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Effects of SPARK Physical Education Program on Behavioral Problems of Children with ADHD

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Attention Deficit Hyperactivity Disorder (ADHD) is one of the most common behavioral disorders in children. The current study investigated the effects of sports, play, and active recreation in children (SPARK) program on reducing the behavioral problems of children with ADHD. In order to conduct the experiment, the participants (n=30) were randomly assigned into an experimental group and a control group. Child Behavior Checklist (CBCL) was administered to both groups. Then, the experimental group received SPARK program for 12 sessions of 30 minutes, while the control group received no training. At the end of the sessions, both groups were assessed once more. Findings demonstrated that the groups were not very different in the pretest stage; but, post-test scores revealed a significant difference between the groups. This implies the efficacy of doing exercise and physical activities on reducing the behavioral problems of the experimental group members. Therefore, it seems that physical activities should be put into focus in schools and educational centers in order to pave the way for designing therapeutic programs for ADHD children. It is recommended that administrators, trainers, and parents provide suitable environments for ADHD children to help them improve their behaviors.

***Keywords*:** SPARK, behavioral problems, ADHD, hyperactivity

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Attention Deficit Hyperactivity Disorder (ADHD) is recognized with symptoms such as lack of attention and concentration, impulsivity, and hyperactivity. In these conditions, the individual's psychosocial functioning, learning, and cognition are also disrupted (Timothy, 2002). ADHD is the most common mental disorder among children. This disorder is categorized in three types: predominantly inattentive, predominantly hyperactive-impulsive, or a combination of the two (Andrew & Crone, 2002). The hyperactivity disorder usually appears in childhood (Kroes, Kessels, Kalff, Feron, Vissers, & Vles, 2002). If the children are not treated at an early age, there may be a high likelihood of having antisocial behavior and depressive states in adolescence. Therefore, it is recommended that parents and educators come to treat these children in childhood (Shrine et al., 2006).

ADHD children have aggressive and violent behaviors especially with their peer groups, and most of them do not speak until the age of three or do not speak during the early years of childhood (Hellgren, Carina Gillberg, Bagenholm, & Gillberg, 1994). Although the causes of ADHD are not completely known, recent evidence has revealed that the defects in dopaminergic pathways in the brain are involved in controlling impulsivity and attention (Biederman & Faraone, 2005). Medical treatments for this disorder are capable of impacting attention, behavior control, academic performance, and social relationships and may improve the patient's condition (Pan, Tsai, and Chu, 2009). Stimulating drugs such as Ritalin (methylphenidate) or amphetamines are partly effective in the treatment. Research shows that these drugs increase the availability of dopamine in the central nervous system (Volkow et al., 1998), but do not lead to complete cure. In addition, these medications have the potential for some side effects including

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increased blood pressure and heart rate (Findling, Short, & Manos, 2001).

On the other hand, one of the suggested ways by psychotherapists and exercise physiologists to prevent and treat behavior disorders is doing exercises (Bahram, Akkasheh, & Pourvaghar, 2014). Research shows that exercising regulates the level of neurotransmitters in the central nervous system. As compared with numerous reports about pharmacotherapy of children with ADHD, few studies have dealt with treating these children through sports and games (Platzer, 1976). Exercise therapy may be an effective method for reducing the symptoms of hyperactive children or even for reducing the amount of medication administered to them (Paluska, 2000). Strong, Malina, Blimkie, Daniels, Dishman, and Gutin (2005) have reported a very high correlation between exercising and the reduction of anxiety and behavioral disorders among school children. Brisswalter, Collardeau, and Rene (2002) have also shown similar results. They indicate that various sporting activities would improve the child's behavioral performance and executive function. In addition, the positive effects of physical activity on the treatment of anxiety, depression, stress, and general improvement of mental health have been demonstrated (Davis, Tomporowski, Boyle, Waller, Miller, & Naglieri, 2007).

Bahrami (2011) believes that ADHD symptoms improve after a long period of doing ball games. Hoza, Mrug, Pelham, Greiner, and Gnagy (2003) have also found that the formation of a sense of friendship among students who participate in sport programs, reduces their behavioral problems. It seems that the subjects feel good because of their participation in the game, and this feeling may lead to paying more attention to different issues. Weber, Vander Stoep, McCarty, Weiss, Biederman, and McClellan (2008) believe that the effect of sports exercises on

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increasing focus and attention of elementary school students has recently attracted the interest of most of researchers. In a study by Coe, Pivarnik, Womack, Reeves, and Malina (2006), it has been shown that participating in sports activities enhances the accuracy and reduces the learning problems of students with ADHD. Madigan et al. (2003) have also found that the students who do more physical activity have higher concentration.

Due to research evidence, it seems that training programs in schools require a careful reconsideration in terms of the appropriateness of new up-to-date discoveries. Sports, play, and active recreation for children (SPARK) program is one of the novel programs that may help individuals with ADHD. SPARK is a comprehensive curriculum and professional development program designed to promote physical activity in and out of school (Sallis, McKenzie, Kolody, Lewis, Marshall, & Rosengard, 1999). Sallis et al. (1999) have investigated the effects of SPARK on the academic achievement of school children. Their findings confirm the cognitive benefits of the program. In the only study applying SPARK for children with ADHD, Kosari, Hemayat-Talab, Arab-Ameri, and Keyhani (2013) have shown that SPARK physical education program is able to improve gross motor skills in children with ADHD. Almost no study has dealt with investigating the effectiveness of SPARK on the behavioral problems of ADHD children. Therefore, the present research intends to examine whether this new approach is effective for reducing the behavioral problems of ADHD children.

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Method

The current research is a quasi-experimental study. The population of the study included all children with ADHD in Khorramabad. Participants included 80 male students aged 9 to 11 years old in Khorramabad who had been referred to counseling and psychological services centers, reporting symptoms of ADHD. After administrating the Child Behavior Checklist (CSI-4), students who scored above the cut-off point in the section of the disorder (50 individuals) were selected; and among them, those who did not use drugs and did not have any illness based on the personal information questionnaire were purposely selected (30 individuals) and randomly assigned to experimental group (15 individuals) and control group (15 individuals). To collect data, the following instruments were utilized:

Instruments

Child Behavior Checklist (CBCL). Developed by Achenbach (1991), CBCL is an instrument that measures the competence and behavior of a child through the views of parents or people who know the child well. This checklist can be used to assess the child's behavior over time or over the period of therapy. This scale comprises of 113 items and provides a total score (general problems). This instrument includes two main dimensions (externalizing and internalizing problems) and eight limited syndromes (anxiety/depression, withdrawal, somatic complaints, social problems, thought problems, attention problems, delinquent behavior, and aggressive behavior). Cronbach's alpha for the different scales of this checklist has been calculated between .46 and .93 for girls aged 4 to 11 years old. Cronbach's alpha for the eight syndromes has been calculated in range of .62 to .92 for boys aged 4 to 11 years old; and it has been .66 to

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.90 for girls aged 4 to 11 years old. The validity of this questionnaire has been confirmed by Ahadi (2009). In Ahadi's study, Cronbach's alpha for externalizing problems and internalizing problems has been calculated 0.59 and 0.65 respectively; and Cronbach's alpha coefficient for the eight subscales has been reported between 0.48 and 0.75.

Personal Information Questionnaire. This questionnaire was used initially to make the subjects homogeneous. It includes information about age, sport background, physical illness background, and physical abnormalities.

Child Symptom Inventory-4 (CSI-4). Developed by Gadow and Sprafkin (1997, 1998), CSI-4 measures the symptoms of attention deficit/hyperactivity disorder based on Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) criteria. This instrument includes two forms: teachers' and parents'. In the present study, the teachers' version was employed. Sensitivity of CSI-4 based on the cut-off scores of 4, 5, and 7 for each of attention deficit/hyperactivity disorder types has been respectively calculated .75, .89, and .89; and its specificity has been calculated to be .92, .91, and .90 respectively. In the current research, the reliability of this instrument has been calculated at .58, .73, and .96.

Intervention Program

SPARK physical education classes have been designed to promote high levels of physical activity that will improve health-related fitness, promote movement skills that add to success and enjoyment in physical activity, and encourage positive socialization (Sallis et al., 1999). The program is divided into instructional units typically 4 weeks (12 lessons) in length. A standard SPARK lesson lasts 30 min and has two parts: a health-fitness activity (15 min) and a skill-fitness

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activity (15 min). Health-related fitness activities target the development of muscular strength and endurance, cardiovascular endurance, flexibility, and locomotor and nonlocomotor skills. In this segment, there are 13 activity units, including aerobic dance, running games, and jump rope.

Skill-related fitness activities target the development of generalizable manipulative and sport-related skills (McKenzie, Sallis, Kolody, & Faucette, 1997). This part of the lesson includes nine sports units that have the most potential for promoting cardiovascular fitness and for generalizing the child's community (e.g. football, basketball). Popular but low-active games, such as softball and kickball also make them more active (McKenzie, Sallis, & Rosengard, 2009).

Procedure

After obtaining informed consent from their parents, the students took part in research. First, CBCL was administered to both groups (pretest). Then, the experimental group received SPARK physical education program under supervision of an expert physical education trainer. The control group received no training. At the end of the training sessions, both groups were assessed once more. To analyze the data, descriptive statistics (mean, standard deviation) were used. Additionally, to test the significance of differences between the control group and experimental group in the posttest stage and also to control the pretest scores, Analysis of Covariance (ANCOVA) was utilized.

Results

Descriptive statistics of the control group and the experimental group in CBCL have been presented in Table 1.

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Table 1
Mean and Standard Deviation of the Experimental Group and Control Group in Pretest and Posttest

Group	Pre test		Post test	
	Mean	SD	Mean	SD
Experimental Group	5.35	1.28	12.25	1.71
Control Group	5.44	1.05	5.65	1.42

According to Table 1, the mean scores of the groups are not very different in the pretest stage; but, a great difference is observed between the experimental group and control group in the post-test stage. On the other hand, despite an increase in the mean score of the experimental group in the post-test stage, there is no significant difference between the standard deviation of pretest scores and that of post-test scores. This means that the increase in the post-test scores of the experimental group has been influenced by all subjects.

In addition, ANCOVA was used to test the significance of the observed difference between the experimental group and the control group in the post-test stage, and also to control the effect of pretest scores. The results of ANCOVA have been reported in Table 2.

Table 2
Results of ANCOVA for both the Control Group and the Experimental Group

Source	df	MS	F	sig
Pretest	1	.15	.049	.714
Posttest	1	147.19	61.59	.001
Error	15	2.254		

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Table 2 shows that the difference between the experimental group and the control group (f= .049, p= .714) is not significant in the pretest; but, the comparison of the groups in the post-test stage, by removing the effect of the pretest, indicates a significant difference between the groups (f=61.59, p< .001). This shows that SPARK has reduced the behavioral disorders of experimental group members.

Discussion

The current study intended to investigate the efficacy of SPARK on the behavioral problems of children with ADHD. The findings suggested that the SPARK physical education program effectively reduces the behavioral problems of the subjects. This finding is consistent with Bahrami (2011), Hoza et al. (2003), Stasik, Touché, Touch, Wlista, and Lange (2009), Hoza et al. (2015), Naderi, Heidarie, Bouron, and Asgari (2010), and Brisswalter (2002). In explaining this finding, it may be possible to say that the improvement in the physical activities may cause children to have more feelings of competence and success during educational situations and daily activities. This positive self-evaluation may encourage the children to participate in group activities and cooperation with peers (Paluska, 2000). This could reduce their aggressive behaviors toward their parents and teachers, and help them create a more positive relationship with others (Raglan, 1987). Being with others, feeling others being next to them, competing with others, and being encouraged to cooperate may be strong incentives for children to do physical activity (Bahrami, 2011). Through playing, ADHD children see themselves with others, while they are warmly welcomed. Hoza et al. (2015) have found that the formation of a sense of friendship among students participating in sports reduces their behavioral problems. Also, research

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shows that physical activities develop motor behavior and at the same time help improve children's social behavior which is essential to their adjustment (Eapen, Swadi, Sabri, & Abou-saleh, 2007).

The followers of Gestalt theory contend that some children become hyperactive as a way to avoid feeling anything and to block their emotions (Oaklander, 2001). They believe that, through contacts and freedom of emotions, playing gives back to children those aspects of the self that they have lost. Through playing games and exercising involved in SPARK, an ADHD child may find a chance to show whatever happens inside his/her mind (tensions, hopelessness, aggressions, and wanderings), and to evacuate the compressed energy which, in turn, results in the reduction of impulsivity (Bahram et al., 2014; Ray, Bratton, Rhine, & Jones, 2001). Empirical data have also demonstrated that heavy physical activity in such patients controls such symptoms as restlessness and excessive activity up to 95 percent (Archer & Kostrzewa, 2012).

Physiologically speaking, it might also be possible to attribute the effects of exercise to some quasi-hormones like Endorphins (Bahram et al., 2014). These quasi-hormones play a role in body relaxation and could be effective in decreasing ADHD symptoms (Ghobari Bonab & Nabavi, 2003). This may happen as a result of making physiological changes like regulating the cardiovascular system which in turn reduces aggression and attention deficit (Bahram et al., 2014). Numerous documents confirm that learning complex movement sequences stimulates the prefrontal cortex used in problem solving, and this effect could improve behaviors (Sallis et al., 1999). Additionally, physical activity might trigger arousal through neurohormonal mechanisms, which could improve the child’s attention (Shephard, 1997). Therefore, biological and

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neurological factors may have also mediated the psychological outcomes following SPARK practice in patients.

The findings of the present research have some implications regarding the importance of extending the duration of physical education courses in schools and kindergartens. SPARK can act as a supplemental treatment for children with ADHD. It may be useful in controlling symptoms like restlessness, anxiety, and excessive activity. Therefore, it is recommended to enrich physical education programs by making use of SPARK activities in special education schools. This may help improve the attention and behavior of children with ADHD, which in turn results in better academic performance. In this regard, school administrators are encouraged to provide health-related physical education programs, because these activities may confer physical, mental, and behavioral health benefits on students. Considering the results of the study, it is also recommended to psychiatrists, counsellors, and psychotherapists to put the SPARK physical education program into focus in clinical settings. The presented conclusion in the paper may have some limitations. According to the sampling strategy, generalization of the findings to other samples should be done carefully.

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