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Hailey Wimmenauer

Coastal Carolina University, hmwimmena@coastal.edu

Christine Rockey

Coastal Carolina University, crockey@coastal.edu

Justin Guilkey

Coastal Carolina University, jguilkey@coastal.edu

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The Impact of High Intensity Training on the Fitness of Middle School Students

Hailey Wimmenauer, Faculty Mentor: Christine Rockey

Coastal Carolina University

Introduction

Today's society has experienced a steady increase in obesity that has affected both adults and adolescents. In addition, a great percentage of the population is not engaging in the appropriate amount of daily activity to reduce health risks like cardiovascular disease. The purpose of this research is to investigate the effects of High Intensity Training (HIT) for middle school students on their fitness scores. In order to do so, background information on the current health status of middle school students and the benefits of HIT were investigated.

To begin, Simeon (2011) found that approximately 30% of South Carolina high school students are overweight or obese and leading into that, about 50% of middle school students do not reach the recommended amount of physical activity per day. The middle school age is where drastic changes in behavior, interests, health status and physical activeness occur. Obesity rates were seen to rise from 13% in sixth grade, to 19% in seventh grade, and to 21% in eighth grade at a local middle school (Valdez, 2015). This increase in obesity rates is of great concern. It is known that an individual who is unfit, overweight, or obese is at risk of greater health consequences, for example, an increased risk of cardiovascular disease which is the leading cause of death. It was found that at least one cardiovascular disease risk factor is present in 37% of normal weight unfit adolescents, with an increase seen in overweight unfit adolescents and obese unfit adolescents of 49% and 61% respectively (May, Kuklina, & Yoon, 2012). It is obvious that these increases in obesity levels and lack of fitness are concerning not only for an individual's future but for their present risk. Research has suggested that issues associated with obesity might be a result of lack of adequate physical activity (Dankel, Loenneke, & Loprinzi, 2015). Therefore, increasing the amount or level of physical activity in middle school settings could be beneficial for students.

According to Sallis (1999), the steepest decline in physical activity (PA) for adolescents occurs between the ages of 13 and 19. A research study by Kimm, et al. (2002) found that for girls at age 9, their MET-times per week were around 30. By the time they were 18, their levels were around 10, about a 66% decrease. A lack of PA can yield additional consequences as well. Trost, et al. (2003) found that individuals who were overweight or obese experienced low self-esteem and self-efficacy. In addition, Anderson et al. (2007) found that there was a relationship between major depressive disorder and anxiety disorder with an individual's Body Mass Index. By increasing PA, the rates of these issues can decline.

Many interventions have been attempted in order to increase physical activity in physical education classes. An issue that occurs in the state of South Carolina is that the standard is for students to become proficient in various sports areas; therefore, teachers spend the majority, if not all, of their time teaching and enhancing these skills. Due to the fast nature of a HIT session, its implementation can yield great benefits for students while not taking away from state requirements. In addition, increases in PA have been found to decrease anxiety and stress, and improve mood and self-efficacy, which is essential for a middle school age group and a common indicator for future PA behaviors (Bandura, 2004; Kilpatrick, 2008). Its implementation can be an easy way to increase PA and a beneficial practice for improving mental health components of the students.

High Intensity Training (HIT) is an interval based workout that can be adjusted to work for very short time periods. For example, an individual could work anywhere from 4-12 minutes, which is a very small portion of a lengthened PE class, and still see the benefits associated with HIT. Improvements in oxygen intake, body mass, insulin sensitivity, and muscular strength and endurance have been observed. It was found that oxygen can be

transported more quickly and efficiently, meaning there is an increased oxidative capacity after as little as six sessions of HIT over a two week period (Gibala, Little, MacDonald, & Hawley, 2012). According to Whyte, Gill, & Cathcart (2010) and Gutin et al. (2002), individuals who engaged in high intensity PA saw improved insulin sensitivity and a decrease in many insulin resistance syndrome markers. One study found that there were improvements in cardiovascular fitness in adolescents after only two-weeks of HIT training (Bond et al., 2015). Lastly, improvements in muscular strength and fitness (Costigan, Eather, Plotnikoff, Taaffe, & Lubans, 2015), upper and lower body strength (Benson et al., 2008), vertical jump (Baquet, Praagh, & Berthoin, 2003), and sprint performance (Buchan et al., 2013) have been observed.

The major objective needed is to promote healthy lifestyles, prevent obesity, and increase activity, especially at the middle school age as this is seen as the turning point for future fitness levels. Valdez (2015) found that up to 85% of youth that are overweight or obese will go on to be obese adults. In middle schools, the Fitnessgram is used as a measurement of an individual's fitness level. It provides the minimum level of performance consistent with good health and gives a general "healthy fitness zone" for all students based on age (Welk, Going, Morrow, & Meredith, 2011). We hypothesize that engaging middle school students in HIT will yield an increase in fitness scores.

Methods

To conduct this study, Coastal Carolina University students went out to Forestbrook Middle School and worked directly with their Physical Education department. In the fall of 2017, we began implementing HIT into various class periods. Each Coastal student attended

different class periods and ran their own HIT workout. In the spring of 2019, two eighth grade classes participated in HIT training two days per week for approximately 14 weeks. With each visit, groups of 5-10 students rotated through HIT for a 4-minute workout. With the allotted class time, there would be about 5-8 rotations of students. Each workout would consist of 20 seconds of work with 10 seconds of rest for a total of 4 minutes. Students would perform two exercises for the entire 4-minute period. Exercises changed each session. Fitness scores for each student are obtained at the beginning and end of the semester. Fitness testing includes height, weight, sit-and-reach, push-up test, curl-up test, and the pacer test. Preliminary post-fitness scores were obtained in order to analyze data directly after the completion of HIT training compared to at the end of the semester when effects could've worn off. In addition to participating in HIT, students also took a brief survey. Two-versions of the survey were administered for those who did and did not participate in HIT (Figure 1). The purpose of the survey was to gauge the students' enjoyment of exercise, self-efficacy, and perceived benefits. After all data is collected, fitness scores will be analyzed to view student increases for pre-testing and post-testing as well as differences in fitness score improvements between those who participated in HIT and those who did not.

Results

Not all results have been completed as they are still being transferred by the school. In addition, more scores will be obtained at the end of the school year to further analyze differences in students who did and did not participate in HIT. Based on preliminary data, there were significant increases in students' fitness scores for sit-and-reach, push-up, curl-up and pacer testing for those who participated in HIT. Further data needs to be collected for height and

Interest/Enjoyment	not true at all			somewhat true			very true
I enjoy doing PE very much	1	2	3	4	5	6	7
PE is fun to do	1	2	3	4	5	6	7
I would describe PE as very interesting	1	2	3	4	5	6	7
I think PE is quite enjoyable	1	2	3	4	5	6	7

Perceived Competence	not true at all			somewhat true			very true
I think I am very good at PE	1	2	3	4	5	6	7
I think I do pretty well in PE, compared to other	1	2	3	4	5	6	7
After being in PE for this quarter, I feel capable	1	2	3	4	5	6	7
I am pretty skilled PE	1	2	3	4	5	6	7

Interest/Enjoyment	not true at all			somewhat true			very true
I enjoy doing exercise with Hailey very much	1	2	3	4	5	6	7
Exercising with Hailey is fun to do	1	2	3	4	5	6	7
I would describe exercising with Hailey as very interesting	1	2	3	4	5	6	7
I think exercising with Hailey is quite enjoyable	1	2	3	4	5	6	7

Perceived Competence	not true at all			somewhat true			very true
I think I am very good at the exercise time with Hailey	1	2	3	4	5	6	7
I think I did pretty well while exercising with Hailey, compared to other students	1	2	3	4	5	6	7
After working at the exercises with Hailey for a while, I feel capable.	1	2	3	4	5	6	7
I am pretty skilled at the exercises we do.	1	2	3	4	5	6	7

Figure 1. Two versions of survey distributed to middle school classes. Version 1 (top two boxes) was distributed to those who did not participate in HIT. Version 2 (bottom two boxes) was distributed to those who did participate in HIT.

weight in order to conclude body mass differences. Additional data needs to be collected for individuals who did not participate in HIT in order to analyze differences between groups and correlations between HIT and fitness improvements. There were no statistically significant differences among survey groups. However, differences were seen in the both the Interest/Enjoyment and Perceived Competence section of the survey between groups. Those who participated in HIT generally felt more competent and capable of performing exercise. Those who participated in general PE reported more enjoyment and interest in their PE classes compared to the HIT group who was asked their level of interest in exercise. Error occurred with distribution of the survey as two different instructions were given. The HIT group was instructed specifically to answer the questions honestly and to carefully read each question. The regular student group may have been given different instructions, it is unknown. However, their survey answers were non-specific resulting in error for analysis.

Discussion

Significant increases in fitness scores were found and based on the survey, those who participated in HIT felt more competent and capable in performing exercise. Previous research also indicates the importance of increasing PA among middle school aged individuals, as well as the benefits associated with HIT. Based on preliminary data, our findings support this research as students experienced increases in muscular endurance and cardiovascular fitness. Further analysis needs to be done on fitness score differences between groups in order to get a clear indication of HIT influences.

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