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A Comparative of finger tapping test scores elite athletes, art, foreign languages and computer- instructional technology students

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Abstract

Fine motor skill is ability to control and coordinate the small muscles in the hand for precise movements. Fine motor skill have been associated with several other cognitive abilities, including processing speed executive functions and scholastic skills. Fine motor skill in the early years have also been shown to predict later academic achievement, especially in reading and mathematics and to predict underachievement in able students at school. In this aspect our objective in this study was to compare finger tapping test scores between students of art, foreign languages, computer-instructional technologies and elite athletes. A significant difference was found between elite athletes and all groups in finger tapping test scores. Elite athletes performed more finger taps than other groups in the same period. In conclusion, the more importance of fine motor skill in terms of sporting success also explains the difference of the finger tapping test performances between the groups.

Keywords: education, motor skills, finger tapping, elite athletes

1. Introduction

1.1. Introduce the problem

The high level of fine motor skills of a person has been associated with mental processing speed, executive processes and cognitive abilities. Education (mathematics, sports) for success, health (Parkinson's Alzheimer's mental retardation, depression) is used for the diagnosis and treatment. however, early development of fine motor skills requires a clear view of educational achievement and its relationship with other skills. Fine motor skill to "encompass control and coordination of the distal musculature of the hands and fingers," as defined by Bruininks and Bruininks (2005). Fine motor skill in the early years have also been shown to predict later academic achievement, especially in reading and mathematics and to predict underachievement in able students at school (Pitchford et al.,

2016). Fine motor skill have been associated with several other cognitive abilities, including processing speed (Wassenberg et al., 2005), executive functions (Livesey et al., 2006; Rigoli, et al., 2012), and scholastic skills (Morales et al., 2011). However, more precise insights into the role of Fine motor skill, and their relationships to other skills in mediating early educational achievements, are needed to support the development of optimal educational interventions (Grissmer et al., 2010; Dinehart and Mafra, 2013). Fine motor skill is ability to control and coordinate the small muscles in the hand for precise movements. When the muscles in the forearm and hand are slow to develop, weakness and incoordination may result. Because of this, Fine motor skill are not only important in sport and education but also in every area of life.

The finger tapping test has been implemented to analyze the accessory muscular control and fine motor ability as early as the 19th century (Jobbagy et al., 2005). The finger tapping test provides information on the control and coordination of the upper arm muscle groups. Finger tapping test is widely used for diagnosis and treatment of people with depression (Arnold, et al., 2005; Bashir, et al. 2013); Parkinson (Kane et al., 2007; Shimoyama et al., 1990), Alzheimer (Dwolatzky et al., 2003), multiple sclerosis (Wilken et al., 2003), mental retardation (Arnold, et al., 2005) and mild cognitive impairment (MCI) (Schweiger et al., 2003) patients. Finger tapping test is also used to examine the relationship between hand preference and dexterity. It clear that the age, educational level, and sex of the individual correlated with finger tapping speeds (Prigatano et al., 2019).

In the finger tapping test, Period-1 reflects the performance improvement process of the rapid repetitive movements within the first 5 s. In addition to the use of the stored energy stored in the anaerobic system, it also includes the process of placing the motor program into memory. Each tap is affected by visual and affective stimuli, emotional and physical health, and factors affecting the skeletal and nervous systems. The test provides information with an average tap range or a tap rate of the finger hit (Arias et al., 2012; Kızıltan et al., 2006, Barut et al., 2013; Shimoyama et al., 1990; Jobbágy et al., 2005; Nalcaci et al., 2001).

1.2. Describe relevant scholarship

When the literature is examined; it has been seen that there are many studies done by finger tapping test method, but the temporal evaluations of these studies were made with the use of analog/digital converters (A/D) or the computer's internal time clock and the time resolutions were not taken into consideration and the speed was 1000 Hz. as the top speed. In these studies; many different techniques such as computer mouse, uniaxial goniometer telegraph switch, computer keyboard, touch plate1 and force transducer have been used. In contrast to these studies, "Tong Tan Tong Finger Tap "software, which we used, has achieved lower temporal resolution than microseconds by using Intel's read time-stamp counter (RDTSC) commands, so it is possible to perform further analysis of other studies. Educational level was accepted as the basis of the hypothetical structure of cognitive accumulation (Barulli and Stern, 2013; Prigatano et al., 2019). As such, it is thought to influence the structure of various overlapping neural networks responsible for learning and problem-solving. Many studies have documented that the educational level of the individual affects neuropsychological test performance in many domains for

individuals (Rosselli and Ardila, 2003; Zahodne et al., 2015). Finger tapping test is also accepted as an important method for evaluating the athletes in different sports branches in terms of fine motor skill performance. Karate, tennis, table tennis, wrestle and badminton are a discipline of martial art requiring high technical skills, such as a fine control of movement both in static and dynamic conditions along with a great ability to perform the main technical actions (strikes and kicks) as fast as possible (Moscatelli, et.al. 2015; Moscatelli et al., 2016). During a sports match, the athletes perform very complex actions which must be fast and accurate, thus this discipline is a good example of a competitive sport with high levels of temporal and spatial constraints which require fast reactions and continuity in motion (Chaabne et al., 2015; Monda et al., 2017; Tan, 2004).

1.3. Purpose of the study

In this aspect our objective in this study was to compare finger tapping test scores and between students of art, foreign languages, computer-instructional technologies and elite athletes.

2. Method

2.1. Participant characteristics

The athlete and nonathlete university students were selected from the faculties of sport science, arts, computer-instructional technologies and foreign languages of Uludağ University. they were informed about the study and participated voluntarily.

Table 1. Characteristics of the Participants

N	Sex Male/Female	Age (year)	Height (cm)	Weight (kg)	BMI (kg/m^2)
144	80 / 64	22.4 ± 2.71	171.33 ± 9.22	68.05 ± 15.28	21.89 ± 4.52

BMI:Body Mass Index, cm: centimetre, kg: kilogramme

A total of 144 subjects with mean age (22.4 ± 2.71 years), height (171.33 ± 9.22 cm), body weight (68.05 ± 15.28 kg) and body mass index (21.89 ± 4.52 kg / m2) were included in the study (Table I.).

2.2. Material and Procedure

The "Finger Tapping Test" in which the speed of consecutive motor movements was evaluated, was implemented via a computer program and the participants were asked to press the specified key consecutively for 20 seconds. The participant was allowed to sit in a position where he felt comfortable. The participant was allowed two familiarization trials for several seconds with each hand. When the participant was ready, he started the test of his own convenience. During the 20-second period, verbal encouragement were made to allow the participant to do better. The obtained data was recorded. This process

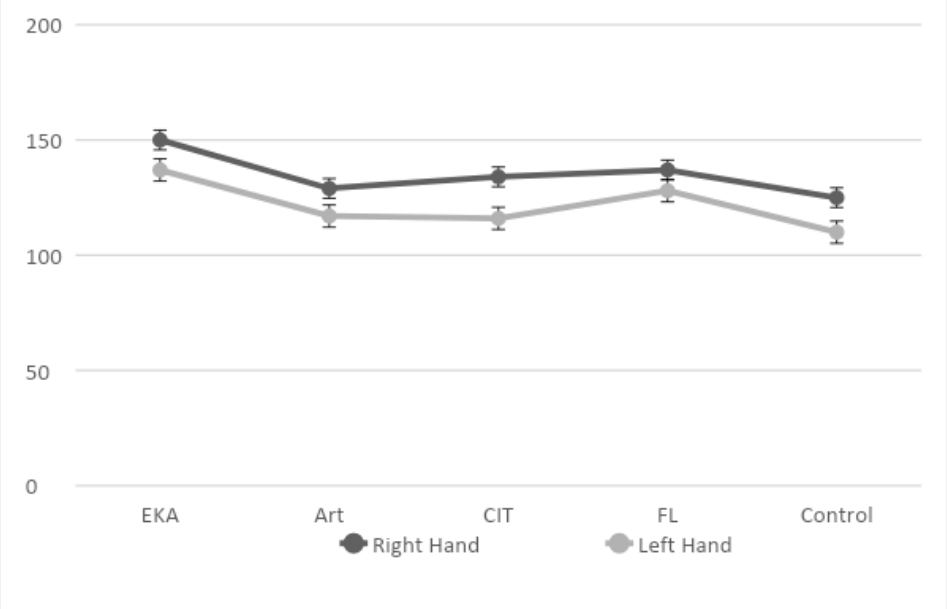
was repeated for each participant with both right and left hands. And body mass index (BMI) was recorded by a Bioelectrical Impedance Analyzer device (TANITA, TBF300 Japan).

2.3 Data Analysis

The One Way ANOVA test was used to compare continuous variables between groups. Comparisons of intra-group dependent variables, were made with paired t test for those which show normal distribution, and with Wilcoxon rank sum tests for those which does not show normal distribution. The Spearman test was implemented for the connections between the tests. $p<0.05$ was accepted as the significance level. SPSS v.24 program was used for statistical analyzes.

3. Results

The findings of the study were analyzed to compare finger tapping test scores and between students of art, foreign languages, computer-instructional technologies and elite athletes.



Figures 1. The Groups' Finger Tapping Test Scores Averages

In the finger tapping test, the average number of right hand tapping of elite athletes, art, control computer-instructional technologies and foreign languages are given respectively,

150,03±21,02; 129,86±10,79; 125,40±18,77; 134,28±16,20; 137±11,95. In the finger tapping test, the average number of left hand tapping of elite athletes, art, control, computer-instructional technologies and foreign languages are given respectively, 137,28±20,89;117±12,44; 110,13±18,28; 116,45±14,93; 128±07,98.

Comparing the finger tapping test scores for the right and left hand with the art, computer-instructional technologies, foreign languages, control and elite athletes; a statistically significant difference was found between elite athletes and all groups in finger tapping test scores ($p<0.05$). elite athletes performed more finger tap than other groups in the same time period.

4. Discussion

The aim of this study was to compare finger tapping test scores and between students of art, foreign languages, computer-instructional technologies and elite athletes. Chiefly, we focused on determining the number of finger taps of the participants. In this regard, elite athletes performed more finger taps than other groups in the same time period. Sağdilek et al. (2017) in their studies; reported that athletes started the movement with a higher performance than the control group and that Period-1 slopes were opposite direction. They also stated that this result could be considered as an indication that the motor program took place in permanent memory. Gökdemir et al. (2007) evaluated the hand performance of table tennis players; hand motor performance between right and left hand was found statistically different. The studies are generally carried out with the method of determining the total number and speed of taps at a given time. Meyer and Sagvolden (2006) report that no significant difference between boys and girls in terms of finger tapping performance. Brown, et al. (2006) found that the standard deviation value in men and women was greater than the average finger tapping scores.

Barut, et al. (2008) compared the hand morphology and hand motor performance of male boxers with the control group of 42 people of the same age and sex by finger tapping method. The right hand finger tapping test scores of the boxers were significantly higher than the control group scores. Similarly, Çıplak (2010) examined basketball and volleyball athletes in which the hand was used as dominant and football and runners where the hand was not very important. As a result of the study, it was found that the average number of tapping of athletes requiring active use of hand was significantly higher than other athletes. Zhang, et al. (2018) found that finger tapping test scores of MCI subjects is significantly lower than that of normal subjects without MCI, and long-term Tai Chi exercise increased the finger tapping frequency of the non-dominant hand of MCI subjects. Muinos and Ballesteros (2013) revealed that athletes were also significantly faster than nonathlete participants when performing motor actions such as hand-tapping with their dominant hand but groups did not differ with the nondominant hand.

5. Conclusions

The more importance of fine motor skill in terms of sporting success also explains the difference of the finger tapping test performances between the groups. We thought that

high level of readiness of the athletes for fine motor skills has been influential in the results.

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