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ADHD in Elementary School Students:
Impact of physical activity on ADHD symptoms

By

Jenny Wilcox

An Alternate Plan Paper Submitted in Partial Fulfillment of the

Requirements for the Degree of

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In

Community Health Education

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ADHD in Elementary School Students: Impact of physical activity on ADHD symptoms

Jenny Wilcox

This alternate plan paper has been examined and approved by the following members of the student's committee.

Dr. Judith Luebke
Advisor

Dr. Dawn Larsen
Committee Member

Abstract

The purpose of this study was to explore alternative treatment options to stimulant medication in reducing symptoms of Attention Deficit Hyperactivity Disorder (ADHD) in elementary aged children. The goal was to understand whether implementing physical activity programs into elementary schools reduces characteristic symptoms of ADHD including, but not limited to hyperactivity, inattentiveness and impulsivity. Secondary data was used in this research to analyze the symptoms of ADHD and the benefits of physical activity as a behavior modification intervention for this disorder with children. The study addressed the research question, what are the most effective types of physical activity for children with ADHD to reduce their symptoms of ADHD? The goal of the study was to analyze the advantages and limitations of implementing more physical activity programs within schools across the United States to treat symptoms of ADHD.

The findings of the study indicated that physical activity improved ADHD symptoms in children. Yoga and meditation reduced symptoms such as hyperactivity, social disorders, oppositional defiant disorder and reductions in peer behaviors for children with ADHD. The major findings of the study discovered that a combination of stimulant medication, therapy and physical activity had the greatest improvements with ADHD symptoms in children. It is important for health educators to have an understanding of the characteristic symptoms of ADHD, and types of physical activities are most effective in reducing ADHD symptoms within elementary school children, to create effective health behavior change interventions.

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Chapter One

Introduction

While symptoms of attention deficit hyperactivity disorder (ADHD) such as impulsivity, hyperactivity and inattentiveness in children may be considered limitations to academic advancement, physical activity may help improve symptoms of ADHD and allow them to focus better in school (Mulrine, 2008). Incorporating more physical activity programs within elementary schools may contribute to the goal of reducing symptoms of ADHD in children.

Attention-deficit hyperactivity disorder (ADHD) is one of the most common psychiatric disorders among children and is characterized by developmentally inappropriate levels of inattention, impulsivity and hyperactivity (Gapin, 2010). The number of children diagnosed with ADHD is on the rise in the United States. Rates have increased steadily from 1997 to 2006, increasing by 42%. Statistical reports indicate that more than 1 in 10 school-age children in the United States have received a diagnosis of ADHD from a health care provider. Additionally, ADHD affects 3-7% of school-age children, with a boy to girl ratio of approximately 3:1 (Visser, 2014). ADHD symptoms are comprised of a persistent pattern of inattention, hyperactivity and impulsivity. ADHD is often co-morbid with other psychiatric conditions, such as oppositional defiant disorder (ODD), conduct disorder, specific learning disorders, depression and mood and anxiety disorders (Cerrillo-Urbina, 2015).

The research presented and analyzed in this study shares details about the methods and research that have been conducted to identify the effects of increased physical

activity in school-aged children to reduce ADHD symptoms. The purpose of the interventions explored in this study was to identify alternative options to address ADHD symptoms in children instead of treating them with medication as the primary source. The goals of physical activity interventions are to provide alternative treatment options to stimulant medication to reduce symptoms of ADHD in children (Hoza, 2015).

Significance of the Problem

Children with ADHD may have a host of impairments including lower cognitive functioning abilities, poor social skills, behavioral concerns and low rates of comprehension compared to their peers (Mulrine, 2008). Sometimes a child may have normal comprehension and cognitive abilities; however symptoms of ADHD can be caused by other issues including emotional distress and environmental concerns, therefore presence of these variables may lead to a more common diagnosis of ADHD (Golubovic, 2014). Due to an increase in variables that could relate to ADHD, there is currently a higher number of children being diagnosed and treated for this disorder with stimulant prescription medication. Even though stimulant medication is commonly used to treat the core symptoms of ADHD, these treatments are not always effective (Meppelink, 2016). Children with ADHD have an array of impairments within social settings, school, and with family members. Therefore, there is a great need for identifying effective alternative treatments, such as physical activity for children with ADHD.

There is evidence that children with ADHD demonstrate poor motor skills, they may not be as physically fit, putting them at an increased risk for obesity in comparison to their peers who have not been diagnosed with ADHD (Golubovic, 2014). Most chil-

dren who have been diagnosed with ADHD are typically less physically fit; they are at greater risk of being obese and are normally treated for this disorder through stimulant medication (Golubovic, 2014).. Therefore, an intervention consisting of implementing increased numbers of physical activity programs within schools across the United States, with the goal of reducing symptoms and other issues related to this disorder is needed. Further, implementing physical activity programs for children with ADHD risk would provide alternative treatment options to stimulant medication.

Purpose of Study

The number of children in the United States diagnosed with ADHD is on the rise, while the number of children exercising is declining and the number of children being treated for ADHD with stimulant medication higher than ever (Meppelink, 2016). Children with ADHD are at greater risk for being less physically fit, they are more likely to be obese and they have typically have lower functioning cognitive ability and comprehension skills, making academic progress difficult for this group of children (Golubovic, 2014). Children with ADHD show poorer skills in sports activities and have inferior sports abilities, as well as below average gross motor performance and physical fitness (Golubovic, 2014). Additionally, children with ADHD are characterized with persistent and impairing patterns of inattention, hyperactivity and/or impulsivity. The purpose of this study was to identify whether physical activity reduces ADHD symptoms in children and improves other health issues related to this disorder.

Research Questions

1. What are the most effective types of physical activity for children with ADHD to reduce their symptoms of ADHD?
2. What is the recommended duration and frequency spent engaging in physical activity to identify improvements in symptoms of ADHD?
3. What are the advantages of implementing increased physical activity programs for children with ADHD within elementary schools across the United States?
4. What are the limitations of implementing increased physical activity programs for children with ADHD within elementary schools across the United States?

Assumptions

1. Research findings reported in reviewed literature were accurate and reliable.
2. The literature reviewed defined ADHD in a similar way to this study.

Limitations of Study

1. The research selected may not cover the entire scope of the benefits of physical activity in children with ADHD.
2. The data collected for this study may not completely cover the scope of this topic.

Delimitations

The research study was delimited to the following:

1. Literature published on ADHD and impacts of physical activity was reviewed.
2. Literature selected and reviewed was published from 2006-2016.
3. Literature selected and reviewed included subject samples aged 5-18 years. The literature did not include adults in the research samples.
4. Literature reviewed was obtained through the EBSCO host Academic Search Premier.

Abbreviations

ADHD	Attention Deficit Hyperactivity Disorder
DSM-5	Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition
CD	Conduct Disorder
LD	Learning Disorder
ODD	Oppositional Defiant Disorder
PA	Physical Activity
SC	Sedentary Classroom
RCT	Randomized Control Trial

Definition of Terms

For the purpose of this study the following terms are defined:

Anxiety disorder: This disorder occurs when a child experiences fear and/or worries that interfere with school, home or play activities” (Centers for Disease Control and Prevention, 2016). The CDC (2016) reported “almost 1 in 5 children with ADHD have an anxiety disorder”.

Conduct disorder: This disorder is diagnosed when children show a behavioral pattern of aggression, and has a history of serious violations of rules (CDC, 2016).

Depression: Children with ADHD are more likely to develop childhood depression; a condition which may interfere with school and home activities. The CDC (2016) reported “almost 1 in 7 children with ADHD have a diagnosis of depression”.

Hyperactivity: Children with ADHD who have symptoms of hyperactivity often fidget with or tap hands or feet, often leave their seat when expected to remain seated and often has difficulty waiting for their turn (CDC, 2016).

Impulsivity: Children with ADHD often interrupt others, talk excessively or blurt out an answer before a question has been completed (CDC, 2016).

Inattentiveness: The DSM-5 defines inattention as six or more symptoms of inattention for children up to age 16; these symptoms need to be present for at least 6 months. Children with ADHD often have trouble holding attention on tasks or activities; additionally they often do not listen when spoken to directly (*American Psychiatric Association [APA], 2013*).

Learning disorder: Many children with ADHD also have a learning disorder, almost one-half of the children ages 6-17 years old diagnosed with ADHD may also have this. Children with ADHD may have difficulties staying on task or being organized, which can keep a child from doing well in school. Learning disorders can include dyslexia, dyscalculia, and dysgraphia (Mayo Clinic, 2016).

Mood disorder: Children with ADHD typically have distorted moods or emotional states that are inconsistent with circumstances (Mayo Clinic, 2016).

Neurodevelopmental disorder: An impairment of growth and development of the brain, which can effect emotion, learning ability and self-control (Mayo Clinic, 2016).

Physical activity: Any bodily movement produced by skeletal muscles that result in energy expenditure (Hoza, 2014).

Stimulant medication: This is a treatment most often used for symptoms of ADHD, it can be used in conjunction with behavior therapy or alone, it is used by approximately 70-80% of children with ADHD (CDC, 2016). Common types of stimulant medications used to treat ADHD include Methylphenidate, Dextroamphetamine, Lisdexamfetamine, and Amphetamine (CDC, 2016).

Oppositional Defiant Disorder (ODD): The DSM-5 criteria for a diagnosis of ODD in a child exhibiting behaviors that include at least four of the following symptoms: anger, irritable mood, argumentative, vindictive, or defiant behavior. Additionally to be categorized as ODD the behaviors need to occur with non-family members. (*American Psychiatric Association [APA], 2013*).

Chapter Two

Literature Review

The purpose of this study was to identify whether physical activity could reduce symptoms of ADHD in children and improve other health and behavioral issues related to this disorder. As an introduction to the topic of ADHD in children, this review briefly explored alternative treatment options by incorporating more physical activity within elementary schools and examined how it could mitigate the symptoms of ADHD. In addition, the specific literature that was reviewed compared the interventions of physical activity and sedentary classroom activities to determine the effects on ADHD symptoms, cognitive function and behavioral issues within children. Several authors have concluded that evidence supports that physical activity is effective in mitigating symptoms of ADHD and improves cognitive performance in children with ADHD risk (Gapin, 2009).

This study examined the different types of physical activity implemented and the frequency, intensity and duration combinations that lead to the best results in reducing ADHD symptoms in children. Since very little research has been conducted on physical activity as a type of alternative treatment for ADHD, this study explored this topic to identify whether this type of treatment is effective. The following topics were explored in this chapter: description and prevalence of ADHD in children, characteristic symptoms of ADHD, benefits of physical activity in children, effects of medical treatments, effects of physical activity in children with ADHD, recommended type, duration, frequency and intensity of physical activity to reduce ADHD symptoms, and priority populations for physical activity interventions to reduce ADHD symptoms.

Description and prevalence of ADHD in children

Even though ADHD is three times more common in boys than girls, school learning and family environments can be challenging for both boys and girls who have this disorder due to the symptoms of ADHD. Kamp (2014) explains that 7.9% of boys have been diagnosed with ADHD compared to 1.8% of girls. Symptoms of ADHD can lead to troubles for children in school and life settings, which can lead to lifelong hardships. The symptoms of ADHD include hyperactivity, impulsivity and inattention, which may create troubles for students with ADHD in maintaining interest and completing tasks at school. Kamp (2014) explained there are also limitations in cognitive, psychosocial and emotional competence that can impair mental well-being and disturb academic environments. Further, Haber (2000) found 40-60% of children with true neurologic ADHD have learning disabilities, therefore they frequently have problems with attention span in the classroom because they do not understand the material presented to them.

Visser (2014) published reports indicating that more than 1 in 10 school-aged children (11%; 6.4 million children) in the United States have received a diagnosis of ADHD from a health care provider. Children diagnosed with ADHD are from diverse demographic and cultural compositions, living within various regions of the United States. ADHD stems from both genetic and environmental factors and it can lead to a disturbance in familial, social and academic environments. Children with ADHD tend to have more difficulty in school due to coexisting conditions including characteristic symptoms, learning disabilities, behavioral issues and lower cognitive function (Golubovic, 2014).

Understanding the characteristic symptoms of ADHD

It is important for school health educators and teachers who are implementing the physical activity programs to have a keen understanding of the characteristic symptoms of ADHD, in order to help them identify whether there are improvements in ADHD symptoms. According to the *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition* (American Psychiatric Association [APA], 2013), in order to be diagnosed with ADHD a child up to age 16 needs to have six or more symptoms of “inattention and/or hyperactivity-impulsivity that interferes with functioning or development, and that negatively impacts directly on social and academic/occupational activities” (American Psychiatric Association [APA], 2013, p.59).

The ADHD symptoms described by the DSM-5 regarding inattention in individuals are below:

- Often they have difficulty organizing tasks
- Often they are forgetful in daily activities
- Often they do not seem to listen when spoken to directly
- Often they are forgetful in daily activities
- Often they do not follow through on instructions

The ADHD symptoms described by the DSM-5 for hyperactivity and impulsivity in individuals include:

- Often they fidget with hands or feet or squirms in seat
- Often they leave their seat when it is not expected
- Often they are restless

- Often they interrupt others
- Often they cannot wait for their turn in a conversation
- Often they are unable to play quietly

Further, DSM-5 reports that “visual and hearing impairments, metabolic abnormalities, sleep disorders, nutritional deficiencies, and epilepsy should be considered as possible influences on ADHD symptoms” (APA, 2013, p. 60).

Benefits of physical activity in children with ADHD

It has been demonstrated that physical activity is essential to improving health and fitness abilities; it is also very beneficial for improving mental health functioning particularly for those with ADHD. Kamp (2014) identified several types of physical activities (PA) that may be effective in treating children with ADHD. Short-term aerobic exercise, based on several aerobic intervention formats seems to be effective in mitigating symptoms such as inattention, hyperactivity, impulsivity, anxiety, executive function and social disorders in children with ADHD (Cerrillo-Urbina, 2015).

Physical activity programs that were implemented in this research included exercises such as walking, jogging, cycling, athletic training, skipping rope, various ball games, swimming, and dancing (Kamp, 2014). Additionally, yoga programs were implemented; even though they were less physically intense, because they related to improving wellness of the mind and body. Practicing mindfulness in yoga gave children more control over their attention, which in turn, was found to be beneficial with psychological symptoms as well in ADHD children (Meppelink, 2016). The yoga program results showed that exercise improved anxious/shy, hyperactivity, impulsive/restless, oppo-

sitional, social problems and the DSM-5 criteria for ADHD diagnosis (Cerrillo-Urbina, 2015). Yoga and meditation were found to have measurable benefits in children with ADHD; more than 50% of the children improved their academic and behavioral performance (Mehta, 2011). Additionally, Gapin and Etnier (2010) found that if children walked at a moderate rate of intensity for 45 minutes, then social skills and cooperation were enhanced, and they had less anxiety, depression and fewer social problems after an intervention involving physical activity.

Existing state of physical activity programming in elementary schools

Children today are the first generation with a shorter life expectancy predicted than their parents, and children who do not have physical activity programming opportunities during the school day, are twice as likely to be sedentary outside of school (Healthy Moves, 2015). Physical activity programming within schools are important for many reasons, however most elementary schools across the nation have physical education classes for only 30 minutes from one to three days per week and recess is still not required by school most school districts (Nye, 2008). Studies reviewed indicate that requiring daily recess time during the day could increase the physical activity levels of the 34.7 million children enrolled in U.S. elementary and middle schools, but currently only 59% of U.S. school districts require elementary schools to provide regularly scheduled recess (U.S. Department of Health and Human Services, 2008). According to the U.S. Department of Health and Human Services (2008), the 2008 Physical Activity Guidelines for Americans recommends children and youth engage in 60 minutes of activity every day, and since this recommendation is not being met by most elementary school children, the U.S. De-

partment of Health and Human Services gave the children a score of a D minus. National-ly, most public elementary schools are not providing an adequate amount of physical ac-tivity programming for children and adolescents to help them meet the national physical activity guidelines (U.S. Department of Health and Human Services, 2008).

Effects of medical treatments and psychosocial therapy in treating ADHD in chil-dren

ADHD symptoms are normally treated with stimulant medications, which can be effective for most children. However, the long-term side effects of these medications are not known. Additionally, prescribed medications normally address only the symptoms of the disorder, not the root cause (Meppelink, 2016). Stimulant medications work for most, but not for all children and often have side effects. Meppelink (2016) explains that the stimulant medication methylphenidate is effective in the treatment of 70% of children with ADHD; but it is not effective in the remaining 30%. Since stimulant medication is found not to be effective for all children diagnosed with ADHD, alternative treatments that can lead to effective results need to be considered. Many researchers have discovered that using stimulant medication alone (without a combination of exercise and therapy) is less effective in treating the symptoms of ADHD. They have found that physical activity, even in small amounts improves brain activity and cognitive function within ADHD chil-dren (Gapin, 2009). Meppelink (2016) found that psychosocial treatment interventions (therapy) alone had fewer effects than stimulant medication. Currently stimulant medica-tion and psychosocial therapy interventions are the most common treatments for reducing ADHD symptoms in children and adolescents. Therefore, pairing stimulant medication,

therapy and physical exercise is an alternative treatment that could likely benefit children with ADHD.

Effects of physical activity in children with ADHD

There are a limited number of published studies conducted on the effects of physical activity on cognitive or behavioral functioning of youth diagnosed with, or at risk for ADHD. However, the research conducted suggests positive effects (Hoza, 2014). Specifically, researchers conducted studies to identify whether physical activity was more effective in reducing symptoms of ADHD in children than sedentary activities. The studies reviewed conducted targeted elementary aged children who had been previously diagnosed with ADHD, and were randomly selected and assigned into one of two groups. One group participated in physical activities and the other participated in sedentary classroom based activities, such as art projects. As part of the group assignment process, participant grade, sex, and ADHD risk status were examined within each cohort to make each group balanced across intervention groups (Hoza, 2014). Physical activity was assigned accordingly with age-appropriate activities and games to maintain the interest of participants. At the end of the study, which lasted 12 weeks, the two groups were compared to identify which group received the greatest benefits from their assigned activity. The hypothesis stated that the group of children with ADHD risk would receive greater benefits in reducing ADHD symptoms from participating in the physical activity sessions compared to the group participating in sedentary classroom activities.

Physical activity programs in this study included both indoor and outdoor physical activity options including yoga, active games, guided walks, cycling, skipping rope,

various ball games (basketball, soccer), and games to improve cooperation. The duration, frequency and intensity of physical activities varied during each exercise session to identify the best combination for improving symptoms of ADHD in the children with the disorder. The physical activity interventions involved moderate to vigorous activities at a rate that required children to breathe hard at different times during the intervention (Hozza, 2014). Data were collected each day while school was in session (September through May). Intervention programs were conducted both indoors and outdoors during winter and spring months, to ensure participants were acclimated to the schedule and expectations prior to the physical activity program initiation. Each child participating in the physical activity program received an accelerometer to wear to identify the total amount of activity completed during waking hours for a consecutive 7-day period. During this time each participant was asked to complete a daily physical activity log, and parents were contacted daily to ensure they were compliant with the expectations and directions (Gapin, 2010).

After the children participated in the physical activities, they performed school work or computer games to identify how long it would take them to complete the assigned tasks. This process helped researchers identify if improvements were made in reducing ADHD symptoms in the participants. The response time to solve the assignments and tasks that required attention for completion was recorded. The group of children with ADHD who participated in physical activity showed improved performance in the tasks that required attention by 30.52% compared to the group of children with ADHD who did not engage in physical activity prior to engaging in the tasks. This study showed that

physical activity was able to improve the attention of children with ADHD and improve their school performance (Silva, 2015). Further, Mulrine (2008) explained that students who run or jog may have fewer incidents of conduct and oppositional problems, in addition to helping them modify their disruptive classroom behaviors. Currently, researchers cannot conclude which type of physical activity is most beneficial in reducing characteristic symptoms of ADHD. However the amount, regularity of activity and duration of the intervention may play important role in reducing ADHD symptoms (Kamp, 2014). Hoza (2014) performed a study on young children at risk for ADHD. Results indicated that physical activity interventions were more effective than sedentary classroom activities in reducing ADHD symptoms as reported by both teachers and parents. Additionally, parents reported overall reductions in problematic social functioning, including behavior with peers. Teachers reported overall reductions in ADHD symptom severity in the physical activity groups.

Recommended duration of physical activity to reduce ADHD symptoms

Mulrine (2008) explains that engaging in at least 30 minutes per day of physical activity, 3 to 5 days per week, has shown behavioral and academic advantages in children with ADHD. Similarly, Wendt (2000) (as cited in Mulrine, 2008) found that 40 minutes per day of exercise 5 days per week for 6 weeks significantly improved the behavior of ADHD school aged students.

Cerrillo-Urbina (2015) explains that time spent engaging in physical activity is effective in mitigating symptoms and behavioral disorders in children with ADHD. Additionally, aerobic exercise seems to reduce inattention, impulsivity and hyperactivity in

youth with ADHD. Reports show that 30 minutes of physical activity is effective in improving other symptoms of ADHD including executive function within children with ADHD. Additionally, it was discovered that executive function improves with aerobic exercise (Cerrillo-Urbina, 2015). Further, Silva (2015) explains that even short durations of intense activity, such as running five minutes without rest, can reduce ADHD symptoms and improve other issues such as cognitive function related to this disorder.

Priority populations for physical activity interventions to reduce ADHD symptoms

Many studies have explored the benefits of exercise for children with ADHD, finding specifically that physical activity improves cognitive performance especially in children who are of elementary school ages (Gapin, 2010). Specifically, Hoza and associates (2014) explored the effects of implementing physical activity and sedentary classroom activities on the symptoms, behavior, moodiness, and peer functioning of young children at risk for ADHD. The intervention consisted of 202 (54% male) children who were randomly selected and assigned to either physical activity or sedentary classroom activities and participated in their designated activity for 30 minutes per day, each school day, over the course of 12 weeks. The results indicated reductions in ADHD symptoms on a DSM-IV based rating scale for children. It was also discovered that the physical activity intervention was more effective than the sedentary classroom intervention at reducing symptoms and impairment associated with ADHD-risk in both school and home domains. Mehta and associates (2011) selected male and female participants within the age range of 5-11 years old.

Summary

The purpose of this literature review was to investigate if implementing physical activity in elementary schools would reduce symptoms of ADHD in children. In addition, the type, frequency and duration of physical activity that is most effective in reducing symptoms of ADHD were also addressed. This review also described the effects of stimulant medication and therapy in treating ADHD symptoms in children. Even though it was found that different types of physical activity reduced symptoms of ADHD in children, outcomes of the research did not disclose which combination of type, intensity, duration and frequency of exercise that was most effective in reducing ADHD symptoms. The literature reviewed suggested that various types of physical activities (yoga, active games, running, biking and walking) reduced the characteristic symptoms of ADHD, without any undesirable side effects that are often associated with prescription medication. The advantages and limitations of implementing increased physical activity programs within elementary schools across the United States will be explored in greater detail in the next chapter.

Chapter 3

Findings and Discussion

The purpose of this study was to identify if physical activity reduces ADHD symptoms in children and improves other issues related to this disorder. Additionally, another purpose of the study was to identify if implementing physical activity programs in elementary schools across the United States would provide alternative treatment options to stimulant medication for children with ADHD risk. The literature selected and reviewed included only children and adolescent subjects; it did not include adults in the research samples. The literature that was selected and reviewed was limited to materials published between 2006 and 2016, and was obtained through the source EBSCO host Academic Premier.

To identify if physical activity reduces ADHD symptoms in children, the following research questions were explored in this study:

- 1) What are the most effective types of physical activity for children with ADHD to reduce their symptoms of ADHD?
- 2) What is the recommended duration of time spent engaging in physical activity to identify improvements in symptoms of ADHD?
- 3) What are the advantages of implementing increased physical activity programs for children with ADHD within elementary schools across the United States?
- 4) What are the limitations of implementing increased physical activity programs for children with ADHD within elementary schools across the United States?

Table 3.1

Most effective types of physical activity: supporting studies

Source	Methodology	Population	Findings
Cerrillo-Urbina, J., et al.	Durations of yoga and aerobic exercise, 50 minutes, 2-3 times per week for 5 weeks.	The mean age of the children was 10.60 years old. 230 children participated.	Yoga improved ADHD symptoms. Duration of 30 minutes improved symptoms of ADHD.
Kamp, C., Sperlich, B., & Holmberg, H.	Various types of exercises, frequencies, and durations are tested with children.	All subjects were 7 to 13.8 years old. Boys and girls were both included.	Yoga training reduced ADHD symptoms significantly especially in combination with medication.
Meta, S., Mehta, V., Mehta, S., Shah, D., Motiwala, A.	Physical exercise, yoga was incorporated with children and adolescents with ADHD.	There were 76 children ages 6 to 11 years old participating in this study.	After 6 weeks of the program, 90.5% showed improvement in their academic and behavioral performance.

Table 3.2

Duration of time spent engaging in physical activity: supporting studies

Source	Methodology	Population	Findings
Hoza, B., Smith, A., Shouldberg, E., Linnea, K., Dorsch, T.	Children put into 2 groups: sedentary or active. Duration was 30 minutes of exercise, 5 days a week for 12 weeks.	Median age was 6.83 years old. Children were enrolled in school.	Reductions in problematic peer behaviors, moodiness and oppositional defiant disorder symptoms were found in children.

Table 3.2

Continued: Duration of time spent engaging in physical activity: supporting studies

Source	Methodology	Population	Findings
Cerrillo-Urbina, A.J., et al.	Aerobic and yoga exercises. Durations were 50 minutes, 2-3 times per week for 5 weeks.	The mean age of the children was 10.60 years old. 230 children participated.	Yoga improved ADHD symptoms. 30 duration minutes of activity improves symptoms of ADHD.

Table 3.3

Advantages of implementing physical activity programs: supporting studies

Source	Methodology	Population	Findings
Mulrine, C., Prater, M., Jenkins, A.	Teachers created structured games and physical movement activities.	Elementary aged students, ages 5-11 years old.	Focus, listening skills and problematic behaviors improved with all children.
U.S. Department of Health & Human Services.	The National Physical Activity Plan Alliance developed a physical activity report card for children based on levels of physical activity and sedentary behaviors in children.	Targeted youth and children in schools across America. Goal is for children and youth reach a daily physical activity benchmark of 81-100%.	Only one-quarter of children and youth 5-16 years old were at least moderately active for 60 minutes on 5 days per week. A grade of a D- was given due to inadequate amount of exercise within children.
Meppelink, R., Bruin, E., Bogels, S.	Mindful (meditation) training for 8 weekly 1.5 hour sessions.	The children were ages 9 to 18 years old, both males and females.	Mindful training improved depression, stress, anxiety, mood and cognitive and emotional states.

Table 3.4

Limitations of implementing physical activity programs: supporting studies

Source	Methodology	Population	Findings
Golubovic et. al.	Children participated in a 6 month exercise program. Fitness levels were assessed tests to test effectiveness.	133 school age children (101 boys and 32 girls). Teachers and parents were surveyed after the intervention.	Parents and teachers felt implementing physical activity would be a time burden. Financial, time and space were all limiting concerns.
U.S. Department of Health & Human Services.	Studies were conducted to identify if physical education classes in schools nationwide were meeting national health and fitness standards.	Children and adolescents grades 1-12, nationwide.	Elementary and middle school physical education classes are frequently taught by untrained classroom teachers or without an activity-based PE curriculum, and therefore the classes may not be effective.

The most effective types of physical activity for children with ADHD to reduce their symptoms of ADHD

All literature reviewed indicated that engaging in some type of physical activity improved symptoms of ADHD in children; however the research indicated there was not one type of physical activity that was universal in having the greatest impact with improving ADHD symptoms. Some of the literature reviewed, indicated that yoga and mindful-based activities were effective forms of improving ADHD symptoms in children with ADHD. Kamp (2014) found that yoga training reduced ADHD symptoms significantly especially in combination with medication. The combination of yoga and medita-

tion exercises resulted in more than 50% of the children improving their behavioral and academic performances (Mehta, 2011).

The recommended duration of time spent engaging in physical activity to identify improvements in ADHD symptoms

The literature reviewed indicated even a short duration of exercise is effective with improving symptoms of ADHD in children, however the specific duration of time leading to the greatest improvements in ADHD symptoms was not disclosed. Hoza (2014) found that children participating in physical activity for durations of thirty minutes on five days per week, had reductions in problematic peer behaviors, moodiness and oppositional defiant disorders symptoms. One author concluded that aerobic and yoga activities improved ADHD symptoms when child participants engaged in thirty minutes of physical activity (Cerrillo-Urbina, 2015).

The advantages of implementing increased physical activity programs for ADHD within elementary schools across the United States

The literature reviewed indicated there are many advantages to implementing physical activity programs in schools as they show evidence in reducing ADHD symptoms in children. Studies have suggested a positive link between physical activity, behavior and academic performance of children with ADHD. It is especially important for children with ADHD to have ample opportunities for physical activity breaks during the school day, in addition to scheduled physical education classes. Movement breaks offered during class contain stretching and periodic movements, which help children, focus and complete tasks (Mulrine, 2008). Several studies showed that physical activity could result

in improved fitness levels, cognitive performance, and improved self-esteem. Specifically, Golubovic (2013) reported physical activity reduced hyperactivity, inattention and impulsivity levels in children with ADHD, as well as encouraged their involvement in social groups.

When children take breaks from learning tasks, they can focus better when they return to their school work (Mulrine, 2008). Therefore incorporating movement breaks throughout the school day could be very advantageous for students and teachers. Physical activity and movement breaks could be incorporated during the school day, during subject transition times, during content lessons as well as structured movement games for recess and gym (Mulrine, 2008). Implementing structured games during recess teaches children socially appropriate values and behaviors, including sharing, fairness and respect (Mulrine, 2008).

Movement, physical activity and stretching breaks could be incorporated several times per school day targeting all children, including those with ADHD. These breaks can be implemented throughout the school day, in addition to scheduled physical education classes. This combination of physical activity programming may lead to greater results in reducing symptoms of ADHD. Children who have ADHD may have difficulty sitting still (Mulrine, 2008), therefore health educators and teachers may need to plan appropriate and effective physical activity breaks. Incorporating yoga, games to improve cooperation, cycling, running, skipping rope and ball games should be considered for physical activity program implementation within schools (Kamp, 2014). If physical activity programming is gradually implemented into schools by adding a few movement and

stretching breaks for students, and eventually changing recess to a structured format, then over time physical activity programs could include running, guided walks, games with balls, yoga, and more.

The 2008 Physical Activity Guidelines for Americans recommends children and youth engage in a minimum of 60 minutes of moderate-to-vigorous physical activity each day, on at least three days per week (U.S. Department of Health and Human Services, 2014). If schools across the United States were to implement more physical activity programs, this would help improve the overall physical activity grade among children and youth across the nation. These guidelines could be met if the physical activity programs were designed to ensure children were reaching the required amounts of activity daily and if they were offered at no or low cost to the children. The physical activity program implementation could include one of the following combinations to reach the recommended 60 minutes of physical activity per day:

- Five, three minute movement and stretching breaks before and during school, amounting to 15 minutes total. Additionally, 15 minutes of structured recess and 30 minutes of physical education (gym) class scheduled daily, to equal 60 minutes total.
- Ten, three minute movement and stretching breaks before and during school, amounting to 30 minutes total, in addition to 30 minutes of structured recess (this could be one 30 minute session or two 15 minute sessions).
- 30 minutes of structured recess (could be one 30 minute session or two 15 minute sessions) and 30 minutes of physical education (gym) class.

Advantages of incorporating physical activity into daily school schedules are that it reduces distractions for all students, it helps students with ADHD focus and complete tasks, it allows all children to become more physically fit, it reduces symptoms of ADHD and it reduces behavioral and social problems for ADHD children. Finally, the literature reviewed indicated that preventing students with ADHD from engaging in physical activity may cause some classroom-related problems and that incorporating PA into the school day was an effective method of delivering behavioral interventions (Mulrine, 2008).

The limitations of implementing increased physical activity programs for ADHD within elementary schools across the United States

The literature reviewed illustrated some limitations that are noteworthy regarding physical activity for ADHD children and how this could affect implementing increased physical activity within elementary schools across the United States. There is evidence that the benefits of physical activity have reduced the characteristic symptoms of ADHD. However, there are some problematic issues with this group of children performing physical activity exercises. Golubovic (2013) explains there is a link between hyperactivity and motor problems within children with ADHD. The literature reviewed showed that implementing different types of physical activity could be applied in various health behavior interventions, within schools and other settings. The most common difficulties related to physical activity for children who have ADHD include: problems with performing organized motor skill activities, lower performance level of gross motor activities, lower levels of physical fitness abilities, insufficient efforts to achieve better results, dif-

difficulties following game rules, feeling of inadequacy with physical activity and low self-respect and self-esteem (Golubovic, S, 2013).

The author of one study reviewed, explains that some physical activity interventions were viewed as a burden by some parents and teachers, in addition to being costly to implement in terms of training and ongoing management. Additionally, even when implemented effectively these evidence-based physical activity interventions could have limited longevity effects with the likelihood of symptoms returning in the months following treatment (Hoza, 2014).

Additional limitations of implementing increase physical activity programs within elementary schools nationwide include: limited allocation of resources (including time, funding and space), access to instruments and equipment (accelerometers, pedometers), and staff to implement successful physical activity programs within schools across the United States.

Discussion of Findings

The literature reviewed identified many benefits of incorporating physical activity into treatment for ADHD children. All of the literature reviewed explained that children with ADHD showed improvements in at least one area that physically, mentally or emotionally benefited them after the physical activity interventions. The majority of the physical activity sessions were at least 30 minutes or longer, which was implemented to maximize the benefits for children with ADHD risk. After the physical activity interventions were implemented, children with ADHD risk were found to have improvements in focus, staying on task for a longer period of time and better classroom behaviors.

The literature reviewed did not identify one perfect combination regarding type, intensity, duration and frequency of physical activity that is most effective in reducing symptoms of ADHD in children. There was not one particular type of physical activity that was proclaimed by all authors to have the greatest overall benefit for children with ADHD risk, however the yoga intervention results showed reduced hyperactivity, impulsiveness, anxious behaviors, ODD, social problems and DSM-IV total (Cerrillo-Urbina, 2015). Kamp (2014) explained in the findings section of his report that yoga training reduced ADHD symptoms (inattentiveness, hyperactivity, impulsiveness) significantly, especially in combination with medication. Additionally, the core symptoms of ADHD were reduced by all of the exercise interventions. The combination of yoga and meditation exercises resulted in more than 50% of the children improving their behavioral and academic performances (Mehta, 2011).

In the literature reviewed, some of the (ADHD children) participants were taking prescription medication during the intervention and some were not. It was discovered that regardless if they were taking medication or not, the results of the studies indicated some type of improvement of cognitive, behavioral, or physical functioning within this group of children. One researcher explained that the participants included in the study were taking medications to treat their ADHD, and there were no significant results for reducing ADHD symptoms. However, the greatest improvements were in cognitive performance with this group of ADHD children (Gapin, 2009). These results indicate that physical activity may allow the ADHD children to perform better cognitively or potentially reduce their medications, if paired with an increase in regular physical activity. With the physi-

cal activity interventions, parents and teachers reported reductions in ODD, problematic peer functioning and ADHD symptoms based on a DSM-IV rating scale for children (Hoza, 2014). Parents and teachers evaluations of behavior found improvements within most of the children after a 6 week intervention which included one-hour yoga and meditation sessions (Mehta, 2011). The findings supported how physical activity improved the cognitive and behavioral performances in children with ADHD to deliver social, academic and behavioral improvements in school and at home. There are advantages and limitations of implementing physical activity programs into schools across the United States; therefore it is important to understand the components of ADHD and the intended behavioral intervention to ensure that the most appropriate method is selected.

Chapter 4

Conclusions and Recommendations

The purpose of this study was to identify if physical activity could improve the symptoms of ADHD in children. The literature reviewed focused on the applications, advantages and limitations of implementing increased physical activity programs and was based on the elementary school aged children and the behavioral intervention. The review of literature findings highlighted important aspects of physical activity interventions within elementary aged children and how they improved ADHD symptoms within children with ADHD.

Summary

The literature reviewed indicated various types of physical activity interventions within elementary aged children were effective in reducing ADHD symptoms for elementary school aged children. The physical activity intervention methods implemented within the study conducted by Silva (2015) was effective in reaching varied populations of children, some had ADHD risk and some did not, however the children with ADHD risk showed the greatest improvements in cognitive function and reduced symptoms of ADHD. The reviewed literature suggested limitations with the physical activity interventions for children with ADHD include difficulty in following game instructions, problems with performing organized motor skill activities and lower physical fitness levels compared to children without ADHD. The reviewed literature also demonstrated challenges with implementing increased physical activity programs within schools across the United States. These challenges include restricted budgets, space, limited time and staffing re-

sources. This is likely a result of increased employment of teachers to administer the program, whereas most physical activity programs could be delivered through current school resources, such as existing physical education classes, and introducing modified classroom environments to include more activity breaks and structured recess.

Conclusion

Based on the literature reviewed and discussion of findings the following conclusions are made regarding implementing increased physical activity programming within schools across the nation. First, physical activity programming within schools requires some type of involvement from the school staff and resources, which may include time, space or financial support. Some forms of physical activity may already be scheduled during the school day, which could include recess, physical education class or periodic movement breaks held during class. This indicates an advantage for schools and students where physical activity programs are already scheduled, given that the students are physically able to participate. Second, implementing new or increased physical activity programming (within schools that currently do not offer this type of programming) may include additional costs, time, space and staffing resources. This could create limitations for schools and children who could potentially benefit from physical activity programs. Additionally, given that many behavior change interventions have a limited budget, many school administrators are forced to conserve costs in certain areas to ensure a health intervention is implemented.

Recommendations

Based on the findings of this study, it is recommended that more research be done to identify how physical activity effects the symptoms of ADHD and if physical activity could be used as an alternate treatment to stimulant medication. Although this study did not include a comprehensive review or comparison of the effects of stimulant medication on ADHD symptoms, it is highly recommended that this be researched further to identify the effects of medication on ADHD. An example of a future study may include a direct comparison of physical activity and stimulant medication to gain a better understanding regarding dosage of medication and exact amounts of physical activity and their effects on ADHD symptoms.

It would be important for future research to measure cost and overall effectiveness, both on a short-term and long-term basis. The findings within the literature supported the need for continued work in this area to identify if physical activity could be used as an alternate treatment to medication in treating ADHD symptoms. Additionally, it is recommended in future research to identify which combinations of type, frequency, duration and intensity are most effective in improving ADHD symptoms.

It would be recommended in future research to be conducted in exploring increased physical activity opportunities within elementary schools across the U.S. through test and pilot programs to begin the implementation process. Health educators could oversee the creation and implementation of movement breaks in classrooms, (they could create programming and train teachers). Additionally, they could design structured recess

games, institute daily physical education classes, ensure all students have the opportunity to participate in 60 minutes of physical activity during each school day.

The overall effectiveness of a health behavior change intervention is largely dependent on careful research and proper planning. Thoughtful design and execution are important features to guarantee resources and time are not wasted with this intervention. The purpose of physical activity interventions is to encourage behavior changes that lead to a healthier way of life; it is essential to the health of our future children and mindful about how behavior change programs are implemented.

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