Sports and Cognitive Functioning among College Football and Basketball Players

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Abstract

Training in sports is a blend of physical and cognitive training. Processes of Attention and concentrations are even more important for contact team sports like football and basketball where the objects of attention are constantly moving, and mental strategies need to be revised according to new incoming information. This study explores the impact of regular sports training in the cognitive functioning of football and basketball players. In a between groups design, purposive sampling was done to include players of the university team and a control group, and standard neuropsychological tests were conducted on them. The results of statistical analysis show that there is no significant difference in the performance of the players and non-players in each of the cognitive functions. The findings of the study contradict previous literature and provide scope for future research on cognitive training methods, and the possibility of studying cognitive functions and excellence in performance.

Key Words: Attention, Basketball players, Cognitive functioning, Football players, Response inhibition, Sportsmen.

Introduction

Human beings exist as a part of the universe and survive through various forms of interaction with nature and the environment. With the power of the physical senses – most normal humans can see, hear, smell, taste and touch the entities around them. This knowledge entails a complex meaning making process, through which the world is observed, interpreted and reacted to the by individual. This intricate and interconnected internal process is called cognitive functioning. The seat of cognitive functioning in any organism is the brain, with different parts responsible for different aspects. Participation or execution of a sport is therefore one of the various domains in which cognitive functioning plays a crucial role, along with physical ability.

Cognition can be studied as a segmented process, involving different levels of processing, and each sub process responsible for the generation of a specific skill. For example, the very first level of processing is the perception of a stimulus- that is the recognition and interpretation of sensory stimuli. This perception occurs through the paying of attention – the ability to sustain concentration on a particular object, stimulus or thought, out of the many present in our sensory field. In order to maintain a record of the important information about the environment that is sensed, attended to and perceived, there is a need for memory. There are three kinds of memory with varying durations of application, sensory memory lasting a few seconds, the short-term memory or working memory that lasts for about 15-20 seconds, and is the juncture at which relevant information or information of interest is sent for processing and retained in the permanent long term memory. This long term memory consequently influences both the attention and perception of a stimulus, as well as higher cognitive functioning, subsequent motor responses, visual spatial processing and executive functioning, which involves processes of decision making, problem solving etc.

Behavior is the product of the processing of information extracted from the environment. This operation is said to occur in three stages that occur independently. These three stages are stimulus identification, response selection and response programming. Behavior in a sports field can also be studied using this model.

Stimulus identification occurs through a number of discrete processes that give meaning to sensory events and transform them. The position of the ball, the position of other players, the distance between the player himself and another team mate or the ball are all stimuli that a sportsman must attend to and identify. Once the stimulus is identified, the response selection stage is reached. This stage is characterized by processes that decide if a response is required and if yes, what response should be made to this external event. For example, if the ball is moving towards the goal, and the player is a defender. The need to respond, to move towards the ball, to block the other team's forward trying to score is decided. The third, response programming stage, then is crucial in the execution of the response. It prepares the motor system to move, in the direction that was selected in the previous stage (Tomporowski, 2003) Therefore, in the context of a game, a well-functioning working memory is important for both consideration of relevant previous cognitions along with the management of incoming sensory stimuli. Response inhibition occurs simultaneously to prevent the interference of irrelevant stimuli.

All these stages of the information processing theory are important for human functioning, but for those engaged in sports, these processes have to occur at a much higher speed and in the midst of more distracting stimuli. Experts in the sport are therefore found to possess superior cognitive skills like visual function, peripheral awareness, anticipation, memory recall and situational probabilities than non-experts. (Ward & Williams, 2003).

Football and Basketball are two of the sports that require well-developed cognitive or executive functioning as well as physical strength and agility. In order to be an accomplished player of the sport, an individual must possess several relevant cognitive skills and these mental functions are probably developed and honed through training in and practice of the sport on a regular basis.

According to Vestberg et al. (2012) the characteristics of a good team player are "excellent spatial and divided attention, working memory and metalizing capacity". With these capacities or what is generally called 'game intelligence', he must be able to adapt quickly, change strategy and inhibit natural responses according to the constantly changing situations on the field. In neuropsychology, these dynamic top-down processes called 'executive functions' collectively, correlate well with each other but less with general IQ.

Review of Literature

Cognitive and executive functions, along with physical strength and dexterity are essential to the performance of a sport. A body of research studied the extent of these mental functions in sports men and women, under varying conditions. Studies have also debated over the best ways to understand and predict a sportsman's game performance based on his performance on standard cognitive tests as well as specially designed experiments that incorporate the practical application of cognitive processes on the playing field. All studies however, agree with the importance of perceptual and cognitive processes in the performance in a sport.

Studies done over time in the field of Sports and Cognitive Psychology have made it clear that well developed cognitive skills and executive functions are beneficial in the achievement of expertise in a sport across all age groups. These studies have mostly been conducted upon a sample that has been extracted from the elite sports groups all over the world. Comparisons have been made between players – High or Low division, depending on their level of play, national, school level or professional. A lot of studies of impaired cognitive and executive functioning in athletes suffering from traumatic brain injuries and concussions have also been conducted (Vestberg et al., 2012). Studies on the effect of exercise on physical and mental health, as well as cognitive functioning have been conducted. (Tomporowski, 2003)

These studies have been conducted on different age groups – children, adolescents, middle aged profession-nals and the elderly. Very few have studied cognitive functioning, impaired or otherwise, in young adults- college students, who have just passed through a developmental period crucial for cognitive development – adolescence. As adults, who are not professionals, but have an established regular engagement with their respective sports, it is possible that their performance on cognitive tests be better than that of their peers.

Method

The aim of the study was to find the relationship between attention and response inhibition. A secondary aim of the study was to find the degree of difference in the attention – focused and divided, and response inhibition of male college students engaged in sports and those who are not. The dependent variables were attention – focused and divided, and response inhibition. The independent variable was the engagement with sports. Focused attention refers to the capacity to perform a task in the presence of distracting stimuli.

Divided attention is the capacity to attend to two or more tasks simultaneously. Response inhibition measures the ease with which a perceptual set can be shifted both to conjoin changing demands and by suppressing a habitual response in favour of an unusual one. (Rao, Subbakrishna and Gopukumar, 2004)

This study was done using a quantitative between-groups design. The sample of 40 male college students, between the ages of 18 and 22, was purposively selected. For the experimental group, 20 football and basketball players from University teams were selected. This was done to ensure that the participants of the study underwent at least 5 days a week of sports training. The control group was selected from those of the same academic background, but absolutely no training or engagement with sports.

It was hypothesized that the college students who played a sport, would perform better in tests for focused attention, divided attention and response inhibition. It was also hypothesized that there would a relationship between the functions of attention and response inhibition.

The tools used to measure these cognitive abilities are from the NIMHANS Neuropsychological Battery – the Color Trails Test, The Triads Test and The Stroop Test, for Focused Attention, Divided Attention and Response Inhibition, respectively. The tests were conducted with prior consent of the participant, and a complete assurance of anonymity, under uniform environmental conditions.

The normality of the data was checked, and the data was found to be not normal. Therefore, the Mann Whitney U test of significance was used to test the significance of the difference between the two groups. Spearman's Correlation Coefficient was used to assess the strength of the relationship between the two variables.

Results

The sample consisted of 40 male college students, out of which 20 were players of football and basketball. These students played their respective sport very frequently and underwent 5 days of training a week. The mean age of this group was 19 years. The other 20 were students who do not play any sport, and the mean age of this group was 20 years.

Table 1: Performance and Statistics of participants in different cognitive tasks

Group	N	Mean Age
Players	20	19
Non-Players	20	20

Table 2: Results of Mann Whitney U Test of Significance for Focused Attention, Divided Attention and Response Inhibition between Players and Non-Players

Variables	P value
Focused Attention	0.534
Divided Attention	0.457
Response Inhibition	0.181

The results of these tests revealed that there existed no significant relationship between the two groups for focused attention, divided attention and response inhibition between players and non-players. It was also found that there was no significant relationship between the processes themselves. Therefore the hypotheses that the players will be better than non-players in functions of Focused attention, divided attention and response inhibition, all stand rejected. The hypothesis that there is a significant relationship between attention and response inhibition also stands rejected. The findings of this study are not congruent with previous literature that suggested a strong influence of engagement with sports and enhanced cognition. There could be several reasons for this difference – the small sample size, the difference in the characteristics of the sample – those studies were conducted on either children or elite players, or professionals, while this sample consisted of college students playing for the university team. The nature of the assessment itself may have played a role in the findings, the sample may have performed differently on a practical task.

Indeed, most studies in this particular area has either been conducted on children or on elite players, who probably receive more advanced training than do college students, who pursue the sport along with their academics, which may have led to this discrepancy between the results of this population and the ones studied previously. The focus of sport training also varies, it is possible that they training the experimental group undergoes is more physical fitness oriented and does not specifically train cognitive resources.

Implications: This study aimed to establish a relationship between regular participation in sports with adequate training, and better cognitive performance. The results do not indicate a very strong relationship, at least for this population. As a follow up to this primary testing, cognitive training can be applied on the players, maybe incorporating some cognitive tasks into their routine exercise. Then, the impact of these sports-oriented training techniques can be assessed. Also, the same study can be done using more practical tasks, based in the larger visual field that the players are accustomed to. This study can be further expanded to examine a larger population. Other variables can also be considered, like number of years of training received in the sport, or the nature of coaching received in childhood or adolescence of those who do not currently play a sport, but have been trained at some point. The aim of this study was to examine the impact of regular engagement with sports on the honing of certain cognitive skills, but the training in sports itself, during crucial developmental stages can be examined in a population of a lower age. This study can also be continued longitudinally, with the introduction of specific cognitive skill training and then examine the possible impact on performance. The performance in sports and cognition, can also be compared with academic performance. There is enormous scope for continuing this study, and developing specific sports-oriented cognitive assessment tools as well. There are also several other mental processes that are involved in the playing of a sport like – memory, visual search behavior, decision-making or executive functioning, can also be studied, to see if they are more connected to the performance of the individual.

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