

*Full Length Research Paper*

# The effects of sports on the attention level and academic success in children

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The aim of the study is to examine the difference between attention deficit (AD) and academic success (AS) of children who do sports and those who do not. A total of 920 voluntary subjects (506 who do sports, and 414 who do not do sports) participated in the study; they are between aged 10 and 14. The children who do sports are from Provincial Schools of Ministry of National Education or Youth Sports Provincial Organisations, Nigde Province, while those who do not engage in sports are from Local Ministry of Education in Nigde Province". The children's mathematics, Turkish language and science courses grades were assessed by the end of the year and through AD's D2 attention test. Their attention level was classified as poor, mediocre, normal and good according to TN-E score. Independent t test, ( $p < 0.05$ ) was used to determine the difference between AS and AD parameters of the children who do sports and those who do not; Chi-square test was used in the analysis of categorical data. According to the results, it was determined that in the categorization of ADs, the number of the children with higher attention level who do sports was higher compared to those who do not do sports ( $p < 0.05$ ). In addition, it was found that the AS (Mathematics, Turkish, Science) of the children who do sports was significantly higher than those who do not do sports ( $p < 0.05$ ). As a result, not only has sport played a significant role in children's health and physical development, it is also important for the improvement of their AS and the AD.

**Key words:** Children, attention deficit test (D2), attention, academic success.

## INTRODUCTION

Attention is most commonly described as a function of the nervous system, and provides several neural stimuli for those who need it in line with their purposes (Banich, 1997; Parasuraman, 2000). Attention deficit (AD) is one of the most common problems in children (Harvey and Reid, 1997). Children with AD are characterized by careless, hyperactive and impulsive behavioral states (Polanczyk, 2007). Excessive AD includes problems such as delay in work, difficulty in organizing, avoidance of tasks requiring long-term mental effort, attention to detail,

forgetfulness of supplies, failure to complete assigned tasks, and extreme forgetfulness during daily activities (Şenol et al., 2006; DuPaul et al., 2009). In order to treat attention deficit hyperactivity disorder (ADHD), the most common and effective treatment is to use medicinal stimulants such as methylphenidate or amphetamine (Mayes et al., 2008). Children's treatment with ADHD also requires interventions along with drug and prudential management (DuPaul et al., 1998), one of which is the physical activity. Two basic mechanisms are

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discussed in explaining the positive effects of physical activity on children with ADHD. It is clear that exercise increases brain blood flow (Zametkin et al., 1990). For example, aerobic exercise can increase tissue blood flow and O<sub>2</sub> uptake (Foss and Keteyian, 1998). In another study, it is claimed that long-term low-impact aerobic exercises (such as walking, running, etc.) reduce hyperactive and impulsive behaviors in children with ADHD, in parallel with increasing cardiovascular resistance (Putnam, 2001).

Yurdakul et al (2012) conducted a study with 146 primary school students in order to investigate the relationship between AD and physical activity in children, indicating that physical activities during the 12-week period provided progress in the development of AD reduction. Topcu et al (2007) conducted a study in which children performed folk dances for two days a week for 15 weeks and found that folk dances had a positive effect on children with AD. He also stated that positive effects of exercise can be used in the clinics as an additional support to promote health care in children with AD.

Another important effect of physical activity on children is that it increases academic success. Studies have shown that physical activity affects brain structure and functions through several different mechanisms. Physical activity has been shown to improve cell capillaries, increase blood flow and brain oxygenation, increase brain neurotransmitter and neurotrophin levels, nerve cells, brain tissue volume, and thus developing new nerve cell connections (Cotman et al., 2007; Cotman et al., 2002; Cooke and Bliss, 2006; Van Praag et al., 2002). Studies have shown that these physiological changes that occur in the brain develop academic success as a result of positively affecting concentration, memory and processing strategies (Cotman et al., 2002; Trudeau and Shephard, 2008).

Coe et al (2006) found that the academic success of children who perform high-intensity exercise increased. Shephard (1996) noted that physical activity improved classroom behaviors in such a situation that students increased attention span, concentration and self-esteem by reducing dementia. It is stated that the physical activity must exceed a certain threshold in order to see desirable effects, and this is explained by the fact that the academic performance is influenced by the high intensity activities instead of the low intensity activities.

Therefore, the aim of this study is to discover if there is any significant academic difference in AD of children who participate in sports as compared to those who do not do sports.

## MATERIALS AND METHODS

The participants of the study consist of either the children who do sports at Provincial schools of Ministry of National Education or Youth Sports Provincial Organisations; moreover, they have all been granted sports licenses by schools and Youth Sports Provincial Organisations in Nigde Province. As for those who do not

do sports study at schools dependent on Local Ministry of Education in Nigde Province. A total of 920 children aged 10-14 (506 who do sports, 414 who do not do sports) participated in the study. 506 of the children participating in the study have been doing team sports as licensed for at least 2 years, 414 of them do not do any sports. 261 of them are soccer players, 106 of them are basketball players, and 139 of them are licensed in the field of volleyball branches. Demographic characteristics of children is shown in Table 1.

## Data collection instruments

### Academic success

The students' academic success in the study was determined by the average of end of term grades which were obtained from the school administrations by a permission from the Provincial National Education for the courses of Mathematics, Science and the Turkish language.

### D2 attention test

D2 Test of Attention developed by Brickenkamp in 1962 was adopted for Turkey for the groups between 11-14 years old by Toker (Toker, 1998; Toker, 1990). The D2 test is a measurement of selective attention and mental concentration. On the front page of the D2 test is a section where you can record your personal information and performance results, and a trial line. On the back page, there is a standard test form. The test page consists of 14 lines, each of which has 47 letters. Each line contains 16 letters consisting of the letters "p" and "d" with one, two, three and four small signs. During the test, the subject has to ignore other unrelated letters to find the letters "d" with two signs and scan the lines to draw on them. Each line is given a 20 second delay. The scores obtained from the D2 Test and what they mean are given below (Brickenkamp and Zillmer, 1998; Spreen and Strauss, 1998). Total Number of Items Processed (TN): A quantitative measure of the performance of all materials involved, both related and unrelated. Total Error (E): Unchecked (E1) and incorrectly marked letters (E2). Percent Error (% E): A variable that measures the qualitative direction of performance. It represents the error rate within all the traded materials. As the error rate decreases, the accuracy of your work, the quality of your work, and the level of attentiveness increase. Concentration Performance (CP): Obtained by subtracting E2 from the number of relevant substances marked correctly. Surge Ratio (FR): The difference between the order of the maximum number of items being processed and the order of the minimum number of items. Total Item-Error (TN-E): The total number of items scanned is minus error points. TN-E is a total performance score, highly trustworthy, and gives a measure of the relationship between performance accuracy and speed. The obtained TN-E score is defined as 50-60% bad, 60-70% medium, 70-85% normal and over 85% is good.

### Statistical analysis

Independent t test was used to determine the difference between AS and D2 attentiveness test parameters of the children who did sports and children who did not do sports after the obtained data were analyzed through SPSS 24.0 program, Chi-square test was used in the analysis of categorical data. Significance level in the study was accepted as  $p < 0.05$ .

## FINDINGS

When Table 2 was examined, it was determined that the

**Table 1.** Demographic characteristics of children.

Parameter	Sports doers	Non-Sports doers
	Mean±Sd	Mean±Sd
Age (year)	12.67±1.08	11.93±1.27
Height (cm)	156.47±10.58	148.24±14.18
Weight (kg)	46.47±11.19	46.14±10.66
BMI (kg/m <sup>2</sup> )	18.77±2.99	20.64±2.92

**Table 2.** Differences between attention parameters and academic success of children who participate in sports activities and those who do not.

Parameter		Mean±Sd	P
TN	Sports doers	365.42±89.19	0.034*
	Non-Sports doers	353.01±86.66	
E1	Sports doers	50.71±50.19	0.001*
	Non-Sports doers	66.88±58.38	
E2	Sports doers	28.51±41.17	0.957
	Non-Sports doers	28.68±32.75	
Error % (%E)	Sports doers	25.72±16.85	0.001*
	Non-Sports doers	20.70±16.20	
TN-E	Sports doers	287.95±81.25	0.001*
	Non-Sports doers	258.73±66.08	
CP	Sports doers	92±60.13	0.001*
	Non-Sports doers	75.75±58.35	
FR	Sports doers	20.90±9.18	0.109
	Non-Sports doers	21.91±9.95	
Maths	Sports doers	79.56±17.92	0.006*
	Non-Sports doers	75.91±18.66	
Turkish	Sports doers	83.23±14.06	0.001*
	Non-Sports doers	79.47±15.12	
Science	Sports doers	82.85±15.40	0.002*
	Non-Sports doers	79.19±16.63	

\*p&lt;0.05.

Maths, Turkish and science courses grades that the parameters of D2 test of sports students were TN, error percentage (% E), TN-E and CP and AS were statistically significantly higher than the non-sports students, which was found to be statistically significantly lower than those who did not.

As shown in Table 3, it is determined that the number of students who did sports was more in the good categorization and fewer in the bad categorization than those who did not do.

## DISCUSSION

Studies of the relationship between physical activity in the literature and the AS have yielded different results. While some studies have identified physical activity as boosting the AS, others have indicated that physical activity does not have an effect on the A. Singh et al. (2012) found that there was a positive relationship between physical activity and the AS in a study conducted on children. In another study, Oh et al. (2003) and Tremblay et al. (2000) found

**Table 3.** Classification of children who participate in sports activities and those who do not, according to TN-E score percentiles.

Parameter		TN-E Classification				Total	P
		Bad	Average	Normal	Good		
Sports doers	No.	220	12	39	235	506	0.001*
	%	43.5	2.4	7.7	46.4	100	
Non-Sports doers	No.	243	20	25	126	414	
	%	58.7	4.8	6	30.4	100	

\*p&lt;0.05.

that students had a positive but weak relationship between physical activity and AS. Coe et al. (2006) found a positive relationship between AS and physical activity levels in high-intensity exercise, although a significant relationship between physical activity levels and the AS was not found in students who participated in moderate-intensity physical activity. Coe et al. (2006) interpreted this as an improvement in AS, with physical activity severity exceeding the threshold limit. Similarly, Iri et al. (2017) and Shephard (1996) reported that physical activity must exceed a certain threshold in order for AS to reach the desired level, which is explained by the fact that academic performance is influenced by high intensity activities rather than average intensity activities. Shephard (1996) also noted that physical activity improves classroom behavior and increases AS and the ability to increase attention span, concentration and self-esteem by reducing children's annoyance.

The study mentioned above shows that the AS of children who do sports is higher than those who do not sports. The children who participated in the current study had licenses and were in the competitor groups. For this reason, it can be stated that the children participating in the study were positively influenced by the AS when their intensity level of exercise was above the threshold which was specified for physical activities parallel with the current in the literature.

In the current study, it was determined that in the classification of AD of children who do sports and children who do not sports, while the number of the children who do sports was found to be low in the bad group and high in the good group. As a result of the study 8-week golf training, which they conducted with children aged 14-15, Tunç et al (2014) found that children's attention levels improved. In a similar study, it was seen that children in educational games, which had physical activity within 5-6 years of age, contributed to attention development positively (Gelişli and Yazıcı, 2016). In addition, a pilot study conducted in recent years reported that social behavioral problems and hyperactivity of children with ADHD are diminished with certain rhythmic movements (therapeutic mental-motion therapy) in music accompaniment, thereby increasing concentration and attention ability (Majorek et al., 2004). Another study in

which attention-seeking levels of skiing and non-skiing children were assessed and they found that their attention-seeking levels are better for children who do skiing (Göktepe et al., 2016). Exercise is believed to be effective on catecholaminergic and dopaminergic systems (Tantillo et al., 2002; Wigal et al., 2003), particularly in short-term intensive exercises, by reducing catecholaminergic and dopaminergic systems to reduce hyperactive and impulsive behaviors in children with ADHD (Tantillo et al., 2002).

The results of the above studies also support the current study and show that sport and physical activity are important factors in the treatment of AD.

As a conclusion, it can be suggested that children should be guided by their parents and their teachers to improve the level of attention and the AS, and sport may be an important factor in the treatment of children with AD.

## CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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