their benefits (Centers for Disease Control. Prevention, 2007; Danaei et al., 2009; Klijn, van der Baan-Slootweg, & van Stel, 2007; Reed, Maslow, Long, & Hughey, 2013; US Department of

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Health and Human Services, 2008). Participating in aerobic exercise not only reduces cardiovascular risk, but risk reduction is also minimized over time (Brown, Naples, & Booth, 2012; Li, 2012; Scully, Kremer, Meade, Graham, & Dudgeon, 1998). Existing models of obesity intervention include increased physical activity, as well as correction and diet modification. Some of the structural programmes of aerobic exercise are walking, jogging, dancing and cycling, which are usually performed three to five times a week, from moderate to submaximal intensity, and according to G. A. Kelley and K. S. Kelley (2008) these are quite satisfactory exercise opportunities. According to Kostić (2009), changes in the structure of children and young peoples' body composition, which result in obesity, are considered one of the most significant public health problems of modern times, which is why constant monitoring of physical activities and energy consumption is important.

The author of the present study believes that there is a need to summarize the relevant literature on the effects of aerobic exercise on children and young peoples' body composition.

Methods

To collect relevant literature suitable for research of this type, the following databases were searched: Google Scholar, MEDLINE, Web of Science, SCOPUS, SCIndeks, and KOBSON. Searched papers (abstracts or whole papers) were analysed. For the works to be included in the final analysis, they had to meet the following criteria:

1. Works that were published in the period from 2008 to 2020;
2. Longitudinal studies conducted in English;
3. Sample of respondents: males and females, 7–20 years old;
4. Type of results obtained: the primary result obtained for the purposes of systematic examination were the effects of aerobic exercise on the body composition of children and young people.

A descriptive method was used to analyse the obtained data. All titles and abstracts are reviewed for potential papers to be included in the systematic review. The keywords used in the database search were: "aerobic training", "body composition", "children and young people", or a combination of these keywords in English: "aerobic training", "body composition", "children", "youth".

Also, the lists of references of previous reviews and original research studies were reviewed. Relevant studies were obtained after a detailed review if they met the inclusion criteria. The exclusion criteria were:

1. Studies written in a language other than English;
2. Duplicates;
3. Studies with respondents older than 20 years.

The search strategy was modified and adapted to each database and search, where possible, in order to increase search sensitivity.

Results

After a general search of the database, 152 studies were identified. After eliminating papers that did not meet the title, abstract, 102 studies did not meet the criteria. Another 20 studies were eliminated due to the language of writing, as well as an additional 15 studies based on the inappropriate age of the respondents. The remaining papers are reviewed in detail. A total of 15 studies met all the set criteria and have been systematically reviewed.

A detailed overview of the process of collecting appropriate works based on the pre-defined criteria can be found in Figure 1.

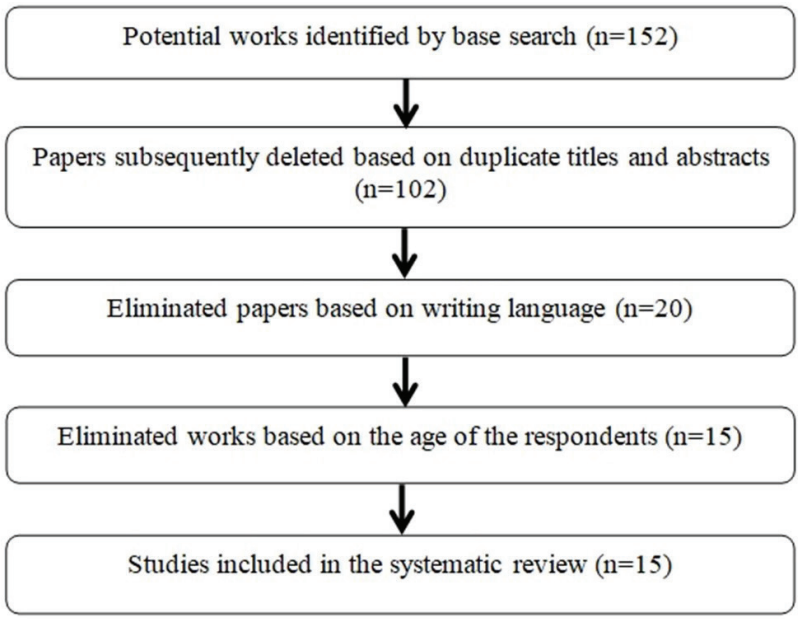

FIGURE 1. Overview of the process of collecting adequate works based on pre-defined criteria

In the final analysis, 15 relevant studies were included in the systematic review, based on early defined parameters and criteria, studies that were published in the period from 2008 to 2020, longitudinal studies conducted in English, the sample of participants had to be both sexes, 7–20 years old, and the primary result obtained for the purposes of systematic examinations were the effects of aerobic exercise on the body composition of children and young people. Table 1 shows the review of the studies.

Table 1. Review of studies

First author and year	The aim of the research	Sample of respondents		Exercise programme	Variables	Results
		Number	Years			
Knöpfli et al., (2008)	Effects of an 8-week programme on BC, aerobic fitness, and quality of life	N-130 M-78 F-52	12.1-15	7 days, 60-90 min.	AV, VO2max, Sp, BE, Q	Significantly corrected BMI and absolute body fat, VO2max and quality of life
Wong et al., (2008)	Effects of 12-week aerobic exercise and endurance training on aerobic fitness BC and BV	M-24 E-12 K-12	E-13.8±1.1 K-14.3±1.5	2x per week, 40-60 min.	AV, BC, BV, BE, T, Ct, Sp	BC E group significantly improved, K group decreased body weight
McGuigan et al., (2009)	Effects of 8 weeks of endurance training	T-48 M-22 F-26	7-12	3x per week	D, AV, BC, CMJ, SJ, PF	Absolute body weight decreased significantly
Dorgo et al., (2009)	Effects of an 18-week manual endurance training programme on PF	N-222 E1-63 E2-30 K-129	E1-16±1.2 E2-15.9±1.2 K-15.8±1.1	3x per week, 80 min.	MEt, MRt+Et, BMI, SF, PF	Muscle fitness and cardiovascular endurance significantly improved, the programme did not affect BC
Zorba et al., (2011)	Effects of 12-week aerobic training on BC, BV, and insulin levels	N-40 E-20 K-20	11±1	3x per week, 20-45 min.	AV, BV	Group E significantly reduced body weight, BMI and AV
Martins et al., (2011)	Effects of an 8-week physical activity programme on BC and PF	F-16 E-8 K-8	E-12.3±0.9 K-13.2±1.1	3x per week, 30 & 45 min.	FG, AV, BC, PF, BE, T, Ks	The programme gives positive effects
Sijie et al., (2012)	Effects of 12-week HIIT on BC, cardiac and aerobic function	F-60	19-20	5x per week, 30-40 min.	HIIT, MICT, VO2max	The high- and medium-intensity group reduced BC, with a significant improvement in VO2max
Reed et al., (2013)	Effects of 12-week physical activity on CA, motor skills and BC	N-470 E-165 K-305	E-10.2±2.3 K-11.2±1.9	5x per week, 45-50 min.	CA, FG, BC	The programme gives positive effects of group E, the girls showed significant results in all variables
Regaieg et al., (2013)	Effects of a 16-week physical activity programme on BC and aerobic capacity	N-28 M-16 F-12	12-14	16 weeks, 4x per week, 60 min.	AV, BC, BE, Ct, Ks	The E group corrected BMI, waist circumference, fat and non-fat fats
Barker et al., (2014)	The effect of 2-week HIIT on aerobic fitness, fat oxidation, blood pressure and BMI	M-10	14-16	6x +per week.	HIIT, AV, BC, VO2max, BE	The programme did not significantly affect body weight and BMI
Silva et al., (2014)	Effects of a 12-week aerobic exercise programme on BC and BV	N-14 E-9 K-7	13-17	3x per week, 30-40 min.	AV, BMI, SF, BC, BV, BE	Significant improvement of SF, reduction of % M and fat fats of group E.
Lee et al., (2014)	Effects of a 22-week swimming programme on BC and pulmonary flow	N -20 E-10 K-10	E-11.4±2.87 K-11.1±1.69	3x per week, 60 min.	BC, AV, PF	The programme had a positive effect on the reduction of BC and % M
Sigal et al., (2014)	Effects of 22-week aerobic exercise and endurance training, as well as combined training on body weight percentage	N-304 E1-75 E2-78 E3-75 K-76	14-18	4x per week	BC, AV, VO2peak,T, PF	All types of training significantly corrected % M and waist circumference
Arazi et al., (2016)	Comparison of 2 aerobic training methods of 8 weeks each	N-33 E1-12 E2-11 K-10	11.2±0.64	3x per week, 30-60 min.	BC, SF, PF VO2max	Screw training significantly affected TK correction and aerobic strength
Yoon et al., (2017)	Effects of 16-week cycling on BC, PF i BV	F-24 E1-12 E2-12	E1-13.3±0.4 E2-13.4±0.3	3x per week, 60 min.	BE, BC, BV, PF	Achieved positive effects on BC and PF

Legend: N- total number of respondents, M- male, F- female, E- experimental group, K- control group, BC- body composition, AV- anthropometric variables, CMJ-vertical jump, SJ-squat jump, MEt- manual endurance training, MRt + Et- manual resistance training + endurance training, BMI- body mass index, SF- skin folds, HIIT- high-intensity interval training, MICT- moderate training intensity, CA- cognitive abilities, VO2max- maximum oxygen consumption, BV- blood variables, VO2peak- oxygen volume during active work, BE- bicycle ergometer, T- treadmill, Q- questionnaire, D- diet, Sp- sports programme, PF- physical fitness, Ks- collective sports, FG- Fitnessgram, Ct- circuit training, %M- percentage of fat; The age values of the respondents are shown as Mean ± SD

Discussion

This study aimed to summarize the relevant literature on the effects of aerobic exercise on children and young peoples' body composition. A total of 1439 subjects participated in the study; the largest number of subjects was in the study by Reed et al. (2013), with 470 subjects, while the smallest number of

subjects was in the study by Barker, Day, Smith, Bond and Williams (2014), with ten respondents. The youngest respondent was seven years old, in a study by McGuigan, Tatasciore, Newton and Pettigrew (2009), while the oldest respondent was 20 years old, in a study by Sijie, Hainai, Fengying and Jianxiong (2012).

The duration of the experimental programme should be adequate and adjusted to the student population. Specifically, the study of Barker et al. (2014) lasted only two weeks and, in the end, there were no significant effects. The obvious and noticeable improvement in physical fitness was not enough to cause positive changes in body composition, and an adjusted duration of the experimental programme is needed, a minimum of 12 weeks in adolescents, if a positive effect on body composition is to be achieved (Kessler, Sisson, & Short, 2012).

Only three studies monitored caloric intake (Knöpfli et al., 2008; McGuigan et al., 2009; Sigal et al., 2014). Although these studies differ according to the type of training they applied, all the mentioned studies showed positive effects on body composition.

The selection of the sample of respondents is a key characteristic, specifically a healthy population, as well as the promotion of studies of that type and their quality. Only five studies had a healthy population for the sample of respondents (Dorgo et al., 2009; Barker et al., 2014; Reed et al., 2013; Arazi, Jalali-Fard, & Abdinejad, 2016; Yoon, Kim, & Rhyu, 2017). It is a very important fact that both the overweight and especially the obese population need to be exposed to physical activities and active lifestyle, physical education classes, various school games and exercises for skills development, as well as many recreational and fitness activities, all in order to improve their health status (Dorgo et al., 2009).

A large number of studies have applied aerobic exercise (Knöpfli et al., 2008; Wong et al., 2008; Zorba, Cengiz, & Karacabey, 2011; Barker et al., 2014; Silva et al., 2014; Arazi et al., 2016; Yoon et al., 2017). Insufficient aerobic capacity can be a predictor of mortality, so long-term improvements in this ability should be a goal, which would significantly change body fat (Watts, Jones, Davis, & Green, 2005). Also, the aerobic type of exercise enables positive changes in body composition, reduction of BMI and fat percentage (Ounis et al., 2008), and also strengthening muscles, increasing bone mass, maintaining oxygen intake, reducing the risk of cardiovascular disease, reducing stress, but also a positive impact on self-esteem (Ekeland, Heian, & Hagen, 2005; Mota-Pereiraet et al., 2011). Cattuzzo et al. (2016) noted particularly important parameters for the development of physique and physical fitness of children and young people, because poor health outcomes at this age can be reflected in later life.

Four studies applied a combination of aerobic training and resistance training (Martins, Marialva, Afonso, Gameiro, & Costa, 2011; Regaieg et al., 2013; Reed et al., 2014; Sigal et al., 2014). The combination of these two types of training provides several benefits, such as improved metabolic capacity and cardiorespiratory fitness (McArdle, Katch, & Katch, 2001) but also quantitative changes in skeletal muscle and increased muscle strength (Kraus & Levine, 2007).

The limitations of this study can be attributed to the fact that the authors did not have absolute access to all databases, so the number of studies that entered the systematic review research is relatively small. Also, some studies monitored the caloric intake, and others did not, which is why the authors decided to summarize all studies under the same set of analyses.

The results of this research can be used in future studies in order to find suitable literature on the effects of aerobic exercise on children and young peoples' body composition and to use them properly in other new qualitative analysis in the future.

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Conflict of interest
The authors declare that there are no conflicts of interest.

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