Visual Response Time & Visuospatial Intelligence Scores of Athletes & Nonathletes

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Abstract

Aim: To compare sports-related visual abilities - hand-eye response time and visuospatial intelligence of athletes to nonathletes. *Materials & Methods:* Differences in sports-related visual abilities such as hand-eye response time and visuospatial intelligence between athletes and nonathletes were studied in 30 boys (age-14.9±1.8 years) and 30 girls (age-14.3±1.6 years) school students. Visuospatial intelligence was assessed with Cattel's Culture Fair Intelligence Test. A random stimulus presentation and response recording was used for eye-hand response time with the help of audio-visual response time equipment. *Results:* Athletes had statistically significantly ($p<0.001$) lower eye-hand visual response time (i.e. the faster) and higher visuospatial intelligence compared to nonathletes. There were no statistical significant sex differences. A negative correlation was observed between the number of years of doing sports and eye-hand visual response time ($r=-0.78$, $p<0.001$) and a positive correlation with visuospatial intelligence ($r=0.69$, $p<0.001$). *Conclusion:* The results of the present study support the view that participation in different sport activities is beneficial to both eye-hand response time and visuospatial intelligence. Keeping in view the results of the present study, we can recommend more sport activities for higher academic achievement in primary, middle, high and senior secondary school students.

Key Words: Response time, Visuospatial Intelligence, Athletes

Introduction

Visual performances are found to be significantly better in athletes as compared to nonathletes for certain visual skills such as visual reaction time and peripheral awareness. It has also been reported that the dynamic visual perception of athletes is superior to that of nonathletes and athletes are reported to be quicker than non-athletes *(Ishigaki & Miyao, 1993)*. It has also been revealed that exercise shortens motor time *(Davranche et al, 2006)*. In a recent study, differences between athletes and the sedentary subjects in terms of visual evoked potentials (VEP) have been reported; acute and habitual exercise affect the visual evoked potentials responses independently of the body temperature and other physiological variables *(Ozmerdivenli et al, 2005)*. They suggested that small sized pre exercise P100 amplitudes in the athletes can be attributed to the effect of rapid visual-activity challenging sports on the central nervous system. *Eysenck (1986)* has re-emphasized the intelligence concept and pointed out the significance of reaction time as a basic measure of intelligence: the speed of information processing is a basic property of biological intelligence (the "speed hypothesis of intelligence"). Accordingly, the nonverbal IQ has been found to be directly correlated with hand speed in right- and left-handed subjects *(Tan 1992)*. The aim of the study was to compare hand-eye reaction time and visuospatial intelligence of athletes to those of nonathletes.

Materials and Methods

*Subjects***-** All the subjects participated in the study voluntarily. There were 30 boys and 30 girls attending high & senior secondary schools in the district of Patiala, Punjab. They ranged in age from 15 to 19 years. Of 30 boys, 5 were football players, 5 were basketball players, 5 were volleyball players and 15 were nonathletes. Five of the 30 girl subjects were basketball players, 5 were volleyball players, 5 were runners and 15 were nonathletes. Athletes were members of school teams playing various sports. Athletes who played for less than 3 years in any sport were not included in the study. Subjects with visual field defects were not included in the study.

Experimental design- All of them were right-handed. Left-handed subjects were not recruited to rule out of having an advantage in reaction time *(Dane & Erzurumluoglu, 2003)*. For the assessment of eye-hand visual response time, a random visual stimulus presentation and response recording was used with the help of audio-visual response time instrument, that is, 'Response Analyzer' which had a display accuracy of 0.001 second. The instrument is specially designed to measure response time in milliseconds. All the subjects were given practice trials with the stimuli to acquaint them with the operation of the apparatus. They were instructed to react as quickly as possible on every trial. Every subject used the right hand in responding to the visual stimulus. Every stimulus presentation was preceded by the investigator's calling "ready". The average of the three readings was taken as the value for response time task. Response times shorter than 150 ms were considered anticipatory responses and those longer than 500 ms were considered attention errors. Both were removed from the analyses. The visuo-spatial intelligence (nonverbal intelligence) was established by Cattel's Culture Fair Intelligence Test. The raw scores were converted into IQs using the table for converting raw scores directly into intelligence quotients (IQ).

Statistical analysis: For descriptive & inferential statistical analysis, the mean, standard deviation, unpaired Student's t test and Pearson correlation in the statistical software SPSS version 16.0 for Windows were used.

Results & Discussion

Table1: Mean±SD of eye-hand visual response time & nonverbal intelligence in young athletes & nonathletes

	Athletes	Nonathletes
Eye-Hand Visual Response Time	**318.1 ±48.8**	**369.4 ±60.1****
Boys	**317.1 ±49.9**	**366.8 ±58.5****
Girls	**320.3± 46.5**	**371.3± 63.0****
Nonverbal Intelligence	**77.4 ±23.6**	**70.3 ±18.6****
Boys	**75.8 ±21.2**	**69.2± 17.7***
Girls	**81.0 ±28.1**	**71.2± 19.4***

Application of ANOVA revealed that there was not any difference for eyehand visual response time and visuo-spatial intelligence among different sports. In the present study, it was found that there were differences in eye-hand visual response time and visuo-spatial intelligence scores between athletes and nonathletes. Eyehand visual response time was higher in non-athletes on the other hand visuo-spatial intelligence was higher in athletes. These differences were not affected by sex (Table 1). In the total sample, there was a negative correlation between the sporting age (that is total duration of playing sports) and eye-hand visual response time ($r=-0.78$, $p< 0.001$) and a positive correlation with visuospatial intelligence ($r=0.69$, $p< 0.001$).

Discussion

It has been well documented that exercise is beneficial to mental health *(Salmon, 2001)*. Researchers have also established that exercise results in a mild enhancement of cognitive function *(Colcombe & Kramer, 2003 and Tomporowsk, 2003)*. According to a recently suggested theory, the "psychomotor theory", there is a relationship between exercise and mind health, and dance is the aesthetic expression of mind in bodily movement *(Tan, 2007)*. Dance originates in a discrete bodily-kinesthetic "intelligence" *(Gardner, 1993);* skilled movement is a form of thinking *(Fischer & Bidell, 1998);* movement is predominant in all forms of human intellectual activity *(Laban & Lawrence, 1974)*. The exercise has also been reported to have antidepressant and tranquilizing effects on the participants *(Berger, 1984)*. *Tan (2007)* suggested that movement may occupy a central position in cognitive actions. Accordingly, *Tan (1991)* reported that there is an inverse correlation between the latency of the Hoffman Reflex recorded from the thenar muscles of the right and left hands and nonverbal IQ: high IQ was associated with higher motoneuronal excitability and vice versa. Concerning the more peripheral nervous system, *Tan (1992)* found that the sensory and motor median-nerve conduction velocity was positively linearly correlated with the IQ in men. IQ is closely related to spinal-motor activity, assessed by Hoffmann reflex in humans *(Tan, 1989b)*, and to the hand skill in right- and left-handed subjects *(Tan 1989a & 1989b)*. In this study, eye-hand visual reaction time was higher in non-athletes ($p<0.001$) and visuospatial intelligence was higher in athletes ($p< 0.01$). Sex did not significantly affect these differences. Two possible explanations for the athlete's advantages in both eyehand visual reaction time and visuospatial intelligence are that subjects with intrinsic neurological advantages such as eye-hand reaction time and visuospatial intelligence can readily participate in sports, and that exercise is beneficial to eye-hand reaction time and visuo-spatial intelligence. In the total sample, there was a negative correlation between the sporting age (that is total duration of making sports) and eye-hand visual reaction time ($p<0.001$) and a positive correlation with visuospatial intelligence ($p<0.001$). These results support the view that exercise is beneficial to eye-hand reaction time and visuo-spatial intelligence. It can be stated that sport activities can be recommended for success in the academics such as mathematics and science in primary, middle, high and senior secondary school students. Moreover, it can be stated that all sports are beneficial for the enhancement of cognitive function *(Colcombe & Kramer, 2003 and Tomporowsk, 2003)* because there was not any difference among different sports mentioned in this study such as football, basketball, volleyball, and running.

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