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Full Length Research Paper

Measurement of attention based on physical activity levels of secondary school students

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ABSTRACT

The goal of this study is to investigate whether or not the attention level of middle school students' changes depends on their physical activity. Fourty middle-school students who have been taking education in Yalova province joined the study as a volunteer. Fifty percent of the participants are male and the others are female. The experimental and the control groups have been formed and each of these groups consisted of 10 male and 10 female students. International physical activity questionnaire short form and Burdon concentration test were used as the information gathering instruments. To compare the experimental groups with the control groups, a T-test was used for independent groups. To compare one to another participant in each group, also T-test was used for dependent groups. Using the international physical activity questionnaire short form, preliminary and final tests were applied to each participant. According to the results of the questionnaire, weekly MET values of each participant were calculated. At the beginning of the study, the Burdon concentration test applied to each participant. Our study has finished in eight weeks. The physical activity levels of the control group were kept constant and no information was given. Twenty pieces of Xiaomi-mi-band-3 smart bracelets were supplied to the experimental group and they were informed about the features of these devices. At the end of 8 weeks period, the international physical activity questionnaire short form and Burdon concentration test were applied to each participant again. According to the physical activity levels of the control group, no significant difference has been found between the results of the Burdon concentration test ($p > 0.05$). But according to the physical activity levels of the experimental group, a significant difference has been found between the results of the Burdon concentration test ($p < 0.05$). As a result, it has been observed that an increase in levels of physical activity provides an increase in concentration. In conclusion, it is seen that many students and young people have low levels of physical activity due to both lifestyle and virtual world dependence. Although there are many factors, the decrease in physical activity causes low levels of attention. The better the attention levels of our students and young people, the more successful they will be in their lives. Our study and most of the mentioned studies reveal that attention is a developable skill and a situational factor that is open to influence. Therefore, attention development in children who are directed to recreational activities should be emphasized, especially during periods of rapid physical growth. If we want our students and young people to be more successful, they should be encouraged and supported more about physical activity.

Keywords: Middle school, physical activity, child attention.

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INTRODUCTION

The World Health Organization (WHO) defines the quality of life as a person's physical, mental, and social well-being. Physical activity, cardiorespiratory form, and body mass index were found to be directly and indirectly related to mental well-being and physical and psychological quality of life (Eddols et al., 2018). Humanity has sailed to new horizons every day with its inventions that have been done for centuries. Most of

these are the developments in the field of technology. Every day, to increase the quality of life, we develop tools that will enable us to make many activities that we use in daily life more effortless and with less energy. However, it can be seen that assuming the behavior models developed by using individuals' mind, creativity, time, physical power, energy, and reflexes with the help of technological tools increases the quality of life, but generally, the free time and energy created cannot be evaluated for improving the quality of life (Bek, 2008). As industrialization and financial growth have taken place, there has been a change in the types of events that people perform in their daily routine, in television watching, and computer use (Hill et al., 2003). Various home functions are automated. For example, motorized vehicles and elevators are automated. Household cleaning is automated using dishwashers, washing machines, and vacuum cleaners. Each of these tasks leads to 'labor savings' and increased immobility.

Physical activity is defined as anybody's movement produced by skeletal muscles requiring energy expenditure. The term "physical activity" should not be confused with "exercise". Exercise is a planned, structured, repetitive, and intended sub-category of physical activity that means the improvement or protection of one or more components of physical fitness is the goal. It includes other activities that include physical activity, exercise, and physical movement, and is part of games, work, active transport, housework, and leisure activities (TFA, 2010).

A large part of the research on physical activity on children draws attention to the effect on weight. Apart from this, there are numerous health conditions or behaviors in which physical activity can help to improve; stress, sleep disorders, eating habits, anxiety, depression, blood sugar control, and general well-being (U. S. Department of Health and Human Services [HHS], 2008). The central nervous system needs physical activity as well as the healthy and effective functioning of the musculoskeletal system (Institute of Medicine, 2013). Physical activity improves students' understanding, memory, and application skills. Many meta-analysis studies examining physical activity, and test results show a positive correlation between activity and language performance, mathematics, reading, and behaviors (Álvarez-Bueno et al., 2017, Arilson et al., 2019). Physical activity levels of individuals are positively related to higher education duration and generally higher degrees (Kari et al., 2017).

More active young people have a longer attention span, faster cognitive processing speed, and generally perform better in standardized academic tests than those who are not active (Institute of Medicine, 2013). Children who have problems with the school may not always need additional class time; sometimes they need physical activity. Focusing on small breaks over a period of 7 hours can be challenging for younger students. A randomized controlled trial was conducted to assess the effect of class activity breaks, and after a 10-minute exercise break, a significantly higher incidence was observed in students compared to a non-stationary control group (Howie et al., 2014).

Cognitive functions are related to taking, storing, processing, and using information such as attention, perception, memory, and thinking. The term 'executive functions', is a built-in concept used to refer to the coordination and control of information processing in psychology. Executive functions regulate other cognitive functions necessary for human activity, such as memory, attention, and thinking. The executive functions are responsible for identifying targets, planning working methods, selecting and controlling the cognitive functions required to achieve the goals, as well as the voluntary control of the individual's actions, the flexibility of the actions, and the evaluation of actions. These functions are very important for decision making, problem-solving, and learning. It has been found that physical activity has a positive effect on children's cognitive functions such as memory, attention, and general information processing and problem-solving skills. Recent studies have shown that increased physical activity improves test results, especially in tasks that require executive functions and memory. However, there is little research on the direct effects of physical activity on cognitive functions, and the results are somewhat inconsistent. Research has also shown that good aerobic fitness has a positive correlation with memory and executive functions. Conversely, muscular fitness does not seem to be related to cognitive functions. Links between physical activity and cognitive functions may contribute to explain the link between physical activity and academic achievement (Finnish National Board of Education, 2012).

In Psychology, attention is defined as selective stimulus selective focus, the ability to maintain this focus, and change the way you want. Concentration ability and attention are important in learning. Learning is most effective when giving attention to a person. Poor attention can be a key sign of behavioral disorders in children, such as hyperactivity, attention deficit disorder, and learning disorders. In cases where many events occur at the same time, attention is focused only on certain points (Morgan, 2011).

Attention is the most effective tool in teaching the recognition of stimuli presented in the learning process, identification of the key issues in the process of processing. One of the main causes of attention deficit and attention loss is mental and physical fatigue (Esin, 2011). Recently studies on learning and academic achievement related to sports branches and activity levels on children have been conducted (Mullender-Wijnsma et al., 2015; Hillman et al., 2009; Bailey, 2017; Dinh-Van Phan et al., 2018; Karoyian and Dymova, 2018; Watson et al., 2019; Kartal et al., 2016; Weiyun et al., 2017; McPherson et al., 2018). This study examines the relationship between the level of physical activity and attention competence, which is one of the important stages of learning.

METHOD

In this study, fourty secondary school students studying in Yalova province have participated as volunteers. 50% of the participants were male and 50% were female. One experimental and one control group consisting of 20 students was formed. Each group consists of 10 male and 10 female participants. The International Physical Activity Questionnaire Short Form (IPAQSF) (Craig et al., 2003) and Burdon Attention Test (BAT) Kaymak (2003) were used as data collection tools. SPSS 22.0 package program was used for data analysis. The T-Test for Independent Groups was used to compare the control and experimental groups. The comparison within the groups is effectuated using the Dependent Groups T-test. The validity and reliability study of IPAQSF is done by Öztürk (2005) on the Turkish population.

First, pre-tests were applied to the students to measure their physical activities during the last 7 days, and their attention level. The experimental group is equipped with a pedometer to measure their daily total steps. After 8 weeks, the same tests are applied again as the final test. International Physical Activity Questionnaire (IPAQ-SF) was developed to determine the physical activity levels of the participants aged 15-65 years. It has been developed to obtain valid and comparable information about physical activity level based on individual reports on the physical activity carried out daily in the international arena. Scoring of the Scale: IPAQ-SF consists of 7 questions that provide information about walking, moderate (light load carrying, normal speed cycling, folk dances, dance, bowling, table tennis, etc.), and violent activities (football, basketball, aerobics, fast cycling, weight lifting, load carrying, etc.) and time spent sitting. There are three levels of physical activity proposed to classify populations: Low, Moderate, High Median values, and interquartile ranges can be computed for walking, moderate-intensity activities, vigorous-intensity activities, and a combined total physical activity score. All continuous scores are expressed in MET -minutes/week as defined below. severe physical activity duration, moderate physical activity duration, and walking, sitting time are investigated. The last seven days are taken into consideration for each question in the inventory. The total physical activity score (MET-min/week) was calculated by converting severe, moderate activity and walking times into MET to the basal metabolic rate with the following calculations: Walking score (MET-min/week) = 3.3 × walking time × walking day. Moderate activity score (MET-min/week) = 4.0 × moderate activity duration x moderate to severe activity day. Severe activity score (MET-min/week) = 8.0 × Severe activity duration × Severe activity day. Total physical activity score (MET-min/week) = walking + moderate activity + severe activity scores (Craig et al., 2003).

Burdon Attention Test consists of a text which composed of 3 paragraphs with 31 letters 'a', 31 letters 'b', 29 letters 'd', and 29 letters 'g' It has given 3 minutes for each paragraph, a total of 9 minutes for total test is fixed. The participants were asked to mark what they saw from the letters a, b, d, and g. BAT was applied to the participants as a pre- and post-test together with IPAQSF.

RESULTS

The results of the survey were converted to numerical values to be analyzed by SPSS. In the IPAQSF total MET scores, in the BAT total number of letters was calculated. The normality test was performed to see the applicability of the results to T-Tests. Independent Groups T-Test was conducted to see if there was a significant relationship between the control and experimental groups. The pre and post-test results within each group are analyzed by Dependent Groups T-Test. The distribution of the participant students is given in Table 1.

20 males and 20 female students participate in the study. Total 40 attended students of which 30 are 6 grade, 10 are grade 7 class student.

The Control and test group pre and post-tests results are presented in Table 2. The results of the physical activity and attention levels of the Test group participants in both the pre-test and post-test tests were higher than the control group.

Table 1. Distribution of the participant according to their class.

	Gender	No	6. Class	7. Class
Control	Male	10	6	4
	Female	10	9	1
Test	Male	10	6	4
	Female	10	9	1

Evaluation of the Pre MET analysis: In the Levene test, the T-Test for $p = 0.831 > 0.05$ was $p = 0.00 < 0.05$. In this case, there is a significant difference between the Pre-MET tests of the Control and Experimental groups. Evaluation of the final MET analysis: T-Test for $p = 0.002 < 0.05$ in the Levene test is $p = 0.00 < 0.05$. In this case,

Table 2. The participants of the preliminary test and the final test results**.**

Test	Groups	Number of participants	Average	Standard deviation
Pre MET	Control	20	2403	349.19
	Test	20	3079.2	357.25
Last MET	Control	20	2434.5	286.56
	Test	20	7320.3	958.30
Burdon pre Test	Control	20	79.8	1.32
	Test	20	82.2	2.80
Burdon last Test	Control	20	80.1	1.88
	Test	20	116.2	2.14

there is a significant difference between the Final MET tests of Control and Experiment groups. Evaluation of Burdon Preliminary Tests: T-Test for p = 0.016 <0.05 in the Levene test is p = 0.002 <0.05. In this case, Burdon Pre-Tests of Control and Experiment groups are significant. Evaluation of the Burdon Final Tests: The P-test for p = 0.469> 0.05 in the Levene test is p = 0.00 <0.05. In this case, the Burdon Final Tests of the Control and Experiment groups are significant.

To investigate whether the increase in physical activity affects the increase of attention level, the Dependent Group T-test is applied to compare the experimental group and control group (Table 3).

In Table 3 for the control group, there is no significant difference between the pre-MET mean and the last MET mean values (p = 0.727 > 0.05). Also, there is no significant difference between the mean value of the pre and last Burdon test. (P = 0.516 > 0.05). In Table 3 for the control group, it is seen that the average MET values are very close to each other in the pre- and post-tests. Similarly, the mean values in the Burton Test are also very close to each other. Since there was no change in MET, there was no difference between Burton Attention Test results.

For the Test group, there is a significant difference between the mean pre-MET and the Last MET values (p = 0.00 < 0.05). Also, there is a significant difference between the mean value in the Pre-Burdon Test and the Last Burdon Test (p = 0.00 < 0.05). For the experimental group, the average MET values of the pre- and post-tests are different from each other in Table 4. Likewise, the average values in the Burton Test are different. Burton

Table 3. Dependent groups T-test for the control group.

		Paired differences					t	Degree of freedom
		Average	Standard deviation	Standard error average	95% Confidence difference range			
					Min. Value	Max Value		
Pairing-1	Pre MET - Last MET	-31.5	397.72	88.93	-217.64	154.64	-0.354	19
Pairing-2	Pre Burdon - Last Burdon	-0.3	2.02	0.45	-1.24	0.64	-0.661	19

Table 4. Control and experimental groups to independent groups T-test.

		Levene test for equality of variances		T-test for equality of averages			
		F	P-values	t	Degree of freedom	P-values	Average difference
Pre MET	Variances count equal	0.046	0.831	-6.053	38	0	-676.2
	Variances are not equal			-6.053	37.98	0	-676.2
Last MET	Variances count equal	11.512	0.002	-21.845	38	0	-4885.8
	Variances are not equal			-21.845	22.371	0	-4885.8

Table 4. Continues.

Burdon pre test	Variances count equal	6.422	0.016	-3.464	38	0.001	-2.4
	Variances are not equal			-3.464	27.057	0.002	-2.4
Burdon last test	Variances count equal	0.535	0.469	-56.524	38	0	-36.1
	Variances are not equal			-56.524	37.414	0	-36.1

F: The test statistics of the Levene test. t: The calculated test statistic of the T-Test. If the p-value of the Levene test is > 0.05, the p-value in the first line of the T-test is taken into account. Otherwise, p in the second line is considered. The reason for this test is to determine whether there is a relationship between the control and experimental groups.

Table 5. Dependent groups T-test for the experimental group.

		Paired differences						
		Average	Standard deviation	Standard error average	95% Confidence difference range		t	Degree of freedom
					Min. Value	Max. Value		
Pairing-1	Pre MET - Last MET	-4241.1	1027	229.7	-4721	-3760	-18.4	19
Pairing-2	Pre Burdon - Last Burdon	-34	3.5	0.7	-35	-32	-43.3	19

Attention Test values are changed when MET changes.

DISCUSSION

This study aims to investigate whether there is a change in the level of attention with the change in the physical activity levels of secondary school students. In the analysis of the collected data, the independent t-test was questioned whether there was a relationship between the groups. As a result of the test, it was determined that the groups did not affect each other. Then the groups were analyzed within themselves. In the t-test performed on the control group, it was determined that the average of the MET value and the average of the BDT test results did not statistically change significantly.

In a study that investigated the relationship of golf with physical activity and attention, it was examined the effect of 8-week-old golf sport on attention, and it was stated that a significant increase occurred in the attention of the children engaged in golf sport at the end of this period (Tunç, 2013). In a study that investigated the role of sports in children's academic achievement, it has been stated that young people who engage in sports in attention-deficit categorization experience fewer attention deficit problems than those who do not do sports (İbiş and Aktuğ, 2018). With these results, the results obtained in this study are parallel to the higher attention points of children who have physical activity.

Attention is not only an important aspect of children's academic life but also an important phenomenon that framed their lives. In one of the studies on attention deficit, which is an important place in daily activities, it was stated that children who are engaged in skiing sport have fewer attention problems than those who do not do sports (Göktepe et al., 2016). Similarly, in another study that investigated the lack of attention among children with fencing and those who did not, the lack of fencing was reported to be more frequent (Kartal et al., 2016). In our results, there was a statistically significant difference between the average of MET values in the t-test conducted to the experimental group and accordingly, the mean of the average of the BAT test results was determined. In other words, it can be concluded that children with low levels of physical activity have more attention deficit.

In longitudinal and cross-sectional studies investigating the relationship between attention deficit and physical activity, physical activity has positive results on attention deficit (Booth et al., 2013), but the results of experimental studies with control groups are mixed (Reed et al., 2010) and better-detailed research is needed. As a result, in our study, the levels of MET consumed in the control group were kept close to each other and there was no significant change in attention levels. The level of MET consumed in the experimental group was significantly increased compared to the previous one and significantly increased when the levels of attention were measured again.

Physical activity and sports during childhood and

adolescence; can cause significant increases in concentration and attention, especially in the development of the movement. In a study that examined the effect of hand-eye coordination on the number of errors in preschool children and the effect of hand-eye coordination on preschool children, they found significant differences in the number of errors in the final tests in pre-school children (Özbar and Kayapınar, 2006). This result is in line with our study findings and highlights the importance of sportive activities and movement.

In this study, the relationship between attention and physical mobility levels of the groups was investigated and a positive correlation was shown. In the study, demographic variables such as age, gender, and socio-economic parameters were not taken into consideration. In the literature, the effects of attention on various sports branches were examined, but the effect of which sport and activity on attention and how they affected were not shown by controlled group studies.

CONCLUSIONS

As a result, it is seen that many students and young people have low levels of physical activity due to both lifestyle and virtual world dependence. Although there are many factors, the decrease in physical activity causes low levels of attention. The better the attention levels of our students and young people, the more successful they will be in their lives. As a result, our study and most of the mentioned studies reveal that attention is a developable skill and a situational factor that is open to influence. Therefore, attention development in children who are directed to recreational activities such as should be emphasized, especially during periods of rapid physical growth. If we want our students and young people to be more successful, they should be encouraged and supported more about physical activity. Besides, the effects of sports activities on attention mechanisms in people of different sports branches and age groups should be examined in future studies.

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