Cognitive Reaction Time Testing in NCAA Division III Soccer Players

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ABSTRACT

Motor skills and physical training is very important when it comes to team sports. But it is also important to remember aspects of cognitive skills and reactive abilities as well when it comes to athlete profiling. PURPOSE: To provide athlete profile information on cognitive and reaction time capabilities in NCAA Division III soccer players. METHODS: Participants were men's and women's NCAA Division III soccer players (n=19; 5 Men's players and 14 Women's players). They were divided into their positions groups: goal keepers (GK), defenders (D), midfielders (MF), and forwards (F). Each participant reported to the Sports Science lab for one testing session. The session consisted of measuring "wingspan" (length) from fingertip to fingertip with shoulders abducted 90-degrees), then cognitive athletic abilities using a sensorimotor station (Senaptec, Beaverton, OR). The sensorimotor tests quantified 7 different metrics that related to depth perception, decision making, and hand-eye coordination. The final test of the session consisted of a reactive agility box test, where the participants were asked to complete a movement-based test as quickly as possible by reacting to random lights (Microgate, Bolzano, Italy). All variables were then analyzed based on the position played on the soccer pitch, using Analysis of Variance. RESULTS: No significant differences were noted in wingspan between positions. Regarding the sensorimotor abilities, MF displayed significantly lower scores in decision-making (p = 0.02), and there was a trend towards MF having lower hand-eye coordination (p = 0.08). GK trended towards better depth perception compared to the other positions (p = 0.09). In the reactive agility test, GK trended towards having lower times, which is a combination of movement speed and decision-making (p = 0.09). CONCLUSION: The data indicate that there were no significant differences in wingspan between soccer positions, however the MF position group had significantly lower scores in decision-making and hand-eye coordination. GK trended towards having better depth perception and lower times in the reactive agility tests, as this is a necessary skill to have for the specific demands of their position. Further research should aim to express the importance of cognitive and reactive capabilities in athlete profiling to help develop and enhance athlete programming.

INTRODUCTION

Motor skills and physical training is very important when it comes to sports. It is also important to remember the cognitive skills are as well. This is especially true for sport positions that require hand-eye coordination and decision-making. For example, it has been shown that specific sensorimotor skills can predict on-field performance for sports like baseball (Burris et. Al., 2017). This can also been seen in goalkeepers in sports like soccer, hockey, and lacrosse, where most of their job is to react to a stimulus (ball). It has been reported that a correlation exists between weight and motion time for goalkeepers, meaning that coaches should consider not only on motor developing skills but also cognitive skills as well (Jorge Rodriguez-Arce., et al, 2019). It is believed that cognitive skills for soccer players and goalkeepers have a direct correlation to their performance.

PURPOSE & HYPOTHESIS

The purpose of the study was to:

- **Observe and test soccer players cognitive capabilities via using the Senaptec sensorimotor station, and a reactive agility test.**
- **Collect and communicate objective data reports to coaches, athletic trainers, sport performance specialists, and the athlete about the mental and physical stress placed on the athlete during game-like conditions.**

METHODS

Men's Soccer

N = 5
20.58 ± 1.26 years
73.18 ± 8.37 kg
178.44 ± 5.48 cm

Women's Soccer

N = 14
20.33 ± 1.02 years
65.25 ± 7.26 kg
163.33 ± 6.50 cm

Figure 1: Senaptec Sensorimotor Station (Beaverton, OR)

Figure 2: Senaptec Hand-Eye Coordination

Figure 3: Senaptec Depth Perception

Figure 4: Microgate's Witty SEM (Bolzano, Italy)

Figure 5: 4-Corner Box Reactive Agility (3.65 meters x 3.65 meters)

Figure 6: React and find the green box 10 times as fast as they can

TEST	DESCRIPTION
Depth Perception	Examines the athlete's depth perception by having them wear 3D glasses and using a Senaptec handheld device. The goal of the game is to swipe (score a goal) in the correct direction shown on the screen on the Senaptec handheld device. The more successful they are at choosing the right direction, the higher their score will be. The higher their score, the better depth perception of the subject.
Hand-Eye Coordination	Examines the athlete's hand-eye coordination by having them tap green ball targets as fast as they can for 30 seconds. Tennis balls are ones you do not want to tap. This will test hand eye coordination and at the end of the test it will give a score of accuracy, precision, and speed statistics
Box Reactive Agility	Examines the athlete reactive agility by having them move their body as fast as they can to the green square and "scan" their hand in front of the semaphore. Once they identify and "scan" the green square, it will disappear and randomly illuminate to another one of the four semaphores. The athlete will attempt to identify, move, and scan 10 of these green boxes as fast as they can

RESULTS

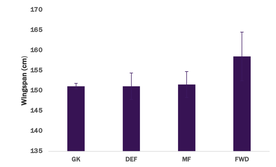

Figure 7: Differences in wingspan between position groups

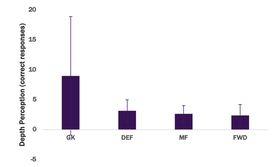

Figure 8: Differences in depth perception scores between position groups

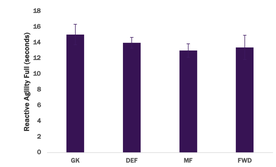

Figure 9: Differences in time to completion of the reactive agility between position groups

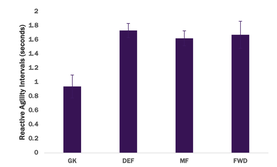

Figure 10: Differences in average recognition and movement time in the reactive agility between position groups

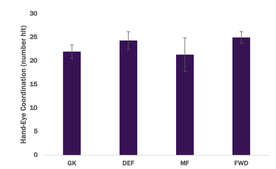

Figure 11: Differences in number of hits in the Hand-Eye Coordination test between position groups

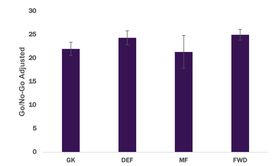

Figure 12: Differences in decision making scores between position groups

CONCLUSIONS & PRACTICAL APPLICATIONS

Due to a small sample size, no statistically significant conclusions could be made from this study. To further strengthen some of the patterns seen from the analyses, more data from subjects specific to the sport of soccer is needed.

The preliminary data from the small sample size indicate trends towards significance in some of the metrics collected:

1. Goalkeepers trended towards more correct depth perception responses.
2. Goalkeepers trended towards faster reactive agility time to completion times.
3. Midfielders trended towards lower hand-eye coordination and decision-making, especially when compared to Defenders and Forwards.

Further research is needed to not only increase the sheer number of profiling data on the sensorimotor side of soccer, but to also start to distinguish the differences between position and their demands on sensorimotor abilities. This can then lead to a better training plan to improve the often-forgotten cognitive side of athleticism.

REFERENCES

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