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[Editors]



Physical Education in Primary School

Researches ▪ Best Practices ▪ Situation

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Dario Colella
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Resistance exercises programs as a part of physical education curriculum for prevention of obesity and inactivity in children

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Abstract

Physical activity levels are declining in all parts of the world. And it is clear that this decline in physical activity is a key contributor to the global obesity epidemic, and in turn, to rising rates of chronic disease everywhere. There is an evident trend of decrease in children and adolescents muscular capabilities observed in primary school children and adolescents. Unfortunately, the P.E. classes and programs in the most of the countries have not been changed for a number of years. There is a variety of different kinds of resistance training programs that are very popular among males and females of different age categories. Resistance training with free weight and machines could be considered classical and most often used in research. Recently, other forms of resistance training are coming in the focus of interest. Research on children attitude towards physical education may be utilized to make physical education a valuable experience for all children. Researches indicates that obese students have less desire to participate in physical education classes than their peers with normal body weight, so resistance training exercises could make them more committed to P.E. classes. Recent findings showed that majority of all children positively evaluated all of the selected resistance training modalities. Most of them (77%) were attracted with exercises on BOSU ball.

Key words: Resistance training, Children, Attitudes.

Obesity and inactivity epidemics in children

At present obesity is one of the most pressing health concerns for children. Nearly one-third of children and teens are overweight or obese in the US – and physical inactivity is a leading contributor to the epidemic. Globally, an estimated number of 43 million preschool children were overweight or obese in 2010, which was an increase of 60% in 20 years (since 1990) (de Onis, Blossner, Borghi, Global, 2010). By 2020, if the current epidemic sustains, 9 percent of all preschoolers will be overweight or obese – nearly 60 million children globally (de Onis, Blossner, Borghi, Global, 2010).

Physical activity levels are declining in all parts of the world. Wealthy, middle or low-income countries share a decline in physical activity (*World Health Organization, 2009, Global health risks*). And it is clear that this decline in physical activity is a key contributor to the global obesity epidemic, and in turn, to rising rates of chronic disease everywhere (WHO, 2009, 2010). Healthy physical activity habits established in childhood and adolescence are often carried into adulthood. Increase in level of physical activity by encouraging activity and involvement in a variety of different kinds of resistance exercise activity can be one of the most effective ways for the decline magnitude and for overcoming this problem.

Unfortunately, recent epidemiological research (Tudor-Locke, 2010; Runhaar, et al., 2010) indicate that contemporary youth are not as active as they should be and reductions in physical activity start in early preadolescence. If we compared present day physical capabilities with the ones 10 years ago, we would come to a similar conclusion. There are several studies investigating different population, but coming to the same conclusion. There is an evident trend of decrease in children and adolescents muscular capabilities observed in English, Dutch and Spanish primary school children and adolescents (Cohen, 2011; Moliner-Urdiales, et al., 2010; Nyberg, 2009). Without interventions that target deficits in muscular fitness and motor skill performance early in childhood, these contemporary trends are likely to continue and the gap between youth with low and high levels of muscular fitness and motor skill competence will continue to increase parallel with their growth.

Constant decrease of physical activity level in childhood

The most usual form of regular physical activity in childhood is Physical Education class (often abbreviated as P.E.). It is an educational course related to the physical activity taken during all levels of education (kindergarten, primary, secondary education) that encourages different kind of motor learning during play or repeated movements setting in order to promote and upgrade overall health. Unfortunately, the P.E. classes and programs in the most of the countries have not been changed for a number of years. The dogma made two or three decade ago about resistance training being inadequate for youth is the main reason why there is no resistance training.

Today there is no fear of resistance training but fear of the data showing the evidence that children are less and less physically active. Now, medical and health organizations agree that there is a necessity for a vigorous daily physical activity. Majority public health recommendations indicate that children and adolescents should accumulate at least 60 min of moderate to vigorous physical activity (MVPA) each day (WHO, 2010). Most frequent chronic diseases today could be prevented or postponed by adoption of healthy habits in childhood. Cardiovascular diseases become clinically manifest mainly during adulthood, the actual problem begins in childhood when lifestyle habits such as physical activity are established (Expert panel on integrated guidelines for cardiovascular health and risk reduction in children and adolescents, 2011). In an extensive prospective study of male adolescents low levels of muscular strength were recognized as an important risk factor for major causes of death including cardiovascular disease in an extensive prospective study of male adolescents aged 16-19 (Ortega et al., 2012).

Resistance exercises in children

There is a variety of different kinds of resistance training programs that are very popular among males and females of different age categories. Resistance training with free weight and machines could be considered classical and most often used in research. Recently, other forms of resistance training are coming in the focus of interest. Resistance training with medicine ball is an old form of training that has new life in the last decade and is one of the forms of resistance training and testing most frequently used with young subjects (Davis et al., 2008; Ignjatovic et al., 2012). Plyometric training has also been frequently used in re-

search involving youth in the last decade. After the early statement that plyometric training is not suitable for kids, several position stands and review articles (National Strength and Conditioning Association, 2009) encourage researchers to proceed. However, many forms of training that are widely used in adult athletes as well as with sedentary subjects and seniors are not investigated in children and adolescents. There are several studies that involved different forms of resistance training: exercises on unstable surface (Bratic, Radovanovic, Ignjatovic, Bojic, & Stojiljkovic, 2012; Radovanovic, Bratic, Marinkovic & Ignjatovic, 2013), exercises with pilates ball (Ignjatovic et al., 2008), and exercises with punching bags (Ignjatovic et al., 2007).

Several experts have suggested that resistance training may offer observable health value to obese children and adolescents (Watts, 2005; Faigenbaum & Westcott, 2007. Benson et al., 2008a). Similarly, several researchers have published results of programs that target increasing physical activity as a method for reducing obesity in children (Shabi, 2006; Benson, et al, 2008b;. Sung, et al, 2005). Apart from effectiveness of some forms of resistance training programs on obese children and adolescents, this form of training allows participants not to feel inferior and bad as most usually happens with some other forms of physical activity that involves continues effort that they are unable to stand. Willing and joyful participation of obese children and adolescents in different forms of resistance training programs can be explained by the fact that resistance training is typically characterized by short periods of physical activity interspersed with brief rest periods between sets and exercises, which is more consistent with how youth move and play, and above all, allows overweight persons to fully participate without forcing them to give up as in majority of other physical activity exercises and physical activity games.

Whether or not children and adolescents should participate in resistance training programs has been a highly debated topic among experts in the field of exercise and health for the past few decades. Participation of youth in organized resistance training programs has not always been encouraged, but the positive results of the numerous studies in scientific literature over the past decade have clearly stated the benefits. Also, position stands of leading world fitness organizations (American Academy of Pediatrics 2008; American College of Sports Medicine 2006; British Association of Sport and Exercise Science 2004; Canadian Society for Exercise Physiology 2008; National Strength and Conditioning Association, 2009; British Journal of Sport Medicine, 2014) all state that strength training can be very beneficial for children and adolescents.

In addition to enhancing muscular strength, power and local muscular endurance, and potential improvement in some motor skills and sport perform-

ance, regular participation in a youth resistance training program has the potential to influence several other aspects of health and fitness. Regular participation in resistance training may result in improvement of body composition, increased bone mineral density, increased cardio-respiratory fitness, enhanced mental health and well-being and a more positive attitude towards lifetime physical activity. Almost every position stand from leading health and fitness organization (American Academy of Pediatrics 2008; American College of Sports Medicine 2006; British Association of Sport and Exercise Science 2004; Canadian Society for Exercise Physiology 2008; National Strength and Conditioning Association, 2009) state that there are psychological and sociological benefits in youth as a result of different kinds of resistance training usually without concrete research supporting this statement.

The research is convincing that resistance training can favourably affect cognitive function in adults. Different studies examining the effects of mental health in adults have focused on: effects on anxiety (O'Connor, Herring, & Carvalho, 2010), improved brain cognition (Anderson-Hanley, Nimon and Westen, 2010), effects of depression, chronic fatigue, on self-esteem, quality of sleep and overall mental health (O'Connor et al., 2010). The evidence supporting resistance training for the improvement of several major mental health issues is quite strong and impressive. The physiology behind it is likely to be multi-factorial adaptations (van Praag, 2009). It involves new nerve cell generation in the brain, increase in neurotransmitters function and new brain blood vessels for more efficient oxygen delivery and waste product removal.

However, there is no clear evidence for such statements in youth. Children and adolescents are not just miniature adults dressed in children's clothes, but individuals with bodies and minds that grow and develop rapidly mentally, physically, and emotionally. During this period of intensive growth all influences, positive and negative could have a great impact on young individuals. It is a priority to have strong evidence of influence of different resistance training programs on children and adolescents.

Also, there is a need for investigating the reasons why some children and adolescents are not interested in various kinds of physical activities. Exploiting the cause will be the first step for increasing the percentage of youth involved in some forms of regular physical activity.

The most usual form of regular physical activity in childhood is Physical Education class (often abbreviated as P.E.). It is an educational course related to the physical activity taken during all levels of education (kindergarten, primary, secondary and university education) that encourages different kind of motor learning during play or repeated movements setting in order to promote and upgrade

overall health. Unfortunately, the P.E. classes and programs in the most of the countries have not been changed for a number of years. The dogma made two or three decade ago about resistance training being inadequate for youth is the main reason why there is no resistance training.

Today there is no fear of resistance training but fear of the data showing the evidence that children are less and less physically active. Now, medical and health organizations agree that there is a necessity for a vigorous daily physical activity. Majority public health recommendations indicate that children and adolescents should accumulate at least 60 min of moderate to vigorous physical activity (MVPA) each day (WHO, 2010). Most frequent chronic diseases today could be prevented or postponed by adoption of healthy habits in childhood. Cardiovascular diseases become clinically manifest mainly during adulthood, the actual problem begins in childhood when lifestyle habits such as physical activity are established (Summary report *Pediatrics*, 2011). In an extensive prospective study of male adolescents low levels of muscular strength were recognized as an important risk factor for major causes of death including cardiovascular disease in an extensive prospective study of male adolescents aged 16–19 (Ortega et al., 2012).

Children attitudes toward use of various resistance training exercises

Research on children attitude towards physical education may be utilized to make physical education a valuable experience for all children (Graham, 1995). Research (Deforche, Bourdaudhuij, Tanghe, 2006) indicates that obese students have less desire to participate in physical education classes than their peers with normal body weight, so resistance training exercises could make them more committed to P.E. classes. Studies examining gender differences toward physical activity attitudes, usually have found that boys tend to have more positive attitudes toward P.E. classes than girls (Sleap & Wormald, 2001). Similar case is with more challenging physical activities that have some elements of risk (Hick et al., 2001; Parkhurst, 2000) were boys reported to have more positive attitudes than girls. In this aspect, the study (Zeng, Hipscher, & Leung, 2011) found that boys were more favor of weight lifting than girls. However, (Ignjatovic, 2016) indicate that there are no statistically significant differences between boys and girls in their attitudes toward five different resistance training modalities: (exercises with own body weight, exercises with barbells weight 1 kg each, exercises with elastic band, exercises with partner and exercises under unstable conditions with BOSU ball). The findings of (Ignjatovic, 2016) showed

that over 50% of all children positively evaluated all of the selected resistance training modalities. Most of them (77%) were attracted with exercises on BOSU ball, followed by exercises with body weight and exercises with dumbbells were positively rated by 72% and 70%, respectively. Finally, exercise in pairs and exercise with rubber bands were positively rated by 67% of primary school children. Table and data's are taken from FIEP conference paper in 2016 (Ignjatović, 2016).

	Strongly dislike (1)	Mostly dislike (2)	<i>Neither like nor Dislike</i> (3)	Mostly like (4)	Strongly like (5)	M	SD
Exercises with body weight	13,00%	5,00%	10,00%	19,00%	53,00%	3,94	1,42
Exercises in pairs	8,00%	13,00%	12,00%	16,00%	51,00%	3,89	1,36
Exercises with dumbbells	9,00%	9,00%	12,00%	17,00%	53,00%	3,96	1,35
Exercises with rubber bands	14,00%	8,00%	11,00%	17,00%	50,00%	3,81	1,47
Exercises on BOSU ball	7,00%	5,00%	11,00%	15,00%	62,00%	4,20	1,23

Table 1. Different modality of resistance exercise and attitude scores

One of the primary reasons why children are engaged with physical activity is desire to experience different activities (Allender et al., 2006). Exercises with BOSU ball were definitely modality of exercise that was new and exciting for the children. This modality of exercise have gained popularity in the past decade, and additionally, numerous studies have evaluated their role in various experimental exercises programs. The use of unstable environments has been proposed to enhance the specific effects of movement through an increased activation of stabilizers and core muscles and can according to the concept of specificity, provide the instability that can occur with the activities of daily living, work, and athletic environments, providing a additional benefits of exercises than trainnig on stable surfaces. Exercises under unstable conditions are suggested as beneficial for children and adolescents, but still not used during regular physical educational classes in longer period and larger scale.

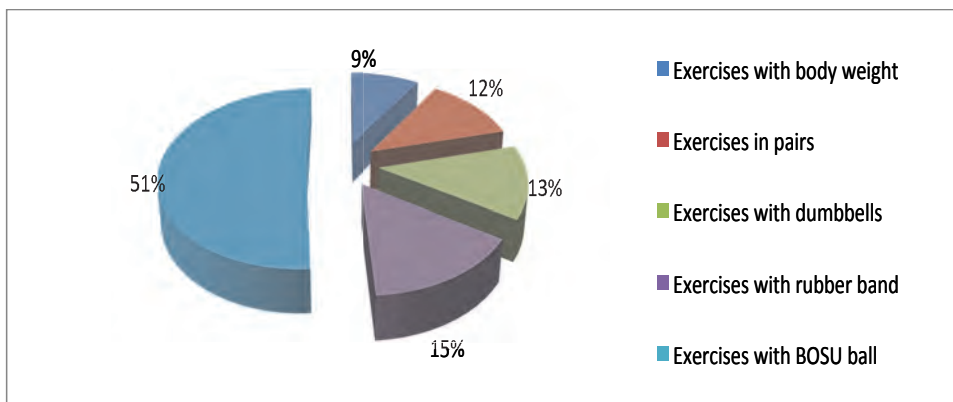


Figure 1. Ranked answers of students first choice of exercise modality

Similarly, elastic bands exercises are also relatively new and interesting form of exercise, but had received the most negative responses (14% answered strongly dislike) by children aged 6-10 (Ignjatovic, 2016). Elastic band exercises are popular among different populations for their possibility to perform movement in all planes, simplicity of tasks and possibility to generate muscle force throughout entire range of motion. They have been documented as a safe and effective strategy to improve the muscle strength in various populations, from children to older adults. The resistance exercise program using elastic bands showed to be especially safe and beneficial on functional fitness for frail older adults (Dancewicz et al., 2003; Topp et al., 2002) and providing enough evidence for safety and effectiveness in frail populations with low initial level of muscle capabilities. On the other hand lack of fun and enjoyment (Crane & Temple 2015), and somewhat demanding positions during selected exercises could be the main cause of attitude toward this modality of resistance exercises in some children. Future research with longitudinal organized elastic band exercises program in school age children are needed for clear understanding of their potential in P.E. curriculum.

Initial investigations in this field suggests that there are no initial barriers for inclusion of different resistance exercises modalities, since resistance exercises have been shown as suitable physical activities for both genders. Furthermore, expert organizations are recommending activities that include basic calisthenics or similar bodyweight activities appropriate for boys and girls age 6 to 10 (Lloyd et al., 2015).

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