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EFFECT OF SPATIAL AWARENESS AND VISUAL MOTOR COORDINATION ON SKILL ABILITY OF INTER-COLLEGIATE MALE KABADDI PLAYERS

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ABSTRACT

The objective of the present study is to assess the effect of spatial awareness and visual motor coordination on the skill ability of intercollegiate male kabaddi players. To conduct the study 100 intercollegiate male kabaddi players were selected. The average age of these subjects was 21.91 years and they represented their respective colleges in intercollegiate kabaddi tournaments organized in Chhattisgarh state. Purposive sampling was used for the selection of subjects. To assess spatial awareness in male intercollegiate kabaddi players of Chhattisgarh, a test standardized by Cesaroni (2007) was used. Reaction time in selected intercollegiate male kabaddi players was recorded with the help of Nelson's simple reaction time test. A mirror drawing test was used to assess the hand-eye coordination of male intercollegiate kabaddi players. The apparatus designed by Johnson and Nelson (1974) was used for the assessment of depth perception. The skill ability of the selected intercollegiate male kabaddi players was judged through the subjective ratings of three judges. Results reveal a significant impact of spatial awareness, reaction time, hand-eye coordination, and depth perception on the skill ability of male intercollegiate kabaddi players with all these variables accounting for 33.4% variance. Based on the results, it may be concluded that spatial awareness and visual motor coordination namely reaction time, hand-eye coordination, and depth perception plays a significant role in determining the skill ability of male kabaddi players. It may also be concluded that spatial awareness and visual motor coordination need special attention while preparing a training plan to enhance the skill ability of the male kabaddi players.

Keywords: Spatial awareness, visual and motor coordination, skill, kabaddi

INTRODUCTION

Visual motor skills denote the combined effort of the visual system and motor movements. It is also referred to as visual motor integration. In visual motor skills, the information provided by the visual system is interpreted by the brain and accordingly the signals are sent for necessary motor actions. In simple terms, when a ball is thrown and someone tries to catch it with their hands is visual motor integration.

Coordinated motor movements are based on visual motor integration. The interpretation of information from our eyes is crucial and if not done so it may result in a faulty motor response. Similarly, if the time taken to process visual information takes longer, the motor response is also delayed that much. Visual-motor integration is also essential for spatial awareness, efficient motor tasks, or speed of movement. It also involves gross as well as fine motor skills.

It is evident from the scientific literature that fine motor skills are dependent upon information gathered by our eyes. In the larger perspective, visual motor coordination is the key to participating and excelling in many sports because it is also a reflection of cognitive abilities.

Muscular movement and response are structured. Just like a normal human being an athlete process information regarding space and environment through sensory organs which are then processed in the central nervous system to be able to do appropriate motor movements. In this regard, the main sensory organ is our eyes which gather information and play a significant part in implementing the command of the central nervous system to produce the required motor movements. The perceptual-motor performance model of Welford (1960) also emphasizes that perceptual responses are the results of input from sensory organs.

The nature of some sports is very demanding in terms of the strain it puts on the visual system. To return a tennis serve, blocking a penalty in soccer, or negating the effort of a raider in kabaddi to earn points are a few examples. Scientifically the importance of visual motor coordination has been highlighted by researchers namely Gregory, 1997 and Yarrow et al., 2009. These studies have highlighted that elite athletes with their superior ability to detect perceptual cues can react accurately to precise motor movements.

Spatial ability is a process for understanding the space surrounding us by processing the information provided by our sensory organs with the help of the brain. Psychomotor abilities are part of visual motor integration and these abilities are eye-hand coordination, reaction time, and depth perception. The reaction time is the time taken to respond to a sensory stimulus while hand-eye coordination also uses proprioception. With depth perception dimensionality of the space can be understood.

Visual motor coordination is also important to form spatial awareness which is often considered a sub-domain of cognition. Visual perception, mental folding and awareness, and mental rotation are part of spatial ability. It is the ability to pinpoint the position of the body concerning other objects present in the space.

The role of visual-motor coordination and spatial awareness in sports have attracted many researchers to work on this topic. Scientific inquiries in this regard have shown that visual system and perceptual motor movements are interrelated and are a vital cog in performance in many sports such as tennis, basketball, cricket, handball etc. Kabaddi is no exception to it because the offensive and defensive skills used in this sports require a fair amount of visual motor skills. Skills such as toe touch, foot touch, kicking, ankle hole, waist hold, etc require quick movements. But despite being a popular sport in India, no study has been conducted in

which the contribution of spatial and visual motor skills have been assessed on the skill ability of kabaddi players. Hence the present study was planned.

Savelsbergh et al. (2002) in their study reported that skilled soccer goalkeepers have superior searchability and they can predict the direction of the ball with efficient motor movements. Shim et al. (2005) studied anticipatory visual clues in highly skilled tennis players. It was found that highly skilled tennis players have a special ability to predict the shots to be played by the opponent through movement pattern information. This gives them added advantage in the form of less reaction time to execute the motor response. Hucinski et al. (2007) in their study investigated the contribution of psychomotor efficiency toward the execution of defensive basketball skills. They reported that psychomotor efficiency is the prerequisite for successfully carrying out defensive skills in basketball. Deveraju and Needhiraja (2013) in a study reported that physical and motor abilities are essential to properly execute basic kabaddi skills. Singh and Singh (2013) reported that the playing ability of kabaddi players is strongly linked to their efficiency in the execution of motor skills. Chowdhary et al. (2014) in their study reported that performance in kabaddi is largely dependent upon players' rhythmic ability and reaction time. Singh and Moriya (2017) in their study found that the dimensions of motor fitness namely agility, reaction time, balance, coordination, and power are significantly correlated with kho-kho playing ability. Haryanto and Amra (2020) in their study reported that the accuracy of backhand backspin serve is strongly correlated with hand-eye coordination and balance of the players. Mohanakrishnan and Murukesan (2021) reported that the offensive skills of kabaddi players are significant predictors of their playing ability.

The objective of the present study is to assess the effect of spatial awareness and visual motor coordination on the skill ability of intercollegiate male kabaddi players. It was hypothesized that spatial awareness, reaction time, hand-eye coordination, and depth perception will be added to the prediction model for the skill ability of intercollegiate male kabaddi players.

2. METHODOLOGY :-

The following methodological steps were taken to conduct the present study.

2.1 Sample

To conduct the study 100 intercollegiate male kabaddi players were selected. The average age of these subjects was 21.91 years and they represented their respective colleges in intercollegiate kabaddi tournaments organized in Chhattisgarh state. Purposive sampling was used for the selection of subjects.

2.2 Tools

2.2.1 Spatial Awareness:

To assess spatial awareness in male intercollegiate kabaddi players of Chhattisgarh, a test standardized by Cesaroni (2007) was used. This test is divided into two phases. During the 1st part, execution, the blindfolded subject has to carry out a command given by an examiner, memorize them and imagine the route taken to get back to the starting point. During the 2nd part, reproduction, the subject has to reproduce on paper the route taken. Points are awarded according to each successful maneuver.

2.2.2 Reaction Time:

Reaction time in selected intercollegiate male kabaddi players was recorded with the help of Nelson's simple reaction time test. In this test reactions of subjects toward visual stimuli are used to calculate reaction time with the following formula :

t = sqrt (2d / g)

d = the distance ruler fell in meters, g = 9.8/m^2 acceleration of gravity, t = Time

2.2.3 Hand-eye coordination:

A mirror drawing test was used to assess the hand-eye coordination of male intercollegiate kabaddi players. In this experiment, subjects have to trace a star-shaped object without touching its boundaries by looking at its image in the mirror. The higher the error lesser the magnitude of hand-eye coordination in the direction of scoring.

2.2.4 Depth Perception:

The apparatus designed by Johnson and Nelson (1974) was used for the assessment of depth perception. There are three rods in this box and the subject can only see these rods against the backdrop of the illuminated white portion. The examiner moves the middle rod and asks the subject to predict when the three rods are in the same line. The deviation is recorded automatically and gives the depth perception score of the subject.

2.2.5 Skill ability:

The skill ability of the selected intercollegiate male kabaddi players was judged through the subjective ratings of three judges. Each judge was asked to rate individual players performance based on skills namely toe touch, foot touch, leg thrust, kicking, rotation, ankle hold, thigh hold, knee hold, waist hold, and blocking. For each skill, the judge has to give marks on a 0-5 mark scale.

Procedure:

100 male intercollegiate kabaddi players from Chhattisgarh were selected. The skill ability of these male kabaddi players was assessed through the subjective rating of 03 judges during a match. The assessment of spatial awareness and visual motor coordination was done according to the tests mentioned in the tools section. The scores on skill ability, spatial awareness, reaction time, hand-eye coordination, and depth perception were tabulated for each subject. Step-wise regression was used for data analysis.

3. RESULT AND DISCUSSION

To predict the kabaddi skills of intercollegiate male players based on spatial awareness and visualmotor coordinative abilities, a step-wise regression model was prepared.

TABLE 1
STEP-WISE REGRESSION - SKILL ABILITY OF INTERCOLLEGIATE MALE KABADDI PLAYERS BASED ON SPATIAL AWARENESS, REACTION TIME, HAND-EYE COORDINATION AND DEPTH PERCEPTION

Model Predictors Variables Entered	R	R^2	Adjusted R Square	R Square Change	F Change
Spatial Awareness	.404[a]	.163	.154	.163	19.06, p<.01
Reaction Time	.489[b]	.239	.223	.076	9.70, p<.01
Depth Perception	.543[c]	.294	.272	.055	7.53, p<.01
Hand-eye Coordination	.578[c]	.334	.305	.039	5.57, p<.01
F (Final Model) = 11.88, p<.01					

[a] Predictors : Spatial awareness
[b] Predictors : Spatial awareness, reaction time
[c] Predictors : Spatial awareness, reaction time, depth perception

[d] Predictors : Spatial awareness, reaction time, depth perception, hand-eye coordination

TABLE 2
COEFFICIENTS IN FINAL MODEL

Model	Model	Unstandardized B	Standardized Beta	t
1	Constant	19.133		6.80, p<.01
	Spatial Awareness	1.025	.404	4.36, p<.01
2	Constant	24.388		7.67, p<.01
	Spatial Awareness	1.102	.434	4.86, p<.01
	Reaction Time	-43.452	-.278	-3.11, p<.01
3	Constant	28.695		8.30, p<.01
	Spatial Awareness	.965	.380	4.29, p<.01
	Reaction Time	-42.870	-.274	-3.17, p<.01
	Depth Perception	-3.381	-.241	-2.74, p<.01
4	Constant	33.554		8.48, p<.01
	Spatial Awareness	.845	.333	3.75, p<.01
	Reaction Time	-37.959	-.242	-2.84, p<.01
	Depth Perception	-3.411	-.244	-2.83, p<.01
	Hand-eye Coordination	-.193	-.205	-2.36, p<.01

Results shown in Tables 1 and 2 indicate that all the dimensions namely spatial awareness, reaction time, depth perception and hand-eye coordination were able to predict the skill ability of male kabaddi players. The F=11.88 reported in the final regression model gives support to this finding with .01 level of statistical significance.

The R^2 for the final regression model was 0.334 and it indicates that these variables have accounted for a 33.4% variance in the skill ability of male intercollegiate kabaddi players.

A detailed analysis of statistical figures reported in table 1 and 2 gives the following additional information

Spatial awareness was included in model 1 and accounted for a 16.3% variance in the skill ability of male intercollegiate kabaddi players (R^2 change = 0.163). The result also gets support from standardized Beta coefficient of 0.404 with a statistical significance level of p<.01.

Reaction time and spatial awareness were included in model 2 and both of them accounted for a 7.6% variance in the skill ability of male intercollegiate kabaddi players (R^2 change = 0.076). The result also gets support from the standardized Beta coefficient of 0.434 for spatial awareness and standardized Beta coefficient of -0.278 for reaction time with a statistical significance level of p<.01.

Depth perception was included in model 3 along with spatial awareness and reaction time. They have accounted for a 5.5% variance in the skill ability of male intercollegiate kabaddi players (R^2 change = 0.055). The result also gets support from the standardized Beta coefficient of .380 for spatial awareness, standardized Beta coefficient of -.274 for reaction time and standardized Beta coefficient of -.241 for depth perception with a statistical significance level of p<.01.

Hane-eye coordination was included in the final model 4 along with spatial awareness, reaction time and depth perception. They have accounted for a 3.9% variance in the skill ability of male intercollegiate kabaddi players (R^2 change = 0.039). The result also gets support from standardized Beta coefficient of .333 for spatial awareness, standardized Beta coefficient of -.242 for reaction time, standardized Beta coefficient of -.244 for depth perception and standardized Beta coefficient of -.205 for hand-eye coordination with a statistical significance level as $p<.01$.

4. DISCUSSION

Results reveal that spatial awareness was the single best predictor of skill ability of male intercollegiate kabaddi players. The next best predictor was reaction time combined with spatial awareness. The next best predictor was depth perception combined with spatial awareness and reaction time. The final model was the inclusion of hand eye coordination. Hence spatial awareness and dimensions of visual motor coordination namely reaction time, hand eye coordination and depth perception were able to create a substantial variance of 33.4% in the skill ability of male intercollegiate kabaddi players.

Results reveal a significant impact of spatial awareness, reaction time, hand-eye coordination and depth perception on the skill ability of male intercollegiate kabaddi players with all these variables accounting for 33.4% variance. The basic nature of kabaddi demands anticipation because the player's movements are very fast. A raider and defensive players need to have spatial awareness about the relative position of other players on the mat and this requires good visual-motor coordination. Ceciliani (2005) reported that motor skills need good support of spatial awareness while Ramadan et al. (2011) reported the influence of eye-hand coordination on layup shooting skills in basketball. Hence the results of the present study are not surprising.

5. CONCLUSION

Based on the results, it may be concluded that spatial awareness and visual motor coordination namely reaction time, hand-eye coordination and depth perception play a significant role in determining the skill ability of male kabaddi players. It may also be concluded that spatial awareness and visual motor coordination need special attention while preparing a training plan to enhance the skill ability of the male kabaddi players.

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